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VIRTUAL LEARNING ENVIRONMENTS IN HIGHER EDUCATION –

A Study of User Acceptance

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2007

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DEDICATED TO THE MEMORY OF MY PARENTS

ABSTRACT

The aim of the thesis was to create knowledge about factors influencing acceptance of virtual learning environments among academic staff and students in blended learning environments. The aim was operationalised by four research questions. To answer the research questions, several studies were performed applying the methods of survey study, conceptual-analytical research, a qualitative meta-analysis combined with a single case study and a comparative, explanatory case study. The empirical studies were performed at five universities in Sweden, Norway and Lithuania. In the thesis, a technology acceptance perspective extended with the perspectives of organisational learning and diffusion of innovations was used. The findings indicated that the contextual factor of culture was powerful in influencing acceptance of virtual learning environments, positively as well as negatively. High degrees of performance expectancy, results demonstrability and social influence affected acceptance of virtual learning environments positively. The degree of social influence was hypothesised to be mediated by the contextual factor of culture. The organisational culture of universities, expressed as shared values of what is good quality teaching and learning, were found to partly oppose values inherent in the virtual learning environments. The factor of students' learning styles did not have any impact on acceptance of virtual learning environments. The original version of the technology acceptance model was found to be insufficient in explaining differences in acceptance of virtual learning environments. In the conclusions of the thesis, a descriptive and explanatory model of virtual learning environments acceptance among academic staff and students in blended learning environments is presented applying the combined perspectives of organisational learning, technology acceptance and diffusion of innovations. Implications for practice are put forward, emphasizing culture as an important factor to consider in the implementation of virtual learning environments.

The study has been supported by the Swedish Research School of Management and Information Technology (MIT) and Jönköping International Business School.

POPULÄRVETENSKAPLIG SAMMANFATTNING

I takt med att kraven på livslångt lärande ökar används virtuella lärplattformar alltmer i högre utbildning. Förändringen från undervisning på campus till lärande helt eller delvis via virtuella lärplattformar ställer nya krav på lärare och studenter. Ett villkor för att lärande verkligen skall ske via de virtuella lärplattformarna är att lärare och studenter accepterar den nya tekniken. Mot denna bakgrund är avhandlingens syfte att skapa kunskap om faktorer som påverkar acceptans av virtuella lärplattformar hos lärare och studenter i högre utbildning. Den universitetsutbildning som har studerats inom ramen för avhandlingen bedrivs i s.k. blandade lärmiljöer, där undervisning på campus varvas med utbildningsmoment som fullgörs via lärplattformar. För att uppfylla avhandlingens syfte har ett antal teoretiska och empiriska studier genomförts. De teoretiska studierna syftade till att ta fram en teoretisk modell för att förklara acceptans av virtuella lärplattformar hos lärare och studenter i blandade lärmiljöer. De empiriska undersökningarna utgjordes av en enkätundersökning vid Högskolan i Jönköping, en fallstudie vid Växjö Universitet och en komparativ fallstudie vid Nordiska Högskolan för Folkhälsovetenskap (Sverige), Universitetet i Tromsø (Norge) och Kaunas Medicinska Universitet (Litauen).

Resultat av de empiriska undersökningarna visade att studenters lärstilar inte har någon inverkan på deras acceptans av de virtuella lärplattformarna. Organisatoriska faktorer, t ex på vilket sätt lärplattformen införs och används i undervisningen, har större inverkan på studenters acceptans än individuella egenskaper hos studenterna själva (som t ex ålder, kön och lärstil). Den faktor som påverkade acceptansen hos lärare och studenter mest var organisationskulturen vid universitetet. Organisationskulturen påverkade acceptansen positivt när den främjade användandet av lärplattformen, och negativt när den motverkade användandet av lärplattformen. Faktorer som påverkade acceptansen av lärplattformarna i positiv riktning var att lärare och studenter upplevde en reell nytta med att använda lärplattformen, att denna nytta var tydlig och kommunicerbar till andra, samt att det var prestigefyllt att använda lärplattformen. Det senare kriteriet var beroende av organisationskulturen. Organisationskulturen kunde också ge upphov till konflikter mellan vad lärare och studenter bedömde som lärande av god kvalitet och det lärande som man upplevde att lärplattformen kunde förmedla. Som ett resultat av de teoretiska studierna presenteras en modell för att beskriva och förklara acceptans av virtuella lärplattformar hos lärare

och studenter i blandade lärmiljöer. Modellen bygger på en kombination av tre teoretiska perspektiv: organisatoriskt lärande, teknologisk acceptans och innovationsteori. Dessa perspektiv förklaras närmare i avhandlingen. Vidare ges ett antal råd till dem som skall fatta beslut om och/eller genomföra implementering av virtuella lärplattformar i syfte att åstadkomma en hög acceptans hos lärare och studenter.

Studien har genomförts med stöd av Forskarskolan för Management och IT (MIT) samt Internationella Handelshögskolan i Jönköping.

PREFACE

The division of Economic Information Systems engages in research and education in the borderland between management and IT. More specifically, the subject area relates to the transmission of information from, between and to people. Of special interest is the role of strategies and information systems when people work together in different kinds of organizations (companies, public authorities and associations), but also when they interact with customers and citizens. Our research is concentrated in the following areas:

- * IT and productivity
- * Strategic use of IT, with a focus on organization for the use of IT
- * Strategy and management control
- * Financial accounting, auditing and economic crime

Most doctoral candidates in the division of Economic Information Systems are enrolled in either the Swedish Research School of Management and Information Technology (MIT) or the Research Programme for Auditors and Consultants (RAC). MIT is a joint endeavour involving some ten colleges and universities. Within the structure of this network, a doctoral programme is offered with a focus on issues arising in the borderland between management and IT. The RAC is a graduate education programme focused on accounting and auditing, with an emphasis on the processing of information. It combines internships at auditing firms with graduate courses and work toward a licentiate degree.

This thesis, *Virtual Learning Environments in Higher Education - A Study of User Acceptance*, is presented by Christina Keller for the degree of Doctor of Philosophy – in the subject area of Economic Information systems – at the Department of Management and Engineering, Linköping University. Christina Keller is currently enrolled in the MIT Research School and holds a Licentiate of Philosophy in the subject area of Economic Information Systems.

Linköping, August 2007

Fredrik Nilsson
Professor
Economic Information System

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It is quite common in the acknowledgements of doctoral theses to state how difficult and tiring it is to write a doctoral thesis. I don't think so. This was fun! And here are my thanks to those who made it even more fun:

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The Swedish Research School of Management and Information Technology (MIT) has primarily funded my thesis work. The research school has also been my research community and, as such, an invaluable resource. I would like to thank professors and colleagues of the research school for intellectual and emotional support. Your comments, advice and support have been truly indispensable for me. I would like to offer special thanks to the three colleagues who read and commented on my manuscript at the final seminar in

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Jönköping, August 2007

Christina Keller

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Appendix 2b. Interview guide, paper I.

Appendix 3. Students' survey questionnaire paper V-VI, English version.

PAPERS:

Paper I: Keller, C. & Cernerud, L. (2002). Students' Perceptions of E-learning in University Education. *Journal of Educational Media*, 27 (1-2), 55-67.

Paper II: Keller, C. (2005). Virtual Learning Environments: Three Implementation Perspectives. *Learning, Media and Technology*, 30 (3), 299-311.

Paper III: Keller, C. & Hrastinski, S. (2007). Do Learning Styles Matter in Online Education? In Buzzetto-Moore, N. A. (Ed.) *Principles of Effective Online Learning*. (pp. 121-135). Informing Science Press, Santa Rosa, California.

Paper IV: 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.

Paper V: Keller, C., Hrastinski, S. & Carlsson, S. A. (2007). *Students' Acceptance of E-learning Environments: A Comparative Study in Sweden and Lithuania*. (pp. 395-406). In Proceedings of the 15th European Conference on Information Systems, St. Gallen, Switzerland.

Paper VI: Keller, C. (2007). *User Acceptance of Virtual Learning Environments: A Case Study from Three Northern European Universities*. (Submitted).

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1. INTRODUCTION

The focus of this thesis is acceptance of virtual learning environments among academic staff and students in blended learning environments in higher education. The thesis examines factors influencing acceptance of virtual learning environments from a technology acceptance perspective, extended with the perspectives of organisational learning and diffusion of innovations.

The research setting of the thesis is blended learning environments. Blended learning environments, where face-to-face instruction is mixed with other types of instruction, are not a new phenomenon. Even as far back as in 1886, the first president of the University of Chicago, William Rainer Harper wrote: *“the student who has prepared a certain number of lessons in the correspondence school knows more of the subject treated in those lessons, and knows it better than the student who has covered the same ground in the classroom”* (Harper, 1971, p. 12).

In Sweden, the Hermods’ Institute of Correspondence Studies provided distance education at high school level from the 1890s (Mårtensson et al., 1998). In the USA, correspondence studies were more commonly used from the 1920s (Moore, 2006). Since the 1970s, the Open University, situated in United Kingdom, has pioneered the concept of modern distance learning by providing blended learning environments of face-to-face tutoring and course packages including audio- and video-based course material. Since the arrival of the Internet, educational net-based technology is evolving rapidly at universities worldwide (Mason, 2003).

In recent years, the need for education has changed because of an increased demand for a highly educated workforce that will be expected to learn continuously (Alavi & Leidner, 2001). In Sweden, the need for lifelong learning in higher education has been expressed at governmental level during the beginning of the 2000s (Governmental Offices of Sweden, 2001). Since 2002, the Swedish Net University has taken on the role of national coordinator of online distance education, offering more than 3,000 courses and programmes at 35 universities during 2006 (Swedish Agency for Network and Cooperation in Higher Education, 2007). As a means of lifelong learning, virtual learning environments

have been developed, such as WebCT, BlackBoard and ClassFronter (Ngai et al., 2007). Virtual learning environments are commonly referred to as learning environments mediated by computers and digital technologies (Weiss, 2006).

The perceptions of learning by virtual learning environments vary among academic staff and students. In an evaluation of online distance education, Westerberg and Måråld (2004) found that university managers and teachers perceived this kind of education as a means of reaching out to a higher number of students. Students, on the other hand, appreciated the opportunity to study in a manner more independent of restrictions of time and space, than traditional education on campus. Teachers experienced a heavy workload and high expectations to be accessible to students, while students perceived the pedagogical quality of online courses being lower, compared to courses on campus (Westerberg & Måråld, 2004). The findings of high expectations of being available to students are confirmed by Zhang and Nunamaker (2003), who found that learners perceive more opportunities for communication with instructors in a virtual learning environment than in a traditional classroom.

On the other hand, Cole (2000) pinpoints the notion of online learning excluding face-to-face meetings between teacher and student, and argues that it removes the focus from *“learning by doing”* to *“learning by thinking”*, promoting the notion of rationality as the only source of knowledge: *“Unlike the Ancients, the on-line student and teacher cannot stroll side by side...Had Socrates not sauntered upon the roads with the like of young Phaedrus, there would have been no Dialogues.”* (Cole, 2000, p. x). If opinions like Cole’s are generally acknowledged in academia, teachers and students would regard face-to-face interaction as an indispensable part of higher education, and learning by virtual learning environments as an inferior form of education.

With these differing opinions in mind, it could be reasonable to wonder if learning by means of virtual learning environments is a phenomenon really accepted by teachers and students. In a blended learning environment, which combines face-to-face instruction and virtual learning environments, acceptance and use of virtual learning environments are a prerequisite for learning. If the virtual learning environment is not accepted and used by academic staff and students, less or no learning will occur. The introduction of virtual learning environments in higher education presents new challenges as the roles and expectations of teachers and students change (Bennett & Lockyear, 2004). This transition is

not always easy, or without individual and organisational complications. It involves a change, both in motives, intentions and behaviour. This is the primary reason for choosing a theory that focuses on intentions and behaviour as the foundation of the research model of the thesis; technology acceptance.

Technology acceptance research emanates from social psychology and is based on the role of intention as a predictor of behaviour. The Technology Acceptance Model (TAM) is considered as the most influential and commonly applied theory for describing individual user acceptance of information systems (Lee et al., 2003). The model assumes that an individual's acceptance of an information system is determined by two major factors or variables: 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 refers to *"the degree to which a person believes that using a particular system would be free of effort."* (Davis, 1989, p. 320). The dependent variables of technology acceptance models are *the behavioural intention* to use an information system and *the actual use*. There are studies defining acceptance as *"the behavioural intention to use an information technology"*, studies defining acceptance as *"the actual use of an information technology"*, and studies measuring both behavioural intention and actual use. In figure 1, the original research model of TAM is depicted.

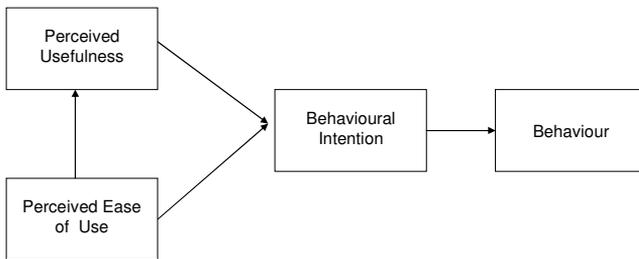


Figure 1. The original research model of Technology Acceptance Model (TAM) (Davis, 1989).

In order to explain the role of technology acceptance in an educational context, the author has adapted the model slightly, to depict the fundamental idea of acceptance as a necessary prerequisite for learning by means of the virtual learning environment. This relationship is presented in figure 2.

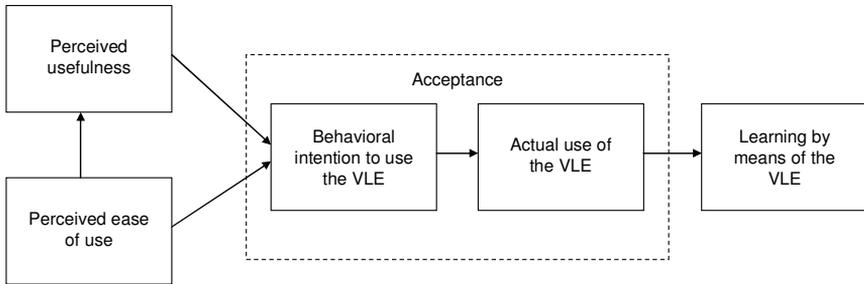


Figure 2. Original version of Technology Acceptance Model (TAM) adapted by the author to an educational context (adapted from Davis, 1989).

In the next section, recent research on virtual learning environments from the perspective of TAM will be reviewed.

1.1. TECHNOLOGY ACCEPTANCE MODEL (TAM) RESEARCH ON VIRTUAL LEARNING ENVIRONMENTS

A number of research studies have used TAM in its original or extended version to explore students' acceptance of virtual learning environments (Selim, 2003; Ong et al., 2004; Drennan et al., 2005; Saadé & Bahli, 2005; Ong & Lai, 2006; Ngai et al., 2007). Findings of the research studies are summarised in table 1. A meta-analysis of the studies were made, describing the relationships between the core constructs of the research models used, and students' acceptance of virtual learning environments. The findings of the meta-analysis are presented in figure 3. The numbers on the arrows represent which research studies listed in table 1 that propose significant relationships between core constructs and acceptance.

From the meta-analysis, the following can be summarised. Selim (2003), in a study of students' acceptance of course websites, found that perceived usefulness and perceived ease of use proved to be key determinants of the acceptance and usage of the web sites, as the two constructs accounted for 83% of the variance in acceptance and usage. The profound importance of perceived usefulness and perceived ease of use to influence students' acceptance positively is also confirmed by Ong et al., (2004), Drennan et al., 2005, and Saadé and Bahli (2005). Ong et al, (2004) also states that perceived ease of use has a positive influence on acceptance via perceived usefulness. Thus, perceiving the virtual learning environment as easy to use, would contribute to perceptions of usefulness in its own right.

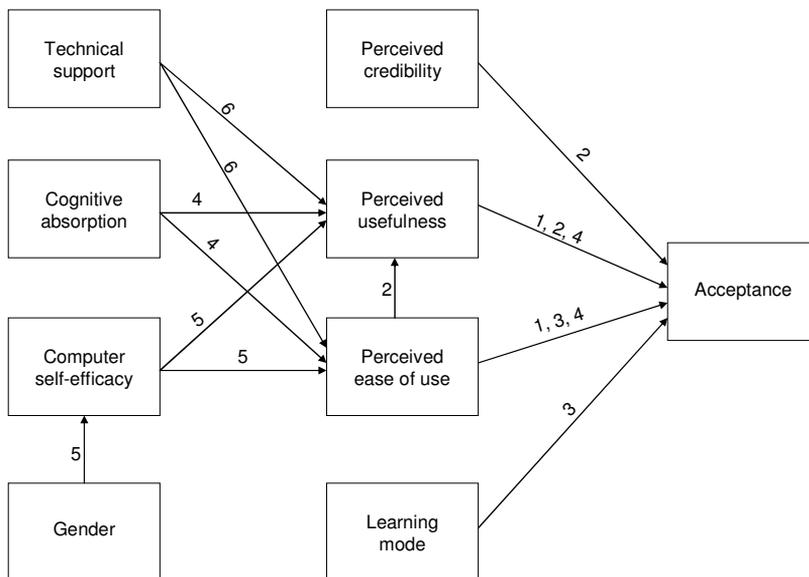


Figure 3. Meta-analysis of core constructs of extended TAM studies influencing students' acceptance of virtual learning environments.

Two additional core constructs of technology acceptance were introduced in the studies of the meta-analysis: *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 positively. 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 positively, but had no direct relationship to acceptance of virtual learning environments. Furthermore, Ngai et al. (2007) propose that the perception of having access to technical support influences perceived ease of use and perceived usefulness positively.

In the studies of the meta-analysis, two individual student background factors were found to exert influence on acceptance. First, the learning mode of the students had an impact on the degree of acceptance, as autonomous and innovative learning modes contributed in creating positive perceptions of flexible online learning (Drennan et al., 2005). Second, gender was found to influence acceptance as men rated their degree of computer self-efficacy, perceived usefulness and perceived ease of use higher than women (Ong & Lai, 2006). Computer self-efficacy is defined as: “an individual’s perception of his or her ability to use computers in the accomplishment of a task rather than reflecting simple component skills” (Compeau and Higgins, 1995, p. 191). Computer self-efficacy influenced acceptance via perceived usefulness and perceived ease of use.

The meta-analysis involves only studies of students’ acceptance. Studies of acceptance of virtual learning environments among academic staff from the perspective of TAM are scarcer. In a study on the impact of educational technology in educational organisations and individual work, Narmaala (2004) performed interviews with academic staff from a technology acceptance perspective. Findings suggested that perceived usefulness played an important role in adopting new technology, but there were also other important factors, such as results demonstrability, defined as tangibility of the results of using the technology, and job relevance.

Table 1. Research studies using TAM or extended version of TAM to explore students' acceptance of virtual learning environments.

No	Author(s)	Research setting	Research model of factors hypothesised to influence acceptance	Factor (s) having statistically significant impact on students' acceptance
1	Selim, 2003	450 students of Business and Economics	Perceived usefulness, perceived ease of use.	Perceived usefulness and perceived ease of use influences acceptance positively.
2	Ong et al., 2004	140 engineers from six international companies.	Perceived usefulness, perceived ease of use, computer self-efficacy, perceived credibility.	Perceived usefulness and perceived credibility influences acceptance positively. Perceived ease of use is an antecedent of perceived usefulness.
3	Drennan et al., 2005	256 students of an introductory Management course.	Perceived usefulness, perceived ease of use, ease of electronic recovery, learning mode.	Positive perceptions toward technology (ease of access and use of learning materials), and autonomous learning mode influences acceptance positively.
4	Saadé & Bahli, 2005	102 students of Accounting, Management Information Systems, Finance and Marketing.	Perceived usefulness, perceived ease of use, cognitive absorption.	Perceived usefulness and perceived ease of use influences acceptance positively. Cognitive absorption influences perceived usefulness and perceived ease of use positively.
5	Ong & Lai, 2006	156 employees from six international companies.	Perceived ease of use, computer self-efficacy, perceived usefulness, gender.	Men's rating of computer self-efficacy, perceived usefulness and perceived ease of use are higher than women's rating. Computer self-efficacy influences perceived usefulness and perceived ease of use positively.
6	Ngai et al., 2007	836 students of seven universities in Hong Kong.	Perceived usefulness, perceived ease of use, technical support.	Technical support influences perceived usefulness and perceived ease of use positively.

The meta-analysis shows the importance of perceived usefulness and perceived ease of use. But complementary core constructs that influence acceptance, such as perceived credibility, cognitive absorption, technical support, and learning mode, are also proposed. Interestingly, learning mode or learning style is introduced as an influencing factor on acceptance. Learning style “describes learner preferences for different types of learning and instructional activities.” (Jonassen & Grabowski, 1993, p. 5). Dimension of learning styles could be e.g. to prefer to learn by reading and reflecting rather than by practical work. Learning styles could also comprise the dimension of how the topic studied is organised mentally by the learner and if the learner prefers to study in an autonomous or a non-autonomous way. There is further evidence of the impact of learning styles on acceptance in research of general technology use. For example, Chakraborty et al. (2007) showed that an innovative cognitive style had significant direct effects on perceived ease of use, perceived usefulness and subjective norm in decision making on use of new technologies.

The extensions of TAM in virtual learning environments research could be interpreted as a sign of the original model being insufficient in explaining all aspects of acceptance. Legris et al. (2003), in a critical review and meta-analysis of the technology acceptance model concluded: “TAM is a useful model, but has to be integrated into a broader one, which would include variables related to both human and social change processes, and to the adoption of the innovation model.” (Legris et al., 2003, p. 191). This viewpoint is acknowledged by Karahanna et al. (2006), who extended TAM with the construct of *compatibility*, originally developed in innovation diffusion theory (IDT) to be able to capture beliefs about the compatibility of the technology to organisational work styles, work practices, experiences and values.

It is reasonable to believe that there are more significant factors than perceived usefulness and perceived ease of use that influence user acceptance. Moreover, TAM does not explain *why* users perceive usefulness or ease of use. Academic staff and students are part of a university organisation, and of a process of adopting an information technology innovation: the virtual learning environment. From this point of view, it is hypothesised that organisational factors and the innovation process have an impact on the individual perceptions of the virtual learning environment. Based on the conviction that the original model of TAM does not sufficiently capture all aspects of, and reasons for, user acceptance, the research model of this thesis will extend the perspective of technology

acceptance with two additional perspectives: organisational learning and diffusion of innovations.

1.2. AIM AND RESEARCH QUESTIONS

The overriding aim of the thesis is to create knowledge about factors influencing acceptance of virtual learning environments among academic staff and students in blended learning environments in higher education.

The overriding aim was operationalised by four research questions. The research questions did not evolve simultaneously. Instead, the questions arose one by one as a result of the research process. Initially, a study was made to explore factors influencing students' acceptance of virtual learning environments from the perspective of TAM, including the impact of learning styles on students' acceptance. When TAM proved to be insufficient in explaining students' acceptance of virtual learning environments, the question of another explanatory model was evoked, as well as the need for a deeper study of the impact of learning styles. This led to the quest for other theoretical perspectives with higher explanatory value. A research model was developed for acceptance of virtual learning environments, which was subsequently tested in a comparative, explanatory case study. Hence, the four research questions guiding the thesis work were:

Research question 1. Which factors influence students' acceptance of virtual learning environments in blended learning environments from the perspective of TAM?

Research question 2. What influence do learning styles have on students' acceptance of virtual learning environments?

Research question 3. Which factors influence acceptance of virtual learning environments among academic staff and students from the perspectives of organisational learning, technology acceptance and diffusion of innovations?

Research question 4. Which factors would a descriptive and explanatory model of acceptance of virtual learning environments among academic staff and students in blended learning environments include, based on the three perspectives of organisational learning, technology acceptance and diffusion of innovations?

The research questions are answered by the six papers included in the thesis. Full text versions of the papers are attached to the thesis. Summaries of the papers are provided in chapter 4. In figure 4, the logical relationships between research questions and the different parts of the thesis are described.

Research question 1 is answered by paper I, while research question 2 is answered by paper III. Research question 3 is answered by the comparative case study that is the foundation of papers IV-VI. Research question 4 is evoked in paper II and further explored in the case study, comprising papers IV-VI.

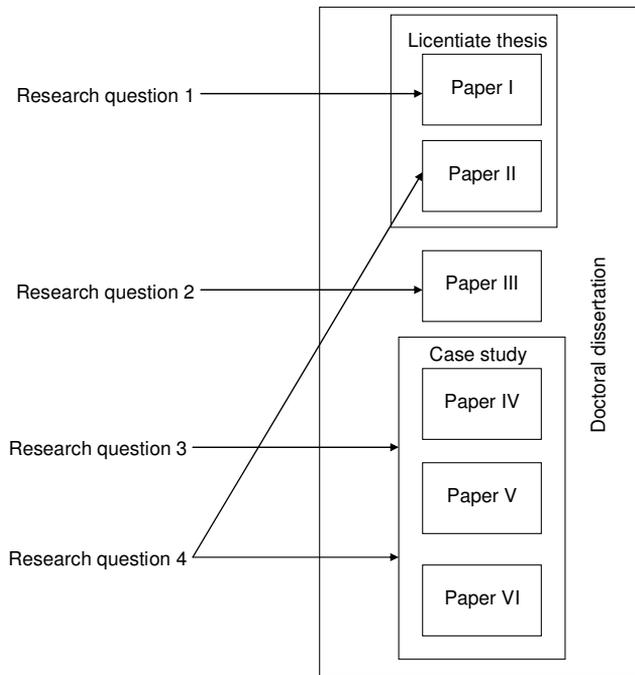


Figure 4. Logical relationships between the research questions and different parts of the thesis.

1.3. STRUCTURE OF THE THESIS

The comprehensive summary of the thesis comprises five chapters. In chapter 1, an introduction to the research area is provided as well as a review and a meta-analysis of technology acceptance research on students' acceptance of virtual learning environments. Furthermore, the structure of the thesis is described, definitions of concepts fundamental for the thesis are given, and abbreviations frequently used in the thesis are explained.

In chapter 2, the theoretical background of the thesis is presented. The chapter is divided into two main sections: *The educational context* (2.1), and *Three theoretical perspectives* (2.2). In section 2.1, the concepts of virtual learning environments, blended learning and learning styles are presented and elaborated on. In section 2.2, the three theoretical perspectives of organisational learning, technology acceptance and diffusion of innovations are presented.

In chapter 3, the research approach of the thesis is described. First, a short review of methodologies used in educational technology research is made. Second, methodological choices and decisions made in the thesis work are elaborated on. Third, the development of the research model used throughout the thesis is described. Fourth, the research settings of the empirical studies of the thesis are presented. Finally, methods of data collection and analysis are described.

In chapter 4, the six papers of the thesis are summarised. The six papers included in the thesis are attached in full their text versions:

Paper I: Keller, C. & Cernerud, L. (2002). Students' Perceptions of E-learning in University Education. *Journal of Educational Media*, 27 (1-2), 55-67.

Paper II: Keller, C. (2005). Virtual Learning Environments. Three Implementation Perspectives. *Learning, Media and Technology*, 30 (3), 299-311.

Paper III: Keller, C. & Hrastinski, S. (2007). Do Learning Styles Matter in Online Education? In Buzzetto-Moore, N. A. (Ed.). *Principles of Effective Online Teaching*. (pp. 121-135). Informing Science Press, Santa Rosa, California.

Paper IV: 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.

Paper V: Keller, C., Hrastinski, S. & Carlsson, S. A. (2007). *Students' Acceptance of E-learning Environments: A Comparative Study in Sweden and Lithuania*. (pp. 395-406). In Proceedings of the 15th European Conference on Information Systems, St. Gallen, Switzerland.

Paper VI: Keller, C. (2007). *User Acceptance of Virtual Learning Environments: A Case Study from Three Northern European Universities*. (Submitted).

In chapter 5, the conclusions of the thesis work are presented and implications of the findings for practice are put forward. Finally, the research approach of the thesis is discussed and suggestions for further research are made, based on five themes of user perceptions of virtual learning environments identified from the empirical studies of the thesis.

1.4. DEFINITIONS

The overriding aim of the thesis was to create knowledge about factors influencing acceptance of virtual learning environments among academic staff and students in blended learning environments in higher education. In this section, the key concepts of the thesis work are defined.

Acceptance

As mentioned in section 1.1, the dependent variables of technology acceptance models are *the behavioural intention* to use an information system and *the actual use*. In research studies applying technology acceptance models, the operationalisation of the concept of acceptance varies. There are studies defining acceptance as "*the behavioural intention to use an information technology*", studies defining acceptance as "*the actual use of an information technology*", and studies measuring both behavioural intention and actual use. When the use of information technology is optional, the actual use often constitutes the dependent variable of the study. In research settings where the use of the information technology is mandatory, the behavioural intention is measured as the dependent variable (Hardgrave &

Johnson, 2003). In the empirical studies of the thesis, the construct of acceptance is defined as “the behavioural intention to use an information system”, where the use of the virtual learning environment in higher education is mandatory.

E-learning, etc

The terms denoting learning by web-based technologies vary throughout the literature, among others the concepts of e-learning, online learning, online education, educational technology, web-based learning, and internet-based learning are used. These concepts are used more or less interchangeably. Garrison and Anderson defines e-learning as “*learning facilitated on-line through network technologies*” (2003, p. xi). According to Wang and Hwang (2004), e-learning denotes “*information and communications technology enhanced learning by delivering learning contents and activities via Internet, intranet/extranet, audio/video...i.e. via an environment consisting of hardware, software and personnel.*” (p. 410). In the thesis, the definition of e-learning according to Garrison and Anderson (2004), is used.

The concepts of e-learning, online learning, online education and web-based learning are used synonymously throughout the text to denote learning by network technologies. Different concepts are used in different parts of the thesis depending on target audiences for the papers (conferences and journals) and on what concepts respondents of empirical studies have used.

The concept of educational technology, used in section 3.1, denotes learning by all kinds of digital media, also e.g. CD-ROM and other stand-alone technologies, not necessarily delivered by network technologies.

Virtual learning environments

There are a number of definitions of the concept of virtual learning environments. Virtual learning environments are commonly referred to as learning environments mediated by computers and digital technology (Weiss, 2006). Wilson (1996), defines the concept in a broad way, stressing interaction: “*computer-based environments that are relatively open systems, allowing interactions and encounters with other participants and providing access to a wide range of resources*” (p. 8). The Joint Information Systems Committee (JISC) (2002) defines virtual learning environments as: “*the components in which learners and tutors participate in online*

interactions of various kinds, including online learning.” The definition of JISC also includes the dimension of learning. The definition of virtual learning environments that will be used in the thesis is an adaptation of the definition by JICS: “a web-based environment where learners and tutors participate in online activities supporting learning”.

The concepts of e-learning environment and web platform are used synonymously with virtual learning environments throughout the thesis, depending on target audiences for the papers (conferences and journals) and on what concepts the respondents of the empirical studies have used. The virtual learning environments studied in the thesis are the commercial, proprietary learning environments of PingPong, Fronter¹ and WebCT.

Blended learning

In the doctoral thesis, acceptance of virtual learning environments is studied in blended learning environments. The concept of blended learning has been defined in a number of ways. The definitions mainly fall into one of three categories: as a combination of different instructional media, as a combination of different instructional methods, and as a combination of online and face-to-face instruction (Graham, 2006). In the doctoral thesis, blended learning is defined as “the combination of web-based and face-to-face instruction”.

Factor, variable and core construct

The concepts of factor, variable and core construct are used synonymously throughout the thesis to denote an individual, organisational, and technological variable, potentially important in gauging how effective information systems implementation is, in terms of use or satisfaction with use (Shaw, 2003). The term “core constructs of technology acceptance” is used throughout the text to denote core constructs from Unified Theory of Acceptance and Use of Technology (UTAUT) and Innovation Diffusion Theory (IDT).

¹ Originally developed under the name of ClassFronter.

Research model versus descriptive and explanatory model

The aim of the fourth research question of the thesis is to create a descriptive and explanatory model of acceptance of virtual learning environments among academic staff and students in blended learning environments. A model is, according to Robson (2002): *“A representation of a system or some other aspect of research interest. It may be expressed in symbols, equations and numbers, or in pictorial images (e.g. boxes with links between them), or in words. Models are mainly used to help explain and understand the phenomena of interest.”* (p. 548). Research models are often associated with models used in quantitative survey approaches, illustrating statistical relationships between factors or constructs. In this thesis, research models are used to describe relationships between factors and to look for regularities or tendencies in the material in order to explain them (Ron, 2002).

The concept of research model is used to denote the tentative models for acceptance of virtual learning environments among academic staff and students that are tested throughout the thesis work. The concept of descriptive and explanatory model is used in the research questions and to denote the final version of the model for acceptance of virtual learning environments, presented in the concluding chapter of the thesis.

1.5. ABBREVIATIONS

The abbreviations presented in table 2 are used throughout the thesis.

Table 2. Abbreviations used throughout the thesis.

Abbreviation	Explanation
ICCE	International Council for Correspondence Education. An international organisation, established in 1938, providing standards and support for distance education.
IDT	Innovation Diffusion Theory. An adaptation of the model of diffusion of innovations to measure adaptation of information technology innovations. One of the user acceptance models included in UTAUT.
JISC	Joint Information Systems Committee. A British organisation, established in 1993, providing support in the use of information and communication technology in higher education.
KMU	Kaunas University of Medicine, Lithuania. [<i>Lt.</i> Kauno Medicinos Universitetas.]. The research setting of paper IV-VI.
LMS	Learning Management System (see definition on p. 16)
MLE	Managed Learning Environment (see definition on p. 17)
MM	Motivational Model. One of the user acceptance models included in UTAUT.
MPCU	Model of PC Utilization. One of the user acceptance models included in UTAUT.
NS	Nordic School of Public Health, Gothenburg, Sweden. [<i>Sw.</i> Nordiska Högskolan för folkhälsovetenskap]. The research setting of paper IV-VI.
SCT	Social Cognitive Theory. One of the user acceptance models included in UTAUT.
SE	School of Engineering, Jönköping University, Sweden. [<i>Sw.</i> Jönköpings Tekniska Högskola]. The research setting of paper I.
SH	School of Health Sciences, Jönköping University, Sweden. [<i>Sw.</i> Hälsohögskolan]. The research setting of paper I.
TAM	Technology Acceptance Model. The most influential model for technology acceptance and one of the user acceptance models included in UTAUT.
TPB	Theory of Planned Behaviour. One of the user acceptance models included in UTAUT.
TRA	Theory of Reasoned Action. One of the user acceptance models included in UTAUT.
UT	University of Tromsø, Norway [<i>No.</i> Universitetet i Tromsø.]. The research setting of paper IV-VI.
UTAUT	Unified Theory of Acceptance and Use of Technology
VLE	Virtual Learning Environment (see definitions on pp. 13 and 16)

2. THEORETICAL BACKGROUND

This chapter introduces the theories and models underpinning the research studies of the thesis. First, definitions and features of virtual learning environments are presented. Second, the concept of blended learning, originally emanating from distance education, is described and elaborated on. Third, the concept of learning styles is introduced. Finally, the three theoretical perspectives included in the research model of the thesis are presented: organisational learning, technology acceptance and diffusion of innovations. Each section of the chapter is concluded with an explanation of how the concept or theoretical model described contributes to the thesis work.

2.1. THE EDUCATIONAL CONTEXT

2.1.1. VIRTUAL LEARNING ENVIRONMENTS

A virtual learning environment in higher education is a part of a virtual university. Peters (2001) describes virtual universities as: “...a *purposefully structured accumulation and combination of a large number of net-based learning approaches.*” (p. 157). Virtual learning environments are commonly referred to as learning environments mediated by computers and digital technology. But, they are by no means virtual in the sense that they are used to provide learning by virtual reality (Weiss, 2006). Wilson (1996) defines virtual learning environments as: “*computer-based environments that are relatively open systems, allowing interactions and encounters with other participants and providing access to a wide range of resources*” (p. 8). Learners can access material independently and follow different paths through the virtual learning environment. Apart from the dimension of independence, the virtual learning environment also adds the dimension of communication to the learning experience by means of electronic interaction and discussion (Piccoli et al., 2001).

The concepts of learning management system (LMS), web-based learning environments, internet-based learning environments, web platforms and e-learning environments are used synonymously with virtual learning environment. The Joint Information Systems Committee (JISC) (2002) defines virtual learning environments as: “*the components in which*

learners and tutors participate in online interactions of various kinds, including online learning.” JICS contrasts the concept of virtual learning environment to the concept of managed learning environment (MLE), which is used to include the whole range of computer-based information systems and procedures of higher education, including the virtual learning environment.

The features of the virtual learning environment can be grouped in three categories: student features, tutor features and designer features (Ryan et al, 2000). Student features are the features accessible for students as they log on to the virtual learning environment. Typical features are course content in the form of web pages, course conferencing system or bulletin board, chat, e-mail, notebook, whiteboard as a shared area for communication, tests marked by the system, student presentation areas, grading information and calendar. The features assisting tutors giving courses online are e.g. progress tracking, timed automatically graded quizzes and tools for student management, such as class and grade lists. There are also specific tools built into the virtual learning environment to assist the designer of virtual courses, such as standard interfaces, and tools for customization and site management features, such as backup and loading of course material (Ryan et al., 2000; JICS, 2002).

The tools of virtual learning environments could be either *synchronous* or *asynchronous*. Synchronous technologies require simultaneous participation of instructors and learners at different locations at the same time. It is accomplished in real-time. Synchronous technologies take on a variety of forms, like video conferencing, audio conferencing and chat. Asynchronous technologies do not require simultaneous participation of learners and instructors. It is delivered on-demand and refers to a learning situation that does not occur in real-time. Students can learn at the time and place of their own choice, which gives them a higher control of their own learning situation.

Technologies for asynchronous e-learning are e.g. electronic mail, discussion groups, electronic bulletin boards, and interactive tutorials or test (Zhang & Nunamaker, 2003). Figure 5 illustrates an example of the features of WebCT that are accessible in a web-based course.

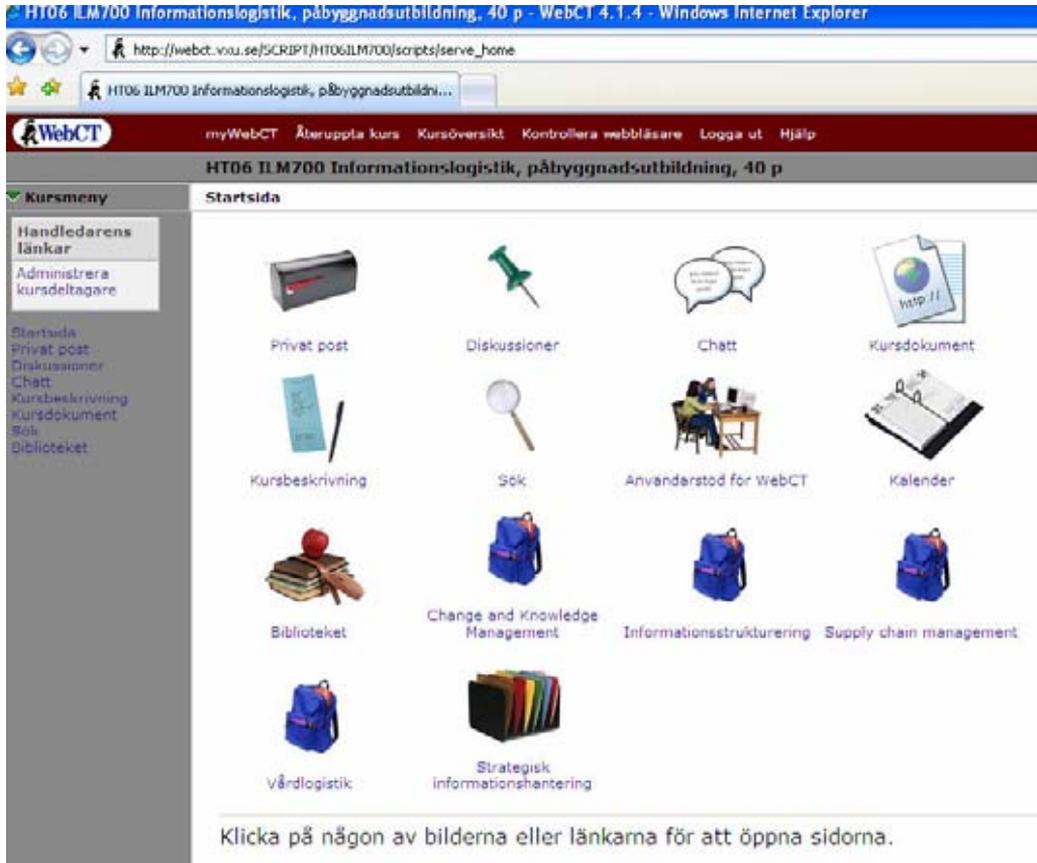


Figure 5. Features of a web-based course published in the virtual learning environment of WebCT.

The features of the web-based course are electronic mail (*Sw.* Privat post), discussion forum (*Sw.* Diskussioner), chat (*Sw.* Chatt), course documents (*Sw.* Kursdokument), course description (*Sw.* Kursbeskrivning), search engine (*Sw.* Sök), user manual (*Sw.* Användarstöd för WebCT), calendar (*Sw.* Kalender), and links to library resources (*Sw.* Biblioteket).

In a study on behalf of the Swedish National Agency for Services to Universities and University Colleges, Schultz and Nergell (2004) found that the Swedish market of virtual learning environments in higher education was dominated by six learning environments: LUVIT, WebCT, FirstClass, PingPong, Blackboard and ClassFronter. In 2005, the companies of WebCT and Blackboard merged to form the world market leader of virtual learning environments, with about 3,650 clients in 60 countries (BlackBoard, 2005). Although the market is dominated by proprietary virtual learning environments, there is a growing interest, nationally and internationally, in the use of open source learning environments in higher education (Sigrén & Holmqvist, 2005) to provide more flexible and cost-effective learning than what can be offered by proprietary systems (Grob et al., 2004).

Contribution to the thesis

The section about virtual learning environments describes the characteristics of the information technology artefact that is used by academic staff and students as a tool for learning. This is the information technology innovation that academic staff and students could accept or not. What features are offered by the virtual learning environment and what features staff and students decide to use is of the greatest importance for how the virtual learning environment is perceived and if and how learning is accomplished. Furthermore, the virtual learning environment could be perceived to imbed values of what kind of learning and learning style that is desirable in the educational context. The virtual learning environments studied in the thesis are the commercial, proprietary learning environments of PingPong, Fronter² and WebCT.

2.1.2. BLENDED LEARNING

In the thesis, acceptance of virtual learning environments is studied in *blended learning environments*. The concept of *blended learning* is closely connected with the concept of *distance education*, as blended learning is often a part of distance education. Blended learning was introduced in 1969 as a basic concept of the Open University of United Kingdom, the world's principal distance education institution (Moore, 2006). Distance learning or

² Originally developed under the name of ClassFronter.

distance education, according to Williams et al. (1999), refers to a teaching-learning arrangement in which the learner and teacher are separated in geography and time. Distance learning could also be described as “*the transmission of a course from one location to another.*” (Leidner & Järvenpää, 1995, p. 274) or as the situation were “*courses and support are supplied by various distance media such as correspondence although there may be face-to-face elements.*” (Simpson, 2002, p. 2).

In 1972, the International Council for Correspondence Education (ICCE) coined the term *distance education* to denote the various forms of educational practices that had evolved around correspondence education. Williams et al. (1999) describe the evolvement of distance learning based on levels of activity. *Level 1*, representing the time period from the 1880s, consisted of printed material, audio- and videotapes and radio transmission. Williams et al characterize this level as *passive distance learning*, as the learner cannot interact with the instructor in real time. The distance learning environment is asynchronous. *Level 2*, started during the 1960s, consists of two-way interactive audio/video teletraining, computer-based training, electronic mail, bulletin board systems and computer mediated conference systems. This level is considered to be *passive to moderately active*. The distance learning environment is synchronous and the learner can interact with the instructor in real time. *Level 3*, beginning in the 1990s, consists of hybrid environments combining elements from previous levels in one virtual classroom, in addition to the capabilities of the Internet and the World Wide Web. This level is considered to be *highly interactive*, as many ways of communication between learner and instructor are possible.

The concept of blended learning has been defined in a number of ways. The definitions mainly fall into one of three categories: as a combination of different instructional media, as a combination of different instructional methods, and as a combination of online and face-to-face instruction (Graham, 2006). Blended learning systems could be defined in the following way: “*Blended learning systems combine face-to-face instruction with computer-mediated instruction.*” (Graham, 2006, p. 5). This definition emphasises the role of computer-mediated instruction in blended learning environments. The definition of Picciano (2006) also encompasses this dimension, when defining blended learning as “*a wide variety of technology/media integrated with conventional face-to-face classroom activities.*” (p. 96). These definitions of blended learning also imply that instruction and learning is partly distributed. The rapid expansion of digital technology in recent decades has had a large impact on the

possibilities for distributed learning. In figure 6, four dimensions of interaction in face-to-face and distributed learning environments are presented: space (face-to-face versus virtual), time (synchronous versus asynchronous), fidelity (high versus low media richness) and humanness (high versus low presence of humans in the learning context). Historically, face-to-face learning has operated on the left side of the figure and distributed learning on the right side. However, with further development of information technology, rich synchronous media, such as videoconferencing, distributed learning could take place both on the left and right side of the figure.

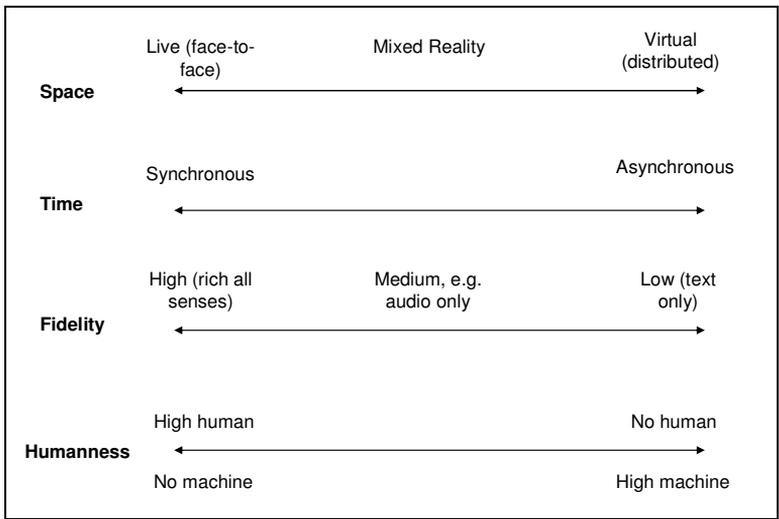


Figure 6. Four dimensions of interaction in face-to-face and distributed learning environments (adapted from Grabam, 2006).

Apart from the dimensions of space, time, fidelity and humanness, blended learning could be categorised according to level of blending. Blending, at an activity-level, occurs when a learning activity contains both face-to-face and computer-mediated elements. The course-level blending is the most common type of blend, where face-to-face elements and computer-mediated elements represent different parts of a course. Blending could also occur at programme level, when different courses are provided either full online or face-to-face. Some educational institutions are creating blended learning models on an institutional

level, where all courses and programmes of the institution are provided by the same blend (Graham, 2006).

Contribution to the thesis

The empirical studies of paper I and paper III-VI were all conducted in blended learning environments. In paper I, the virtual learning environment was used as a complementary support in learning on campus in bachelor programmes of health care and engineering. Students attended courses on campus, and course material, schedules, and other information was provided by the virtual learning environment. In addition, asynchronous online discussions were used to provide student and teacher feedback on assignments and thesis work.

In paper III, the virtual learning environment was used in a master course in change and knowledge management offered as distance education. Students attended lectures and seminars on campus at the beginning and end of the course. In between the sessions on campus, seminars, assignments, and group work were performed in the virtual learning environment.

In paper IV-VI, the research setting was master public health education provided as distance education. Students attended lectures and participate in group work on campus for three to four days each semester. In between sessions on campus, learning took place by means of the virtual learning environment, as group work, online discussions and the writing and posting of assignments.

Conclusively, the research settings represent blended learning at course level, where face-to-face elements and computer-mediated elements represent different parts of a course.

2.1.3. LEARNING STYLES

Learners differ in their ability to process information, construct meaning from information, and apply information to new situations. The concept of learning styles describes learners' preferences towards different types of learning and instruction. Learning styles measure tendencies to collect and process information by different self-assessment techniques, such as questionnaires that ask individuals how they prefer to learn. Therefore, they describe

learners' own perceptions of their preferences rather than the actual skills or effectiveness in learning (Jonassen & Grabowski, 1993).

Students with different learning styles can be expected to react in different ways to virtual learning environments, in respect to learning outcomes as well as in attitudes. Among others, Drennan et al. (2005) concluded that autonomous and innovative learning modes created positive perceptions of flexible online learning. According to Federico (2000), successful learning stems from the conformity between student needs and the learning environment. Learning styles are considered as one of the more important factors that influence e-learning (Chen & Ford, 2000). Among the most commonly reviewed learning styles in the literature are field dependence/field independence, which is categorised as a cognitive control, Kolb's learning styles and the learning styles of Honey and Mumford.

The cognitive control of field dependence/field independence describes the degree to which a learner's perception or comprehension of information is affected by the surrounding perceptual or contextual field. Field dependent learners find it difficult to locate the information they are looking for, because other information tends to disguise it. Field independents, on the other hand, finds it easy to recognise and select the important information from the surrounding field. They also experience reorganisation, restructuring and revision of information to be easier, than field dependent learners (Jonassen and Grabowski, 1993). Previous research on learning outcomes has showed that field independent learners were more likely to solve problems than field dependent learners (Heller, 1982; Ronning et al., 1984) and that field independency is important in analysing and categorising visual information (Wise, 1980). Lu et al. (2002) investigated the influence of field dependence/field independence on students in a WebCT-based graduate course on management information systems. The authors concluded that the field dependent and field independent students performed equally well in the course.

One of the most prominent typologies of learning styles is the one created by the American psychologist, David A. Kolb. According to Kolb (1984), there are four basic *learning modes*: concrete experience (*feeling*), abstract conceptualization (*thinking*), reflective observation (*watching*), and active experimentation (*doing*). The dimension of concrete experience and abstract conceptualization describes how a person grasps or perceives information, while the dimension of reflective observation and active experimentation describes how information is transformed or processed. The four learning modes are combined into four

learning styles. The relationship between learning mode and learning style is depicted in figure 7. *Convergers* combine abstract conceptualization and active experimentation. The *divergent* learning style emphasizes concrete experience and reflective observation. The dominant learning abilities of *assimilators* are abstract conceptualization and reflective observation, while *accommodators* focus on concrete experience and active experimentation.

Concrete experience	Accommodators	Divergers
Abstract conceptualization	Convergers	Assimilators
	Active experimentation	Reflective observation

Figure 7. Learning modes combined into learning styles according to Kolb (1984).

Learning style is partly shaped by personality type, as assimilators tend to be introverted while convergers may be extroverted (Margerison and Lewis, 1979; Kolb, 1984). There are also relationships between learning styles and educational specialization. Early educational experiences shape individual learning styles in the sense that people are taught how to learn. According to Kolb, there is an increasing process in specialization that deepens in undergraduate education which suggests that people’s learning styles and their educational discipline can be linked. This correlation shows that business majors commonly are accommodators, while students in nursing and engineering are convergers. English, political science, and psychology majors are most likely divergers, while mathematics, economics, sociology and chemistry majors are assimilators. Learning style is not only shaped by education. The learning style of a person is also shaped by professional career, current job, and adaptive competencies (Kolb, 1984).

Inspired by Kolb, Honey and Mumford (1985) proposed four learning styles: *activist*, *reflector*, *theorist* and *pragmatist*. Honey and Mumford's four learning styles are, to some extent, equivalent to the learning modes of Kolb. *Activists* are open-minded and involve themselves fully in new experiences. They are weaker in implementation and consolidation, and are highly sociable. Their days are filled with activity and they are easily bored. *Reflectors* are thoughtful and cautious, and collect as much information as possible before taking action. They prefer to take a back seat in meetings and discussions, and enjoy observing other people in action. *Theorists* approach problems logically, and integrate their observations into theories. They tend to be perfectionists, and like to analyse and synthesize. They favour rationality and logic. *Pragmatists* thrive on new ideas and like to put them into practice. They seek out new ideas and take every opportunity to experiment with applications. They are practical, down-to-earth people who like making decisions and solving problems (Honey & Mumford, 1985; Downing & Chim, 2004).

Contribution to the thesis

Learning styles are considered in literature to be an important individual student background factor influencing perceptions of virtual learning environments. As such, the question of how learning styles influence students' acceptance of virtual learning environments constitutes research question 2 of the thesis. A simple self-assessment of Kolb's learning styles were used as one of the student background factors in the survey study of paper I. The influence of learning styles on students' perceptions of, and performance in, virtual learning environments was further explored in paper III of the thesis, by a combined literature study and single case study, examining the influences of learning styles of Kolb and Honey & Mumford.

2.2. THREE THEORETICAL PERSPECTIVES

In this section, the three theoretical perspectives of the thesis are presented: organisational learning, technology acceptance and diffusion of innovations.

2.2.1. ORGANISATIONAL LEARNING

Implementing an innovation in an organisation could be studied as an organisational learning process. Although organisational learning is a concept that is accepted as being of importance, there is no theory or model of organisational learning that has widespread acceptance. This thesis focuses on the organisational learning that takes place in connection with the implementation of virtual learning environments. To do this, the organisational learning model by Fiol and Lyles (1985), introducing the typology of higher-level and lower-level learning, and four contextual factors, will be presented and applied. The perspective of Fiol and Lyles is chosen because of the focus on the development of insights and knowledge as a response to organisational change. Furthermore, the impact of contextual factors such as culture, strategy, structure and environment on organisational learning are considered in the model. Contextual factors have been found to be critical in describing and explaining organisational learning.

The work on organisational learning stems, according to Denton (1998), from Cyert and March's (1963) observations that organisations adopt over time, a behaviour pattern that was labelled organisational learning. Their work has influenced a number of authors who have different ways of defining and describing organisational learning. Although the observations of Cyert and March are more than 40 years old, their impact on research is still strong. They developed theoretical building blocks that became the foundations of current research in organisational learning (Argote & Greve, 2007). There is a variety of definitions of organisational learning. Argyris and Schön (1978, p. 116) defines the concept as: "*a process of detecting and correcting error*". Argyris (1994) describes the reciprocal learning process that may be active in organisations as being of two ideal-types: single-loop learning and double-loop learning. What is learned in single-loop learning are the presupposed, often non-expressed notions that exist in an organisation in the form of theories-in-use (norms and values) and theories-of-action (conceptions why someone acts in a certain manner) between individuals. It is the actions and not the governing variables that are

changed in single-loop learning. What is learned enables the individual to correct errors or to adapt to an existing situation. Double-loop learning involves changing the governing values of the individuals of the organisation. As a result, actions and the assumptions on which action is founded may be changed. If successful, this learning scenario will produce new strategies of action and new theories-in-use. The modes of single- and double-loop learning are described in figure 8.

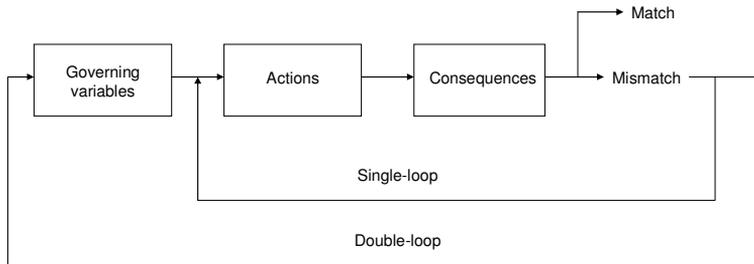


Figure 8. Single-loop and double loop learning (Argyris, 1994).

March (1991) builds further on the idea of single- and double-loop learning and defines organisational learning as a process comprising two basic elements: *exploration* and *exploitation*. These two elements are seen as mutually dependent processes of equal value for the organisation. The organisation has to learn both by exploration and exploitation for the organisational learning to be useful. March defines exploration and exploitation in the following way: “*Exploration includes things captured by terms such as search, variation, risk taking, experimentation, play, flexibility, discovery, innovation. Exploitation includes such things as refinement, choice, production, efficiency, selection, implementation, execution.*” (March, 1991, p. 71). According to March (1991), there must be an equilibrium between exploration and exploitation. Organisations occupied with too much exploration could be trapped in experimentation without achieving gain from any of its benefits. Conversely, organisation with too much focus on exploitation is likely to be trapped in the state that March calls “*suboptimal stable equilibria*” (1991, p. 71). To achieve sustainable growth, organisations must sometimes explore new opportunities, sometimes exploit them. The gains obtained from exploration are generally more uncertain and long-term, compared to the short-term immediately obtainable gains of exploitation. As a result, organisational learning is mostly focused on exploitation and exploration is put on hold.

Fiol and Lyles' contribution to the field of organisational learning builds on a literature review of existing texts on the subject. Their definition of organisational learning is wide and comprehensive: "Organisational learning means the process of improving actions through better knowledge and understanding" (Fiol and Lyles, 1985, p. 803). Fiol and Lyles' topology of lower-level and higher-level learning has similarities to single- and double-loop learning, as well as to March's typology of exploration and exploitation. Lower-level learning occurs within a given organisational structure and leads to the development of rudimentary associations of behaviour and outcomes of relatively short duration. It is a result of repetition and routine and involves association building. Higher-level learning aims at adjusting overall rules and norms rather than specific activities and behaviours. The associations that are a result from higher-level learning have effects during a longer period of time and higher impact on the overall organisation. Higher-level learning is a result of the use of heuristics, skill development and insights, while lower-level learning is a result of repetitive behaviour. The two levels of organisational learning are summarised in table 3.

Table 3. Levels of learning (Fiol and Lyles, 1985).

	Lower-level learning	Higher-level learning
Characteristics	Occurs through repetition	Occurs through use of heuristics and insight
	Routine	Non-routine
	Control over immediate task, rules & structures	Development of differentiated structures, rules, etc to deal with lack of control
	Well-understood context	Ambiguous context
	Occurs at all levels in organisation	Occurs mostly at upper levels
Consequence	Behavioural outcomes	Insights, heuristics, and collective consciousness
Examples	Institutionalises formal rules	New missions and new definitions of direction
	Adjustment in management system	Agenda setting
	Problem-solving skills	Problem-defining skills
		Development of new myths, stories and culture

Organisational learning results in associations, cognitive systems, and memories that are developed and shared by members of the organisation. According to Fiol and Lyles (1985), four contextual factors influence the probability that organisational learning will occur: *culture, strategy, structure* and *environment*. The contextual factors have a reciprocal relation to learning in the sense that they create learning, and are a result of learning. Organisational culture is defined in various ways in the literature, e.g. *“as collectively shared forms of for example, ideas and cognition, as symbols and meanings, as values and ideologies, as rules and norms, as emotions and expressiveness as the collective unconscious, as behaviour patterns, structures and practices, etc.”* (Alvesson, 2002, p. 3). In the organisational learning model by Fiol and Lyles, organisational culture consists of shared, commonly held and relatively stable beliefs, and norms that influence behaviour, actions taken and decisions made (Fiol & Lyles, 1985; Williams et al., 1993). The norms inherent in the organisational culture will influence the behavioural and cognitive development that the organisation can accomplish. Correspondingly, a major change in an organisation often involves a change in shared beliefs and norms. Organisational strategies determine the goals and actions of organisations, and influences learning by providing a boundary to decision making and a context for the interpretation of the organisational environment. In turn, which strategic options that are perceived is a function of the capacity of learning within the organisation. Organisational structure plays a crucial role in determining learning processes. A mechanistic, centralised structure tends to reinforce past behaviours, while an organic, more decentralised structure tends to allow changes in beliefs and actions to a higher extent (Duncan, 1974). The organisational environment influences and is influenced by the learning that takes place in the organisation. For learning to take place, both change and stability between learners and their environments are required (Hedberg, 1981). If the organisational environment is too turbulent, learning will not occur. On the other hand, if the environment is too stable, there is no inducement to learn, as beliefs, norms and behaviours never become obsolete (Fiol and Lyles, 1985).

Critical voices on organisational learning research

The concept of organisational learning is very varying and has been defined differently in a wide range of literature. Organisational learning has been critiqued as being *“excessively broad, encompassing merely all organisational change... and from various other maladies that arise from insufficient agreement among those working in the area on its key concepts and problems”* (Cohen &

Sproul, 1991, p. 1). The extent of literature in the area is overwhelming for researchers and practitioners. Most of the definitions of organisational learning seem to be complementary, rather than fundamentally original or conceptually different (Matlay, 2000). Finally, the prevailing concept of organisational learning has a strong bias towards the traditional scientific approach to management, and stresses the importance of continuous improvement (Wang & Ahmed, 2003).

Contribution to the thesis

The research model of the case study (papers IV-VI) comprises Fiol and Lyles' (1985) organisational learning process of lower-level and higher-level learning as well as the four contextual factors of culture, strategy, structure and environment.

2.2.2. TECHNOLOGY ACCEPTANCE

In this section of the thesis, the perspective of technology acceptance will be presented. First, the original version of Technology Acceptance Model (TAM) is described. Second, the development and contents of the Unified Theory of Acceptance and Use of Technology (UTAUT) is presented. Finally, criticism of technology acceptance models and suggestions of improvement are put forward, and the contribution of the theoretical perspective to the thesis is described.

Technology Acceptance Model (TAM)

Individual users can exhibit a variety of behaviours when confronted with a new information technology: *"They may completely reject it and engage in sabotage or active resistance, they may only partially utilize its functionality, or they may wholeheartedly embrace the technology and the opportunities it offers."* (Agarwal, 2000, p. 86.). To predict and explain user acceptance it is necessary to understand why people accept or reject the information system (Davis, 1989). The Technology Acceptance Model (TAM) is considered as the most influential and commonly applied theory for describing individual user acceptance of information systems (Lee et al., 2003). The information systems research stream of technology acceptance originally emanates from theories of social psychology, among them Theory of Reasoned Action (TRA) (Fishbein and Ajzen, 1975), and Theory of Planned Behaviour (TPB) (Ajzen,

1991). TAM is based on the fundamental idea of these theories: the role of intention as a predictor of behaviour (e.g. use of an information technology).

TRA is a theory on human behaviour comprising a conceptual framework relating beliefs, attitudes, intentions and behaviours with respect to a given object. The conceptual framework is founded on the presumption that specific intentions and behaviours can be predicted by beliefs and attitudes (Fishbein and Ajzen, 1975). The core constructs of TRA are *attitude toward behaviour* and *subjective norm* (Venkatesh et al., 2003). Attitude is defined as “an individual’s positive or negative feelings (evaluative affect) about the target behaviour” (Fishbein and Ajzen, 1975, p. 216). Subjective norm is defined as “the person’s perception that most people who are important to him think he should or should not perform the behaviour in question” (Fishbein and Ajzen, 1975, p. 302). The conceptual framework of TRA is presented in figure 9.

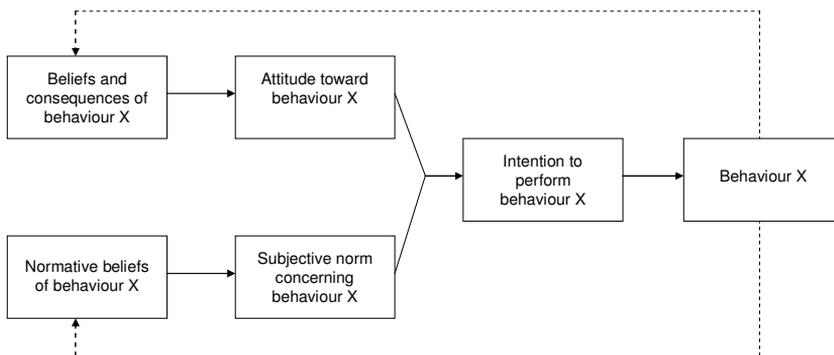


Figure 9. A schematic presentation of the conceptual framework for the prediction of specific intentions and behaviours (Fishbein & Ajzen, 1975).

In figure 10, a general description of the conceptual framework underlying the technology acceptance perspective in information systems research is presented. This perspective is simplified, compared to TRA. Actual usage of an information technology is the dependent variable. The role of intention is critical in predicting usage in most technology acceptance models, even though some researchers also have focused on the direct relationship between reactions and usage. The usage of the information technology forms new reactions, which are followed by new intentions (Venkatesh et al., 2003).

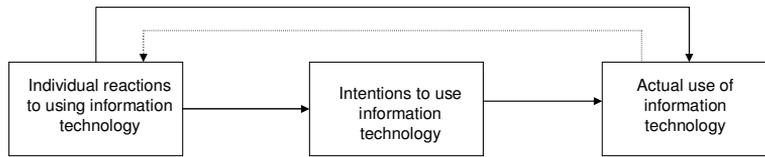


Figure 10. Basic concept underlying user acceptance models (Venkatesh et al., 2003).

The Technology Acceptance Model (TAM) assumes that an individual's acceptance of an information system is determined by two major factors or variables: *perceived usefulness* and *perceived ease of use*. Perceived usefulness is, according to empirical studies, the stronger of the two determinants and influences the behavioural intention to use an information system directly. Perceived ease of use primarily influences the behavioural intention to use an information system via perceived usefulness, but also has a more limited direct influence on behavioural intention (see figure 1, p. 3). The dependent variables of technology acceptance models are *the behavioural intention* to use an information system and *the actual use*. There are studies defining acceptance as "*the behavioural intention to use an information technology*", studies defining acceptance as "*the actual use of an information technology*", and studies measuring both behavioural intention and actual use. Bearing on Theory of Planned Behaviour (TPB) (Ajzen, 1991), behavioural intention should have a direct influence on performance when the behaviour is voluntary. Even when behaviour is not voluntary, as may be the case in educational settings, intentions are still considered as key considerations (Hardgrave and Johnson, 2003) as "*indications of how hard people are willing to try, of how much effort they are planning to exert, in order to perform the behaviour.*" (Ajzen, 1991, p. 181). Thus, when the use of information technology is optional, the actual use often constitutes the dependent variable of the study. In research settings where the use of the information technology is mandatory, the behavioural intention is measured as the dependent variable (Hardgrave & Johnson, 2003).

TAM has been widely applied to a variety of information technologies and users. King and He (2006) performed a statistical meta-analysis of TAM, using 88 studies published during 1998-2003. The results showed TAM to be a valid model that has been widely used, but also has potentially wider applications. The core constructs of perceived usefulness and behavioural intention were found to be highly reliable and the influence of perceived ease

of use via perceived usefulness was confirmed. Only in research contexts involving internet applications did perceived ease of use influence behavioural intention to use an information system directly. While being generally strong, the statistical correlations of TAM varied among the studies of the meta-analysis. This variation was due to moderating factors outside the model, e.g. the experience level of users.

Venkatesh and Davis (2000) extended TAM by including *subjective norm* from TRA/TPB as an additional predictor of behavioural intention and behaviour in the case of mandatory settings. This extended model of TAM is referred to as TAM2. TAM has also been expanded in other ways. Karahanna et al. (2006) extended the model with the construct of *compatibility*, originally developed in innovation diffusion theory (IDT). The content of compatibility was divided into four constructs: compatibility with preferred work style, compatibility with existing work practices, compatibility with prior experience and compatibility with values. As mentioned in section 1.1, TAM has also been extended with the constructs of computer self-efficacy (Compeau & Higgins, 1995) and perceived credibility (Ong et al., 2004) as well as cognitive absorption (Saadé and Bahli, 2005) in the context of e-learning research. However, the most elaborate and scientifically established extension of TAM is Unified Theory of Acceptance and Use of Technology (UTAUT), which will be described in the next section of the thesis.

Unified Theory of Acceptance and Use of Technology (UTAUT)

Building on eight prominent user acceptance models having their roots in information systems, psychology and sociology, Venkatesh et al. (2003) developed an extended technology acceptance model: Unified Theory of Acceptance and Use of Technology (UTAUT). The eight models used in the development process were: Theory of Reasoned Action (TRA), Technology Acceptance Model (TAM), Motivational Model (MM), Theory of Planned Behavior (TPB), Combined TAM and TPB, Model of PC-Utilization (MPCU), Innovation Diffusion Theory (IDT) and Social Cognitive Theory (SCT). In table 4, these eight models are described according to core constructs and their definitions.

Table 4. Models and theories of individual acceptance (excerpt adapted from Venkatesh et al., 2003).

Model	Core constructs	Definitions
Theory of Reasoned Action (TRA)	Attitude Toward Behavior	“an individual’s positive or negative feelings (evaluative affect) about performing the target behaviour” (Fishbein & Ajzen, 1975, p. 216).
	Subjective Norm	“the person’s perception that most people who are important to him think he should or should not perform the behaviour in question (Fishbein & Ajzen, 1975, p. 302).
Technology Acceptance Model (TAM)	Perceived Usefulness	“the degree to which a person believes that using a particular system would enhance his or her job performance” (Davis, 1989).
	Perceived Ease of Use	“the degree to which a person believes that using a particular system would be free of effort” (Davis, 1989).
Motivational Model (MM)	Subjective Norm	Adapted from TRA/TPB. Included in TAM2 only.
	Extrinsic Motivation	The perception that users will want to perform an activity “because it is perceived to be instrumental in achieving valued outcomes that are distinct from the activity itself such as improved job performance, pay or promotions (Davis et al, 1992 p. 320).
	Intrinsic Motivation	The perception that users will want to perform an activity “for no apparent reinforcement than the process of performing the activity per se” (Davis et al, 1992, p. 1112).
Theory of Planned Behavior (TPB)	Attitude Toward Behavior	Adapted from TRA.
	Subjective Norm	Adapted from TRA.
	Perceived Behavioural Control	“the perceived ease or difficulty of performing the behaviour” (Ajzen, 1991, p. 188).
Combined TAM and TPB (C-TAM-TPB)	Attitude Toward Behavior	Adapted from TRA/TPB.
	Subjective Norm	Adapted from TRA/TPB.
	Perceived Behavioural Control	Adapted from TPB.
	Perceived Usefulness	Adapted from TAM.

Table 4. Models and theories of individual acceptance (excerpt adapted from Venkatesh et al., 2003), continued.

Model	Core constructs	Definitions
Model of PC Utilization (MPCU)	Job fit	“the extent to which an individual believes that using [a technology] can enhance the performance of his or her job” (Thompson et al, 1991, p. 129).
	Complexity	Based on Rogers and Shoemaker (1971), “the degree to which an innovation is perceived as relatively difficult to understand and use” (Thompson et al, 1991, p. 128).
	Long-term Consequences	“Outcomes that have a pay-off in the future” (Thompson et al, 1991, p. 129).
	Affect Towards Use	Based on Triandis (1977), affect towards use is “feelings of joy, elation, or pleasure, or depression, disgust, displeasure, or hate associated by an individual with a particular act” (Thompson et al, 1991, p. 127).
	Social Factors	Derived from Triandis (1977), social factors are “the individual’s internalization of the reference group’s subjective culture, and specific interpersonal agreements that the individual has made with others, in specific social situations” (Thompson et al, 1991, p. 126).
Social Cognitive Theory (SCT)	Facilitating Conditions	Objective factors in the environment that observers agree make an act easy to accomplish. In an IS context, “provision of support of for users of PCs may be one type of facilitating condition that can influence system utilization” (Thompson et al, 1991, p. 129).
	Outcome Expectations – Performance	The performance-related consequences of the behaviour. Specifically, performance expectations deal with job-related outcomes (Compeau & Higgins, 1995).
	Outcome Expectations – Personal	The personal consequences of the behaviour. Specifically, personal expectations deal with the individual esteem and sense of accomplishment (Compeau & Higgins, 1995).
	Self-efficacy	Judgment of one’s ability to use a technology (e. g., computer) to accomplish a particular job or a task.
	Affect	An individual’s liking for a particular behaviour (e. g., computer use).
	Anxiety	Evoking anxious or emotional reactions when it comes to performing behaviour.

Table 4. Models and theories of individual acceptance (excerpt adapted from Venkatesh et al., 2003) continued.

Model	Core constructs	Definitions
Innovation Diffusion Theory (IDT)	Relative Advantage	“the degree to which an innovation is perceived as being better than its precursor” (Moore and Benbasat, 1991, p.195).
	Ease of Use Image	“the degree to which an innovation is perceived as being difficult to use” (Moore and Benbasat, 1991, p. 195).
	Visibility	The degree to which one can see others using the system in the organisation (adapted from Moore and Benbasat, 1991).
	Results demonstrability	“the tangibility of the results of using the innovation, including their observability and communicability” (Moore and Benbasat, 1991, p. 203).
	Voluntariness of Use	“the degree to which use of the innovation is perceived as being voluntary, or of free will” (More and Benbasat, 1991, p. 195).

When tested empirically by Venkatesh et al. (2003) in two different organisations, UTAUT was found to explain 70% of the variance of intentions to use and actual usage of information systems. This is an improvement, compared to the explanation of variance accomplished by the original user acceptance models, of between 17 and 53%. The four core constructs of UTAUT are *Performance Expectancy*, *Effort Expectancy*, *Social Influence* and *Facilitating Conditions*. The core constructs are further defined in table 5. The table also summarizes what constructs from the original user acceptance models that make up the constructs of UTAUT.

Table 5. Definitions of core constructs of Unified Theory of Acceptance and Use of Technology (UTAUT) (adapted from Venkatesh et al., 2003).

Core constructs	Definition	Consists of
Performance Expectancy	The degree to which an individual believes that using the system will help him or her to attain gains in job performance.	Perceived usefulness (TAM), extrinsic motivation (MM), job-fit (MPCU), relative advantage (IDT) and outcome expectations (SCT)
Effort Expectancy	The degree of ease associated with the use of the system.	Perceived ease of use (TAM), complexity (MPCU), and ease of use (IDT)
Social influence	The degree to which an individual perceives that important others believe that he or she should use the system.	Subjective norm (TRA, TAM, C-TAM-TPB), social factors (MPCU) and image (IDT).
Facilitating Conditions	The degree to which an individual believes that an organisational and technical infrastructure exists to support use of the system.	Perceived behavioural control (TBP, C-TAM-TBP), facilitating conditions (MPCU) and compatibility (IDT).

Performance expectancy, effort expectancy, social influence and facilitating conditions are independent variables influencing the dependent variables of behavioural intention and usage. Gender, age, experience and voluntariness of system use have an indirect influence on the dependent variables via the four core constructs.

The relationships between the variables of the model are depicted in figure 11.

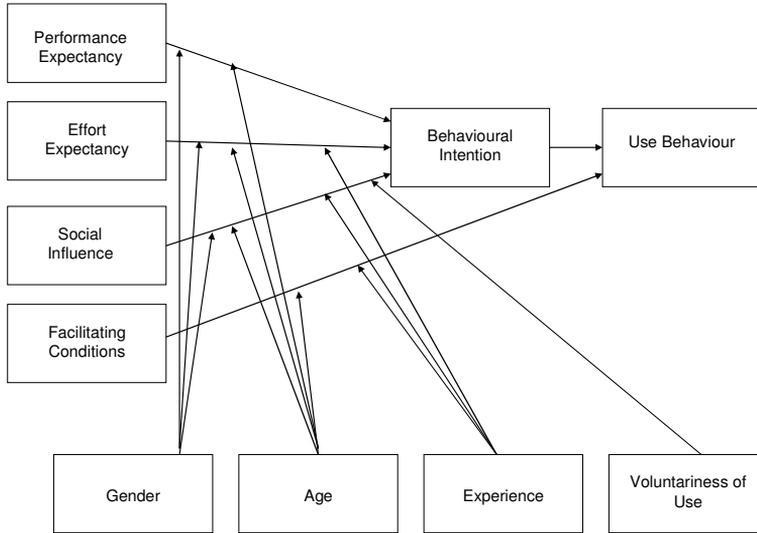


Figure 11. Research model of Unified theory of Acceptance and Use of Technology (Venkatesh et al., 2003).

Performance expectancy is, based on empirical studies, the strongest determinant in both voluntary and mandatory settings. It is dependent on gender and age in the sense that it is a stronger determinant for men and particularly younger men. Effort expectancy influences the behavioural intention to use information systems. The influence of the variable is dependent on gender, age and experience of computer usage. The influence of the variable is stronger for women, particularly younger women in early stages of experience. Social influence is only a significant determinant of usage behaviour if usage is mandatory. It also appears to lose its importance as a determining factor over time, as the information system becomes incorporated in the organisation. The influence of the variable will be moderated by gender, age, voluntariness and experience. The effect of the variable is stronger for women, particularly older women

in mandatory settings and in early stages of experience. Facilitating conditions were only found to exert influence on usage, not on intention. The influence was moderated by age and experience in the sense that it was stronger for older workers with less experience of computer usage (Venkatesh et al., 2003).

Critical voices on technology acceptance models

In spite of the high explanatory value of UTAUT, Venkatesh et al. (2003) identified a number of limitations of prior studies, applying the eight original user acceptance models (among them TAM). The technologies studied had been relatively simple and individual-oriented. Complex and group or organisation-oriented technologies had not been studied to any larger extent. The studies had not always been conducted in actual organisations, and sometimes the participants of the studies were students. The nature of measurement was most often cross-sectional, which is a severe limitation as users' intentions and behaviours could not be tracked over time. Karahanna et al. (1999) agree to the importance of a time perspective, when stating that few empirical studies have made a distinction between user beliefs and attitudes during the adoption and when the information is continuously used (pre-adoption versus post-adoption). This distinction seems to be crucial in understanding and managing the adoption process over time.

Most of the studies had been conducted in voluntary contexts, while use of information systems in real-life organisations is, to most extent, mandatory (Venkatesh et al., 2003). According to Legris et al. (2003), TAM is a useful theoretical model creating understanding and explanation of use behaviour in information systems. It has been tested in many empirical studies and seems statistically sound and rigorous. However, the limitations of TAM research are the frequent use of students instead of potential "real" users, and that mostly office automation software or systems development applications are used. Furthermore, the measurement of use is self-reported, not actual.

In a study by Lee et al. (2003), thirty-two information systems researchers assisted in critically examining TAM and specifying future directions by answering an open-ended questionnaire. The value added by TAM research was specified by the researchers as providing a parsimonious model to examine factors leading to information system acceptance, and to strengthen the research field by its rigour. The identified shortcomings of TAM research fell into four categories: First, it is a cumulative research approach primarily based on replicating previous studies with minor adjustments. Second, TAM research may be overdone: “...it has received *disproportional amount of attention in IS research detracting research from more relevant research problems which may not be as easy to investigate rigorously.*” (Juhani Iivari in Lee et al., 2003, p. 766). Third, the narrow focus of TAM has reduced what is included in studies of technology and design. Finally, the inherent simplicity of TAM makes it hard to put into practice, as practitioners may experience a lack of tangible advice: “...*imagine talking to a manager and saying that to be adopted technology must be useful and easy to use. I imagine the reaction would be “Duh!” The more important questions are what make technology useful and easy to use.*” (Alan Dennis in Lee et al., 2003 p. 766).

Benbasat and Harki (2007) argue that the independent attempts by several researchers to expand TAM has created a state of theoretical chaos and confusion, in which it is not clear which version of TAM is the commonly accepted one. Furthermore, the authors agree with Lee et al. (2003) that the intense research focus on TAM seems to have diverted researchers' attention away from more relevant research. To solve these problems, Benbasat and Harki make five suggestions. First, going back to the original theories (TRA and TPB), to allow for novelty and discovery. Second, conceptualising system use in a way that includes a broader perspective of what users actually do in and around information systems. Third, develop longitudinal, multi-stage models to capture variables on system use at different stages of the implementation. Fourth, identify the antecedents of the beliefs contained in adoption models, e.g. to develop a theory of usefulness. Fifth, usefulness has to be measured beyond perceptions, with the aim of identifying information technology artefacts

that are not only perceived to be useful, but also can be objectively shown to be useful.

Contribution to the thesis

The original version of TAM is used as the basis of the research model in the empirical study of paper I. Technology acceptance models (TAM, SCT, and UTAUT) are one of the theoretical perspectives described and applied to implementation of virtual learning environments in paper II.

The research model of the comparative, explanatory case study (paper IV-VI) comprises the four core constructs of UTAUT: performance expectancy, effort expectancy, social influence and facilitating conditions.

2.2.3. DIFFUSION OF INNOVATIONS

The perspective of diffusion of innovations was chosen to provide knowledge about the innovation process in organisations, and of which characteristics of innovations that contributes to user adoption. Furthermore, the perspective depicts diffusion of innovations as a social process, which complements the perspective of the individual user, implicit in technology acceptance models.

In this section, the perspective of diffusion of innovations will be presented. First, the theory of diffusion of innovations according to Rogers (1995), is presented. Second, Innovation Diffusion Theory (IDT), an adapted diffusion model of information technology innovations developed by Moore and Benbasat (1991), is described. Finally, critical views on diffusion research are summarised and the contributions of the theoretical perspective to the thesis are put forward.

Rogers (1995) defines diffusion as *“the process by which an innovation is communicated through certain channels over time among the members of a certain system”* (p. 5). Diffusion is defined as a process, changing a social system and leading to certain consequences. An innovation is an idea, practice, or

object that is perceived as new by an individual or an organisation. The idea might not be original or new from a general perspective. It is the perceived newness of the idea that determines if it is an innovation or not. Individuals differ in innovativeness, which is defined as “the degree to which an individual is relatively early in adopting new ideas than other members of the system” (Rogers, 1995, p. 22). To describe innovativeness, Rogers suggests a standard set of five adopter categories. Adopter categories are the classification of members of a social system on the basis of innovativeness. Adopter distribution in the total population tends to follow normal distribution. The adopter categories and their dominant attributes and their share of the total population are described in table 6.

Table 6. Adopter categories, dominant attributes and share of the total population (adapted from Rogers, 1995).

Adopter category	Dominant attribute	Share of the total population
Innovators	Venturesome	2.5%
Early adopters	Respect	13.5%
Early majority	Deliberate	34%
Late majority	Sceptical	34%
Laggards	Traditional	16%

Early adopters seem to differ in personality variables from later adopters. According to Rogers, they have greater empathy, a greater ability to deal with abstractions, greater rationality and intelligence, a better ability to cope with uncertainty and risk, and a more favourable attitude toward change. Early adopter categories also display different communication behaviour in the innovation decision process than later categories. They have more social participation, more change agent contact, greater exposure to media and interpersonal communication channels, engage in more active information seeking and have a greater knowledge of the innovation.

Not only individuals make decisions to adopt or not to adopt an innovation but also organisations. Rogers (1995) describes three types of organisational innovation-decisions: *optional*, *collective* or *authority* decisions.

Optional decisions are choices made by an individual to adopt or reject an innovation independent of the other members of the social system. Collective decisions are choices to adopt or reject the innovation made by consensus among the members of a social system. Authority decisions are choices that are made by relatively few individuals in the social system, possessing power, status or technological expertise. The type of innovation-decision is related to the rate of adoption. Innovations requiring individual decisions generally are adopted faster than innovations requiring more persons involved in the innovation-decision.

The innovation process in organisations consists of two broad activities: *initiation*, defined as the entire information gathering, conceptualizing and planning for the adoption of an innovation, and *implementation*, all of the events, actions and decisions involved in putting an innovation into use. Initiation is divided into two stages, *agenda-setting* and *matching*, while implementation comprises the three stages of *redefining/restructuring*, *clarifying*, and *routinizing*. Agenda-setting occurs in the innovation process when a general organisational problem that may create a need for an innovation is defined. During this stage a *performance gap*, a discrepancy between an organisation's expectations and actual performance, is defined. During the matching stage, the innovation is tailored to solve the organisational problem and fill the performance gap. The first stage of the implementation is redefining/restructuring, when the innovation is re-invented to accommodate the organisational needs more closely. Clarifying occurs as the innovation is put to a more widespread use and the meaning of the innovation becomes clear to the organisation's members. Routinizing marks the end of the innovation process, as the innovation becomes an incorporated part of the organisation and ceases to be an innovation. The innovation process is depicted in table 7.

Table 7. *The innovation process in organisations (Rogers 1995).*

I. Initiation		II. Implementation		
1. Agenda-setting	2. Matching	3. Redefining/restructuring	4. Clarifying	5. Routinizing

To be adopted by an organisation, an innovation has to be perceived as being in possession of certain attributes. Rogers (1995) has defined these attributes as *relative advantage*, *compatibility*, *complexity*, *trialability* and *observability*. Relative advantage is the degree to which the innovation is perceived as being something better than the idea that it succeeds or substitutes. It is often expressed as economic profitability, social prestige or other measurements of “success”. Rogers states that the relative advantage of an innovation, as perceived by the members of a social system, is positively related to its rate of adoption. Compatibility is the degree to which an innovation is perceived as being consistent with sociocultural values and beliefs, existing ideas and the needs of its potential adopters. When it comes to sociocultural values and beliefs, an innovation could be incompatible with both national and organisational cultures. An innovation possessing a high degree of compatibility is perceived as more familiar and thus less threatening to the potential adopter. Complexity is the degree to which an innovation is perceived as relatively difficult to understand and use. All innovations could be graded in degree of simplicity or complexity, with information technology innovations being fairly complex to the adopter. Although the research evidence is not fully conclusive, Rogers (1995) suggests that the complexity of an innovation, as perceived by members of a social system, is negatively related to its rate of adoption. Trialability is the degree to which an innovation may be experimented with on a limited basis. Innovations that can be tried or tested to find out their characteristics or consequences are more likely to be adopted fast. Observability is the degree to which the results of an innovation are visible to others. The results of some innovations are easily observed and communicated to others while the results of other innovations are both difficult to observe and to describe to others. Rogers (1995) argue that the observability of an innovation, as perceived by the members of a social system, is positively related to its rate of adoption.

Innovation Diffusion Theory (IDT)

Moore and Benbasat (1991) adapted the characteristics of Rogers' model and developed a survey questionnaire instrument to measure perceptions of adoption of information technology innovations. The main constructs of interest in Moore and Benbasat's study were the perceived characteristics of using an innovation, relying primarily on the constructs of relative advantage, compatibility, complexity, observability and trialability. Furthermore, the constructs of *image* and *voluntariness of use* were thought important in influencing adoption of information technology adoptions. Image was defined as "*the degree to which use of an innovation is perceived as to enhance one's image or status in a social system*" (Moore and Benbasat, 1991, p. 195). The construct of voluntariness of use was added to capture the degree to which the use of the innovation was perceived as of free will. In addition, the construct of *ease of use*, equalling the construct of perceived ease of use from the technology acceptance model, was included in the development of the measurement instrument. During the development of the survey questionnaire, the construct of observability was divided into two new constructs: *results demonstrability* and *visibility*.

The results of the study was a measurement instrument including the constructs of relative advantage, ease of use, image, visibility, compatibility, results demonstrability, trialability and voluntariness of use. In a later study by Moore and Benbasat, these constructs, with the exception of trialability, were found to have predictive validity regarding rate of adoption of information technology innovations (Moore and Benbasat, 1996; Venkatesh et al., 2003). The core constructs of Moore and Benbasat's final research model are defined in table 8.

Table 8. Definitions of core concepts in Innovation Diffusion Theory according to Moore & Benbasat (Venkatesh et al., 2003).

Core constructs	Definition
Relative Advantage	“the degree to which an innovation is perceived as being better than its precursor” (Moore & Benbasat, 1991, p. 195).
Ease of Use	“the degree to which an innovation is perceived as being difficult to use” (Moore & Benbasat, 1991, p. 195).
Image	“the degree to which use of an innovation is perceived to enhance one’s image or status in one’s social system” (Moore & Benbasat, 1991, p. 195).
Visibility	The degree to which one can see others using the system in the organisation” (adapted from Moore & Benbasat, 1991).
Compatibility	“the degree to which an innovation is perceived as being consistent with existing values, needs, and past experiences of potential adopters” (Moore & Benbasat, 1991, p. 195).
Results Demonstrability	“the tangibility of the results using the innovation, including their observability and communicability” (Moore & Benbasat, 1991, p. 203).
Voluntariness of Use	“the degree to which use of the innovation is perceived as being voluntary, or of free will (Moore & Benbasat, 1991, p. 195).

Critical voices on diffusion of innovations research

Innovation diffusion theory has, according to Rogers (1995), been a target for four major criticisms: its pro-innovative bias, the individual-blame bias, the recall problem and the issue of equality. The pro-innovative basis is the implication that an innovation is in itself something good, that should be diffused and adopted by all members of a social system. The meaning of the individual-blame bias is the tendency to hold an individual, rather than the social system, responsible for his or her problems with the innovation. The recall problem mirrors the problem of respondents to accurately recall their reactions to an innovation. Finally, the issue of equality is an important basis for criticism as innovations often widen the socio-economic gaps among the members of a social system.

Lyytinen and Rose (2003) argue that the information systems innovation research so far has overlooked the significance of different kinds of

information technology innovations: *"In brief, not all IT innovations are born equal and IS research should recognize this."* (p. 577). Orlikowski and Iacono (2001), argue that information systems research generally overlooks the information technology artefact. Moore and Benbasat's innovation diffusion theory is taken as an example of conceptualizations of technology that do not capture technology: *"All share the assumption that the critical aspect of information technology can be captured through some set of surrogate (usually quantitative) measures – such as individual perceptions, diffusion rates, or dollars spent. For example, the study by Moore and Benbasat (1991) develops an instrument for assessing individual users' perceptions of the new technologies they might consider adopting."* (Orlikowski & Iacono, 2001, p. 124).

Contribution to the thesis

A classification of adopter categories according to Rogers (1995) is used as one of the student background factors in the survey study of paper I. Diffusion of innovations is one of the theoretical perspectives described and elaborated on in paper II of the thesis.

The research model of the comparative, explanatory case study comprises three constructs from Moore and Benbasat's (1991) innovation diffusion theory (IDT), results demonstrability, visibility and voluntariness of use. The case study also explores and analyses what kind of innovation-decision that was made on the use of the virtual learning environment, and what stage of the innovation process that has been reached in the university organisation.

3. RESEARCH APPROACH

In chapter 3, the research approach of the thesis is described. First, a short review of methodologies used in educational technology research is made. Second, methodological choices and decisions made in the thesis work are elaborated on. Third, the development of the research model used throughout the thesis is described. Fourth, the research settings of the empirical studies of the thesis are presented. Finally, methods of data collection and analysis are described.

3.1. EDUCATIONAL TECHNOLOGY RESEARCH

Virtual learning environments are studied in the international research field of educational technology. The research field is relatively young and different research approaches compete for acceptability (Driscoll, 1995). Literature on educational technology is large and growing, but often anecdotal more than built on rigorous empirical research (Romiszowski & Mason, 2004). Furthermore, the field has been criticized for a lack of cumulativeness (Hoadly & Pea, 2002).

In a review of the American educational technology research field from the 1970s to the 2000s, Honey et al., (2000) explored the nature of the technological elements involved in the research, the research questions asked, and the research methods used. The authors concluded that the technological elements involved in the research have developed from text-based, locally network or stand-alone computers, to more complex technologies combining e.g. computation, connectivity, multimedia capacities and speed. In the 1970s, the research questions mainly focused on whether certain kinds of computer-based activities improved students' learning. Recently, researchers are increasingly asking questions about how technology is integrated into educational settings, how technology is interpreted and adapted by users, and how to match technological

capacities with learners' needs. Research has also evolved to include assessment, administration, communication and curriculum development. As the complexity of the research questions have evolved, so have also the sophistication and variety of research methods.

In a review of research approaches underlying research on educational technology examining articles of four educational technology journals, Hrastinski and Keller (2007) concluded that the area was dominated by empirical studies, adopting pluralistic research approaches. The reviewed studies mainly relied on quantitative methods, but qualitative and mixed research approaches were also commonly applied. Articles applying quantitative methods measured learner and teacher attitudes to educational technology, the impact of the technology on learner performance, and the extent of electronic communication between learner and teacher. The focus of the qualitative articles was to retrospectively discuss a project or a course in a descriptive case study, or to categorise themes and meanings of interaction in learning environment. Surveys, field experiments, and case studies were the most common research approaches. Falling into the category of non-empirical studies, a number of articles could be classified as design science, as development and design of virtual learning environments were described. European research had a crucial point in case studies describing pedagogical approaches or design of e-learning systems, while American, Australian and Asian research more seemed to rely on quantitative research methods such as surveys and field experiments. In spite of the national differences, educational technology research was found to be characterised by a diversity of research approaches, both positivist and interpretive, depending on the research questions asked.

3.2. METHODOLOGICAL CONSIDERATIONS AND DECISIONS

The choices of which research approaches to use during different parts of the thesis work were guided by the aim and the four research questions.

The aim of the thesis was to create knowledge about factors influencing acceptance of virtual learning environments among academic staff and students in blended learning environments in higher education. Factor research is one of the major research streams in information systems research (Kwon & Zmud 1987; Shaw, 2003). Within this research stream, a factor is defined as an individual, organisational, and technological variable, potentially important in gauging how effective information systems implementation is, in terms of use or satisfaction with use (Shaw, 2003). Factor research applies quantitative methodologies, measuring different factors and assessing the relationships between factors by statistical analysis. As TAM is a classic example of factor research, a theory-testing, quantitative research approach comprising a survey study was used to answer research question 1, “*Which factors influence students’ acceptance of virtual learning environments from the perspective of TAM?*”. To give the students an opportunity to express opinions on the virtual learning environment that were not captured by the concepts of TAM, open-ended questions of the advantages and disadvantages of the learning environment were asked. To provide a qualitative description of how the virtual learning environment was used in the educational context, semi-structured interviews were made with teachers, involved in the implementation process at the two university colleges studied.

To answer research question 2, “*What influence do learning styles have on students’ acceptance of virtual learning environments?*”, a research approach was chosen which combined a literature review with a single case study. In the literature review, a qualitative meta-analysis was performed of articles from educational technology journals exploring the influence of learning styles on students’ perceptions of and performance in virtual learning environments. The case study assessed the learning styles of 19 students on a master course on the academic subject of change and knowledge management. The relationships between the learning styles of the students and their perceptions of the communication in the virtual learning environment used in the course were explored statistically, and additional open-ended questions were asked concerning advantages and

disadvantages of the electronic communication. The combination of literature review and case study gave both theoretical and empirical evidence to draw conclusions on the impact of learning styles on students acceptance of virtual learning environments.

The third research question was *“Which factors influence acceptance of virtual learning environments among academic staff and students from the perspectives of organisational learning, technology acceptance, and diffusion of innovations?”* To answer this research question, a comparative, explanatory case study approach was chosen. The case study comprised semi-structured interviews with academic staff, a students’ survey questionnaire and document analysis, in order to capture the core concepts of organisational learning, technology acceptance and diffusion of innovations from a qualitative (interviews) as well as quantitative (survey) point of view. In the case study, the question of *what* factors influence acceptance was asked, but also the question *why* certain factors seemed to be more important than others. The question of *why* is the most important dimension of explanatory case study research (Miles and Huberman, 1994). As a means of depicting relationships between factors, statistical regression analysis was used. The aim of the statistical analysis was not to create a statistical regression model. Instead, it was to describe relationships between factors in the three cases, and to look for regularities or tendencies in the material and in order to explain them (Ron, 2002). Furthermore, as cross-sectional studies offer weak evidence of cause and effect (Gable, 1994), the research settings should be studied at no less than two points of time.

The fourth research question was *“Which factors would a descriptive and explanatory model of acceptance of virtual learning environments among academic staff and students in blended learning environments include, based on the three perspectives of organisational learning, technology acceptance and diffusion of innovations?”* To answers the research question, a conceptual-analytical research approach was chosen to identify the theoretical perspectives that could lay the foundation of a research model, supplementing TAM (paper II). Second,

the research model was tested by a retrospective analysis research approach, and refined (the licentiate thesis). Third, the research model was tested in an empirical case study (paper IV-VI), based on the assumption that theory can be built from case study research (Eisenhardt, 1989).

Strengths and limitations of the chosen research approach and alternative research approaches are discussed in section 5.5.1.

3.3. THE DEVELOPMENT OF RESEARCH MODELS

In this thesis, research models are used to describe relationships between factors and to look for regularities or tendencies in the material in order to explain them (Ron, 2002). From the original model of TAM, applied in paper I (Keller & Cernerud, 2002), the research model of the thesis has evolved step by step to the descriptive and explanatory model presented in the concluding discussion of the thesis. In this section, the development of the research model throughout the empirical studies of the thesis is described.

The initial research model applied in the empirical survey study of paper I was based on the original version of TAM. The research model hypothesised that individual student background factors influenced the core constructs of perceived usefulness, perceived ease of use and added educational value. A high degree of perceived usefulness, perceived ease of use and added educational value would then influence students' use of the virtual learning environment in a positive way (Keller & Cernerud, 2002). The initial research model of paper I is described in figure 12.

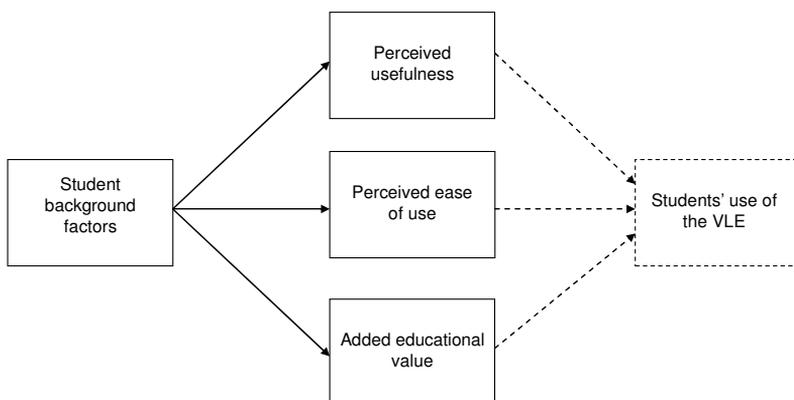


Figure 12. The initial research model of the empirical study of paper I.

The statistical analysis of the data from the survey showed that there was a strong significant relationship between students' perceptions of the virtual learning environment and which university college the students belonged to. This observation led to the conclusion that organisational factors depending on the school were more influential in affecting students' perceptions of virtual learning environments than individual student background factors. Furthermore, a factor analysis of the students' responses on the three core constructs of the survey questionnaire (perceived usefulness, perceived ease of use and added educational value) resulted in one factor. The accordingly revised research model is presented in figure 13.

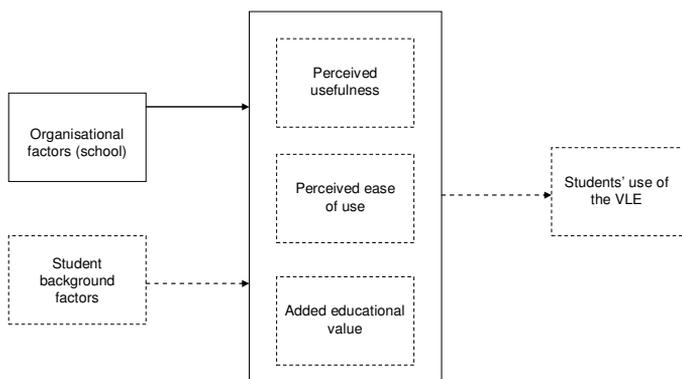


Figure 13. The revised research model of the empirical study of paper I.

The aim of paper II of the thesis (Keller, 2005a) was to search for theoretical perspectives offering explanations of the findings of paper I. The theoretical perspectives chosen were technology acceptance, diffusion of innovations, and an organisational learning process perspective. In the licentiate thesis (Keller, 2005b), a retrospective analysis was made of the data from paper I, from the three theoretical perspectives presented in paper II. As a conclusion of the retrospective analysis, an extended research model was presented in order to explain students' acceptance of virtual learning environments in higher education. In this research model, an organisational learning process to accept or reject the virtual learning environment influenced students' acceptance directly and indirectly via the core constructs of technology acceptance. High degrees of performance expectancy, effort expectancy, social influence, facilitating conditions, visibility and results demonstrability were hypothesised to influence students' acceptance positively. A high degree of teachers' voluntariness of use was hypothesised to influence students' acceptance negatively. The extended research model is depicted in figure 14.

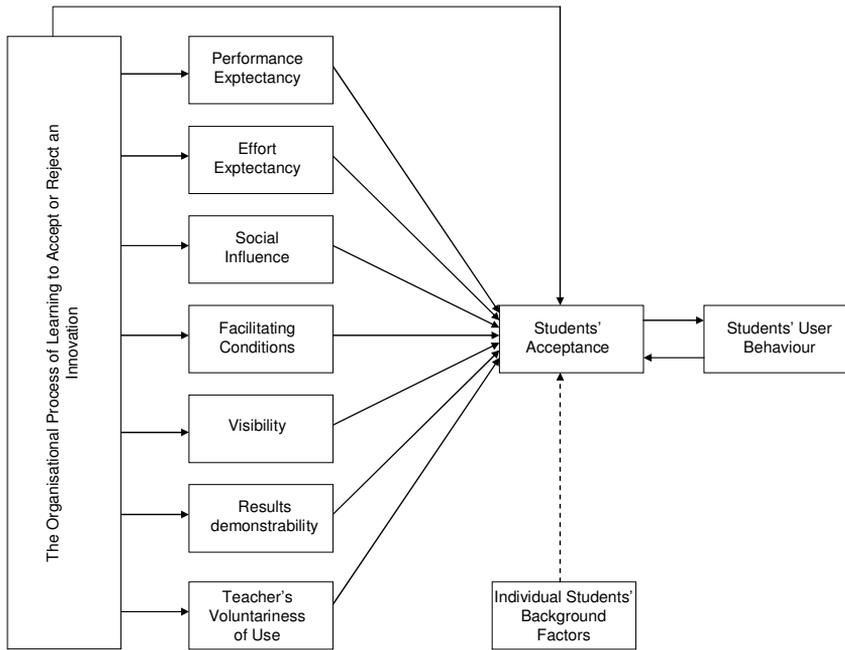


Figure 14. Research model for students' acceptance of virtual learning environments in blended learning environments (Keller, 2005b).

Subsequently, the research model from the licentiate thesis was further refined. In the case study of paper IV-VI (Keller, 2006; Keller, Hrastinski & Carlsson, 2007; Keller, 2007), a research model was used that combines elements from organisational learning (perspective I) according to Fiol and Lyles (1985), UTAUT (perspective II) and IDT (perspective III). The research model, building on three perspectives, is presented in figure 15a.

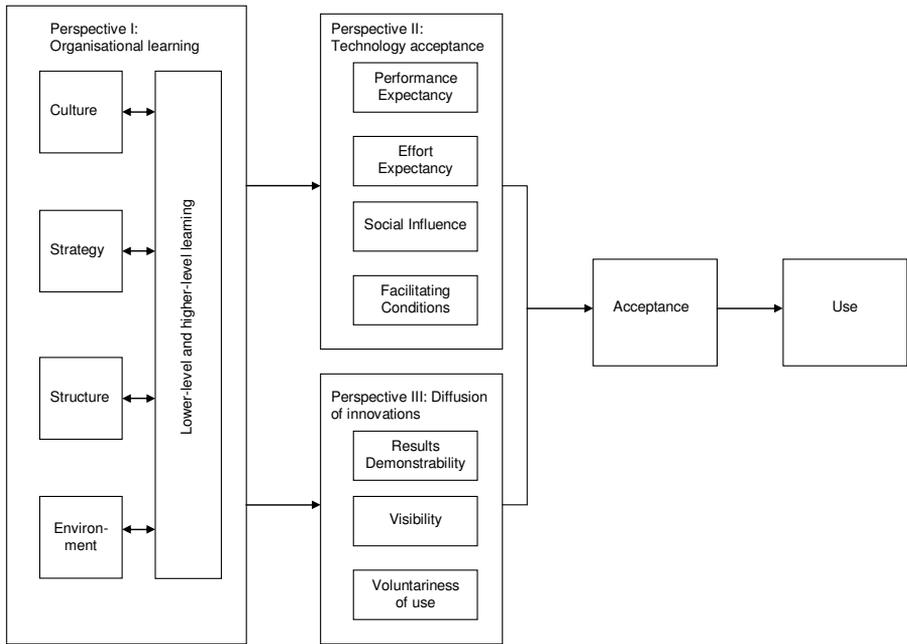


Figure 15a. Overall research model of the case study and the interviews with academic staff.

Perspective I. Organisational learning: The four contextual factors of *culture*, *strategy*, *structure* and *environment* influences, and are influenced by, the process of lower- and higher-level learning. *Lower-level learning*, in association with the virtual learning environment, concerns the development of new routines and rules, adjustment in management skills and problem-solving skills. *Higher-level learning*, regarding the virtual learning environment, involves the development of new organisational missions, directions and agenda, problem-defining skills, and new myths, stories and culture. The organisational learning, in association with the implementation and use of the virtual learning environment, influences the degrees of performance expectancy, effort expectancy, social

influence, facilitating conditions, visibility and results demonstrability perceived in the university organisation. Furthermore, the perceived voluntariness of use is a result of the organisational learning process resulting in agreements on the use of the virtual learning environment.

Perspective II. Technology Acceptance (UTAUT): Performance expectancy is the degree to which the user believes that using the virtual learning environment will help him or her to attain gains in educational performance. *Effort expectancy* is the degree of ease associated with the use of the virtual learning environment. *Social influence* is the degree to which the user perceives that others believe that he or she should use the virtual learning environment. *Facilitating conditions* are the degree to which the user believes that an organisational and technical infrastructure exists to support the use of the virtual learning environment (Venkatesh et al., 2003). High degrees of performance expectancy, effort expectancy, social influence and facilitating conditions are proposed to influence the general acceptance of the virtual learning environment positively.

Perspective III. Innovation Diffusion Theory (IDT): Results demonstrability is the tangibility of positive results using the virtual learning environment, including their observability and communicability. *Visibility* is the degree to which the user can see others using the virtual learning environment at the university. *Voluntariness of use* is defined as the degree to which use of the virtual learning environment is perceived as being voluntary, or of free will (Moore & Benbasat, 1991). High degrees of visibility and results demonstrability are proposed to influence the general acceptance of the virtual learning environment positively. A high degree of voluntariness of use is proposed to influence the general acceptance of the virtual learning environment among academic staff positively, while it is proposed to influence general acceptance among students negatively.

Academic staff is considered to be an active part of the everyday lower-level and higher-level learning taking place in the university organisation. One of the outcomes of this learning process is the organisational culture, defined by Williams et al. (1993) as the commonly held and relatively

stable beliefs, attitudes and values that exist within the organization. Academic staff is a part of the university organisation for longer periods of time, while students attend courses or programmes and subsequently leave the organisation. As a result, academic staff is hypothesised to mediate their shared beliefs, attitudes and values to the students of the university. Moreover, the decisions making the virtual learning environment optional or mandatory for students to use in programmes and courses are taken by the academic staff. Hence, the research model of the students' survey study focuses on the six remaining core constructs of UTAUT and IDT: performance expectancy, effort expectancy, social influence, facilitating conditions, results demonstrability and visibility. The research model of the students' survey study is presented in figure 15b. The organisational learning process, influencing and influenced by the four contextual factors, as well as the factor of voluntariness of use, are hypothesised to be mediated by academic staff to students and are, therefore, marked with dashed lines in figure 15b.

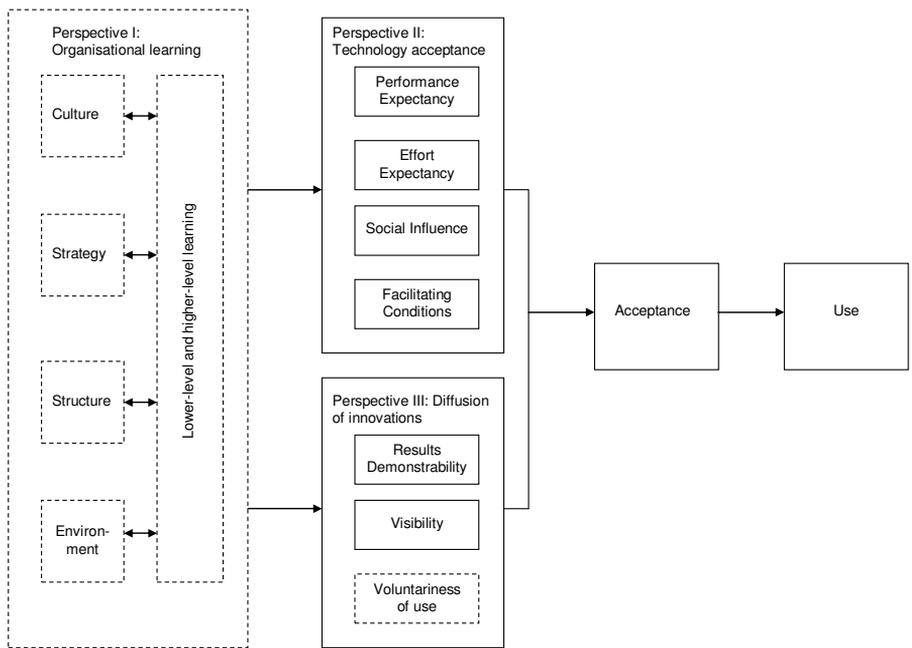


Figure 15b. Research model of the students' survey questionnaire.

3.4. RESEARCH SETTINGS

In this section, the research settings of the empirical studies of the thesis are presented.

3.4.1. PAPER I

The research setting of the empirical study of paper I was the School of Health Sciences (SH) and the School of Engineering (SE) at Jönköping University. A survey questionnaire was distributed among students of the schools. The questionnaire is presented in Appendix 2a. The students of both schools had been using the same virtual learning environment

(PingPong) as a part of a blended environment for approximately two years when the study was performed. In this case, the term, blended learning environment, describes a learning situation where the virtual learning environment was used as an addition to teaching on campus. The students of both university colleges experienced traditional teaching on campus, such as lectures, seminars and tuition sessions face-to-face. The web platform was mainly used for providing course information, text based course content and hyperlinks to electronic articles. In some cases, the virtual learning environment was also used for virtual seminars and tuition sessions, for providing electronic exams, and for presenting lectures and short instructional films asynchronously using streaming video. The study base was students having used the platform in at least two main courses during the last year. This criterion was met by 750 students at SE and SH. From these students, 150 students were randomly selected for the study, 75 from each of the two schools, comprising equal numbers of female and male students. The students represented the bachelor programmes of Occupational therapy, Biomedical laboratory science, Medical imaging, Prosthetics and orthotics, Nursing, Social work, Computer engineering, and Electrical engineering.

To provide a background for the analysis of the survey data, semi-structured interviews were performed with teachers at SE and SH, also acting as key persons of the implementation process. The interview guide is presented in Appendix 2b.

3.4.2. PAPER III

The research setting of the single case study on learning styles of paper III was a master course during the autumn semester of 2005 at Växjö University, on the academic subject of change and knowledge management. The student group comprised 19 students, 14 women and five men. The mean age of the students was 43 years. The course was mainly delivered through online seminars that included discussions in a discussion forum (asynchronous), and seminars in real-time by chat

(synchronous). Students attended lectures and seminars on campus at the beginning and end of the course.

3.4.3. PAPER IV-VI

In this section, the case selection is discussed and the research setting of the comparative, explanatory case study of paper IV-VI is presented.

Case selection

The case selection was made on the basis that the research setting should be educational institutions providing higher education and that a virtual learning environment should currently be implemented in web-based programmes and courses. It was also considered necessary that some of the characteristics of the educational institutions should vary in order to analyse the impact of variation of factors. The choice of research settings in three different countries was made in order to study if the national culture could have an impact on the acceptance of virtual learning environments.

The cases were chosen on advice from a Swedish public health professor by theoretical sampling (Glaser and Strauss, 1967; Eisenhardt, 1989). Hence, the cases were chosen for theoretical reasons, and not for statistical reasons. The choice of case universities has consequences for what can be studied, what conclusions can be drawn from the case study and if, and how, the findings could be generalised to other research settings. The three chosen case universities provided the same kind of higher education, courses and programmes in public health. The three universities differed in size, structure and geographical location. One university was small and provided only public health education, while the other two universities were part of larger traditional university organisations. As the students at the universities were master students, they were older than common undergraduate bachelor students. The majority of the students were female. As a result, the findings from the case study concerns one specific academic subject, public health, and

master education. Another consequence of the case selection was that older students were focused on, before younger students. The variation among the case universities concerning size, structure and geographical location provided opportunities to explore the effect of organisational size, structure and national culture on acceptance of virtual learning environments.

As case study research does not build on the principles of statistical sampling, it is not feasible to make generalisations based on academic staff and students. On the other hand, case study research could form a basis for generalising in the sense that empirical findings could be generalised to theoretical statements, such as concepts, theory, specific implications and rich insight (Walsham, 1995; Lee & Baskerville 2003; Yin, 2003). Robson (2002) describes the generalisability of case study research as analytical or theoretical generalisation: *“Here the data gained from a particular study provide theoretical insights which possess a sufficient degree of generality or universality to allow their projection to other contexts and situations.”* (Sim, 1998, p. 350). The aim of the case study was to provide such a generalisation in order to create a model to describe and explain acceptance of virtual learning environments among academic staff and students in blended learning environments.

The academic subject of public health

The academic subject of public health describes and analyses changes of health, of populations and the determinants influencing health. It also suggests actions to promote and protect health and to prevent disease (Baggott, 2000; Detels et al., 2002). Public health education is offered as university bachelor and master programmes by faculties of medicine or social science. Public health is a continuing education for students with a former profession, such as physicians, nurses, dentists, veterinarians, psychologists and social workers. The latest available definition of the mission of European Schools of Public Health says: *“Schools of Public Health train their students to be able to develop, organise, manage, evaluate and adjust cost-effective interventions aiming at the promotion of health and reduction of present and forecasted public health problems.”* (Foldspang, 2007, p. 5).

The academic subject of public health is further presented in paper VI.

Nordic school of public health

The Nordic School of Public Health (NS) is situated in Gothenburg, Sweden. The school provides master and postgraduate education in public health for students from all Nordic countries: Sweden, Norway, Denmark, Finland, Iceland, the Faroe Islands, Greenland and Aland (Nordic School of Public Health, 2003). The teaching languages are Swedish, Norwegian, Danish and English. There are 400 to 500 students on the public health courses at the school each year. The majority of the students are Swedish or Norwegian. The total number of staff at the school is about 60 (Nordic School of Public Health, 2007). The school is directed by the Nordic Council of Ministers and is financed by subsidies in proportion to the growth national product of each Nordic country. The virtual learning environment Fronter is used to deliver master courses in a blended learning environment.

Semi-structured interviews were conducted at NS in June and November 2005. The respondents of the interviews were the dean, the project manager of the implementation and one of the teachers, who was an active member of the project group and used Fronter in his courses. Thirty-two students in two master courses answered the students' survey questionnaire during the autumn semester of 2004. Sixty-three students of six master courses answered the questionnaire during the autumn semester of 2005.

The research setting of Nordic School of public health is further presented in paper VI.

University of Tromsø

The University of Tromsø (UT) is the northernmost university in the world, situated about 350 kilometres above the Arctic Circle. It is the smallest university in Norway with 6,300 students and 1,800 employees.

The teaching languages are Norwegian and the Sámi language. Courses for foreign students are taught in English. The Institute of Community Medicine is responsible for two master programmes in public health, one programme comprising two years and 120 points, the other programme being based on prior vocational experience, comprises one and a half years and 90 points (University of Tromsø, 2005). Since 2003, the institute offers a two-year master programme in public health. The programme is partly web-based with each course including mandatory meetings on campus lasting two or three days. The institute has 105 employees. The virtual learning environment Fronter is used at the institute.

Semi-structured interviews were performed at UT in June 2005 and in February 2007 with two deans, two course administrators and two teachers, using Fronter in their courses. The seven students of the master programme in public health answered the students' survey questionnaire in February 2007.

The research setting of University of Tromsø is further presented in paper VI.

Kaunas University of Medicine

Kaunas University of Medicine (KMU) is the largest institution for medical and public health education in Lithuania. It is an autonomous university, financed mainly by the Lithuanian state (Kaunas University of Medicine, 2005a). KMU is also a World Health Organisation collaborating centre for research and training in epidemiology and the prevention of cardiovascular and other chronic non-communicable diseases (Kaunas University of Medicine, 2003). The total number of students in 2003 was 3,400. The principal language of teaching at KMU is Lithuanian, but foreign students are instructed in English. KMU has five faculties: the Faculty of Medicine, Faculty of Odontology, Faculty of Pharmacy, Faculty of Nursing and Faculty of Public Health. There are 109 teachers employed at the faculty (Kaunas University of Medicine, 2005b). The Faculty of Public Health offers one bachelor programme, two master

programmes and one Master of Management Continuing Training programme in Public Health. Continuing training courses are provided for different target groups of public health and medical professionals. The majority of participants in the courses are family doctors, public health professionals and health care managers (Kaunas University of Medicine, 2003). The virtual learning environment, WebCT, is used to deliver courses in a blended learning environment.

Semi-structured interviews were performed at KMU in September 2004 with the dean, the head of the distance education centre and with one teacher, using WebCT in her courses. Thirty-five students in three master courses in public health answered the students' survey questionnaire during the autumn semester of 2004.

The research setting of Kaunas Medical University is further presented in paper VI.

3.5. DATA COLLECTION METHODS AND ANALYSIS

3.5.1. PAPER I

In paper I, a survey methodology was used. To provide a background to the analysis of survey data, semi-structured interviews were made.

Students' survey questionnaire

The questionnaire items of the survey measured the constructs of *perceived usefulness*, *perceived ease of use*, and *added educational value*. The operationalisation of the three core constructs into statements of the questionnaire is described in table 9. The students were asked to rate if they agreed to the statements on a Likert scale from one ("I disagree totally") to five ("I agree totally").

Table 9. Operationalisation of core constructs to questionnaire items (Keller, 2005b).

Core construct	Operationalised as statement
Perceived ease of use (TAM)	The web platform was easy to understand and use
Perceived usefulness (TAM)	The use of the web platform has facilitated my studies. The use of the web platform has improved my possibilities to solve problems connected to my training programme.
Added educational value	The use of the web platform has increased flexibility in my studies. The use of the web platform has improved communication with teachers and tutors. The use of the web platform has improved communication with other students. The use of the web platform has improved the pedagogical value of the courses.

To capture the influence of technical infrastructure on students' perceptions, a question about the extent of technical problems when using the virtual learning environment was asked. Individual student background factors were determined and measured, such as educational programme, age, gender, previous knowledge of computers, attitudes to new technology, and learning styles. Attitudes of new technology were measured according to Rogers' (1995) five adopter categories. Learning styles were assessed by statements evaluating which one of Kolb's learning styles (1984) the students preferred. The questionnaire is presented in Appendix 2a.

The percentages of the answers "I agree totally/I agree to a large extent" and "I disagree totally/to a large extent" were calculated for all participating students for the statements measuring perceived ease of use, perceived usefulness and added educational value. A factor analysis (Hair et al., 1998) of the statements showed a close interrelationship (factor score more than 0.5) between the questions, resulting in one factor or index. As the construction of the seven statements was symmetrical, a data reduction was performed by creating an index. The index was formed

by summing up the answers to the statements for each individual. “I do not agree” was given the index value 1 and “I agree totally” was given the index value 5. The seven statements were given the same weight in the total index. The index thus varied between 7 and 35 for each individual.

A multiple regression analysis was then performed (Greenland, 1998) where the index was the dependent variable (y-variable) of the analysis. Seven independent variables (x-variables) were used in the analysis; gender, age, school, previous knowledge of computers, attitudes to new technology, and learning style. The correlation coefficient for each x-variable was calculated with the p-value, denoting the probability for the correlation coefficient not being zero. R-square was calculated to denote how much of the variability in the attitude variable (y-variable) could be explained by the influence of the x-variables.

In two open-ended questions, students were given the opportunity to state their own opinion of advantages and disadvantages of using the virtual learning environment. The written qualitative information was reduced and put through content analysis (Downe-Wamboldt, 1992) leading to classification into main categories. The proportion of students stating the most frequent advantages and disadvantages was calculated for each category.

The semi-structured interviews

To gain knowledge about implementation and use of virtual learning environments at each school, semi-structured interviews were performed with the two teachers serving as key implementers of the virtual learning environment at the School of Health Sciences and the School of Engineering. The interview guide is presented in Appendix 2b. The findings from the interviews constituted the foundation of the analysis of the organisational factors influencing the outcomes of the implementation process.

3.5.2. PAPER II

Paper II is a conceptual-analytical contribution, describing three different perspectives of implementation and acceptance of new technologies. Järvinen characterises conceptual-analytical studies in the following way: “*In conceptual-analytical studies basic assumptions behind constructs are first analyzed; theories, models and frameworks used in previous empirical studies are identified, and logical reasoning is thereafter applied.*” (Järvinen, 2004, p. 10).

Literature and library article databases (EBSCO and Elsevier Science) of organisation theory, management and information systems research were searched with keywords such as *implementation, implementation process, technology acceptance, user acceptance, user resistance, innovation, diffusion, learning, learning process* and *organisational learning*. The aim of the search was to identify perspectives that together could form an as holistic view as possible to mirror the process of information systems implementation and acceptance. The models should be able to explain acceptance of new technology on an individual and organisational level. The chosen theoretical perspectives were analysed according to their basic concepts, how the perspectives regarded the virtual learning environment and its user, and if the perspective could consider the different roles of teachers and students. Moreover, the implications for successful use and implementations of virtual learning environments inherent in the perspectives were identified and elaborated on.

3.5.3. THE LICENTIATE THESIS

In the licentiate thesis, the empirical data from the study of paper I were analysed retrospectively from the three theoretical perspectives of paper II. The retrospective analysis is, according to Järvinen (2004), characterised as a theory-testing research approach. Lee (1989) recommends four questions for theory-testing case research approaches:

- For the question of *empirical validity*, does the study confirm the theory through empirical testing?

- For the question of *logical consistency*, are all the predictions considered consistent with one another?
- For the question of *relative predictive power*, does the case study rule out rival theories?
- For the question of *falsifiability*, does the case study consider any predictions through which the theory of interest could be proven wrong?

In the retrospective analysis the question of empirical validity was focused upon, since the analysis was the first step in assessing the explanatory value of the theoretical perspectives of paper II. Questions of logical consistency, relative predictive power and falsifiability would have been subsequent steps in the theory-testing approach. The core constructs from the three theoretical perspectives, reviewed in paper II, were applied to the findings of paper I in order to see if possible explanations of the results could be found. The analysis focused on elucidating aspects of the differences between the two university colleges, which were the research objects of the study. The data was further analysed from three perspectives of technology acceptance (UTAUT), diffusion of innovations and organisational learning to see if the findings of the previous study could be described and further explained.

3.5.4. PAPER III

In paper III, a research approach combining a literature review and a single case study was applied.

Literature review

To identify relevant literature, searches were performed in the scientific databases of ABI/Inform, and Emerald, using the term *learning style*. Furthermore, tables of content of educational technology journals not included in the databases were scanned to identify articles about learning styles. To structure the literature review, the articles were organised in a concept matrix augmented with units of analysis (Webster & Watson,

2002). As a result, three different focus of content was identified in the articles of the literature review: the impact of learning styles on students' performance, the impact of learning styles on students' attitudes, and the use of different learning styles in different learning environments. Based on this finding, three research questions were identified to guide the qualitative meta-analysis of the articles:

- How well do students of different learning styles succeed in online education?
- What attitudes do students of different learning styles have towards online education?
- Do students use other learning styles in online education than in classroom teaching?

A qualitative meta-analysis was made by classifying the articles in categories representing each research question and summarising the findings. To achieve a critical mass of scientific studies to draw valid conclusions from, the study was focused on the learning styles most commonly reviewed in the literature, Kolb's learning styles, and the learning styles of Honey and Mumford.

Single case study

To capture empirical data on the influence of learning styles on students' acceptance of virtual learning environments, a single case study approach was chosen, comprising a learning style inventory, a survey questionnaire with closed and open-ended question, and log analysis.

The 19 students of a master course on the academic subject of change and knowledge management were assessed by Honey and Mumford's learning style inventory. The questionnaire surveyed students on their perceived participation in the asynchronous and synchronous discussions. In the open-ended questions of the survey, the students were given the opportunity to, in their own words, state the advantages and

disadvantages of asynchronous and synchronous communication by the virtual learning environments. Apart from this, students' actual participation in online seminars was measured by log analysis.

A statistical bivariate correlation analysis was performed to explore relationships between students' learning styles and their perceived participation in asynchronous and synchronous discussions. The perceived participation was compared to the actual participation, measured by log analysis. The answers to the open-ended questions were categorised into themes by the use of content analysis, reducing and coding the responses of the students into different categories (Krippendorff, 2004).

3.5.5. PAPER IV-VI

According to Yin (2003), a case study is an empirical inquiry that investigates a phenomenon within its real-life context, especially when the constraints between phenomenon and context are not clearly evident. It relies on multiple sources of evidence, and benefits from the prior development of theoretical propositions to guide data collection and analysis. A comparative, explanatory case study approach was used to analyse the acceptance of virtual learning environments among academic staff and students at the three universities. The research approach was chosen in order to test the research model and to describe and explain differences in degrees of acceptance at the three research sites. Methods for data collection were qualitative, semi-structured interviews with academic staff, a students' survey questionnaire and document analysis. The respondents of the interviews were key persons of the implementation process, e.g. deans, project managers and teachers. Document analysis was done in order to capture the contextual factors of the organisational learning process as well as the formal decision process in implementing the virtual learning environment. The survey questionnaire was distributed to students in order to assess degrees of acceptance of the virtual learning environment. Both Yin (2003) and

Gable (1994) state that case studies can include quantitative elements. Gable argues that case studies, when integrated with a survey, can be useful as a source of rich detail to facilitate the interpretation of quantitative findings from the survey, and as a further means of triangulation, by testing the patterns or propositions of the study with a case as well as with the quantitative survey data.

Data was collected from two of the research sites at two points of time. From one of the research sites, data was only collected at one point of time. This was due to a change of academic staff which restricted the opportunities of access to the site. In table 10, the data collection is further described according to data collection method, site, respondents and time period.

Table 10. Overview of data collection at the three university departments.

Data collection method	Research site	Respondents	Time period
Interview	Nordic School of Public Health	Dean, project manager and teacher	June, 2005 November, 2005
	University of Tromsø	Two deans, two teachers and two course administrators	June, 2005 February, 2007
	Kaunas University of Medicine	Dean, head of distance education centre and teacher	September, 2004
Survey questionnaire	Nordic School of Public Health	32 students in two master courses 63 students in six master courses	Autumn semester 2004 Autumn semester 2005
	University of Tromsø,	Seven students in the master programme	Spring semester 2007
	Kaunas University of Medicine	35 students in three master courses	Autumn semester 2004
Document analysis	Documents from all three research sites were analysed during the entire case study.		September 2004 – April 2007

The interviews

Qualitative, semi-structured interviews were conducted among academic staff at the three universities. The respondents were chosen among strategic and operative key persons in the implementation of the virtual learning environment, such as deans, project managers and teachers. Apart from the deans, the respondents were chosen by recommendation of other respondents, using snowballing sampling (Robson, 2002).

The aim of the interviews was to depict the organisational learning process in connection with the use of the virtual learning environment, to explore the degree of acceptance of the virtual learning environment in the organisation, and to estimate what stage of the organisational implementation process the university had reached. To depict the organisational learning and the implementation process, the respondents were asked to describe the course of events in their own words. To explore the degree of acceptance of the virtual learning environment, an interview guide was used, operationalising six of the seven core constructs of perspective II and III of the research model. The questions used to estimate each construct are presented in table 11. Voluntariness of use was estimated by asking the respondents to describe the policy of the university.

The interviews lasted from 45 minutes to two hours. Seven interviews were recorded and subsequently transcribed. The other interviews were documented by the taking of notes during the interviews. After the interviews, the notes were completed into written down transcripts. As the research study was theory-based, the transcriptions were analysed by a template analysis style (Malterud, 2001), where the text was organised according to pre-existing theoretical categories to provide descriptions of the organisational learning process, the implementation process and degrees of acceptance.

Table 11. Definitions and questions used to estimate six core constructs of UTAUT and IDT during interviews with academic staff.

Core constructs	Definition	Questions used in estimating constructs
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)	What advantages has the virtual learning environment (VLE) brought to the education? Has using the VLE increased possibilities of communication with colleagues? Has using the VLE increased possibilities of communication with students?
Effort Expectancy	The degree of ease associated with the use of the system (Venkatesh et al., 2003).	Do you find the VLE easy to use? Is your communication with the VLE clear and understandable? Is the VLE generally considered to be easy to learn among staff and students?
Social Influence	The degree to which an individual perceives that important others believe that he or she should use the system (Venkatesh et al., 2003).	Do the university board and management support the use of the VLE? Does staff in general support the use of the VLE? Is there resistance among staff towards the use of the VLE? Is it more prestigious for staff to use the VLE, than not to use it?
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).	Is there a technical infrastructure supporting the use of the VLE? Are there resources available for pedagogical and technical support? Are there resources available for staff and students to learn to use the system? Are there specific persons or groups available for assistance when problems occur using the VLE?
Results Demonstrability	The tangibility of the results using the innovation, including their observability and communicability (Moore & Benbasat, 1991).	Has the performance of the students generally improved because of the use of the VLE? Is it generally known in the organisation what advantages the VLE has brought? Is it easy to explain the advantages of the VLE to students and staff?
Visibility	The degree to which one can see others using the system in the organisation (Moore & Benbasat, 1991).	Are members of the university organisation in general aware of the VLE and its use? Do they know that the VLE exists and what purpose it serves? Are students and staff able to observe others using the VLE?

The survey questionnaire

A questionnaire was constructed measuring six core constructs from the theoretical perspectives II and III of the research model: *performance expectancy*, *effort expectancy*, *social influence*, *facilitating conditions*, *results demonstrability* and *visibility*. The constructs were measured by 26 statements. The statements were constructed from the original questionnaire items developed by Venkatesh et al. (2003) and Moore and Benbasat (1991) and adapted to an educational context. The statements measuring the core constructs are presented in table 12. The students were asked to rate their level of agreement to each statement on a five-point Likert scale (from “I disagree completely” to “I agree completely”).

Apart from the core constructs, the influence of the background factors of university, age, gender, prior knowledge of computers, confidence in computer use, and teachers’ voluntariness of use were explored. To estimate the use of the e-learning environment, students were asked to estimate the rate of use, and duration each time the environment was used. The questionnaire also comprised open-ended questions, where students were asked to state advantages and disadvantages of learning by means of virtual learning environments. The questionnaire is presented in Appendix 3.

The questionnaire was originally written in Swedish and subsequently translated into English and Lithuanian. The Nordic students answered the Swedish version of the questionnaire and the Lithuanian students the Lithuanian questionnaire. Norwegian students could choose between answering the Swedish or English questionnaire. The survey was distributed to students and collected by teachers (Sweden), course administrators (Norway) and head of distance education centre (Lithuania).

Table 12. Definitions and questions used to estimate six core constructs of UTAUT and IDT in the students' survey questionnaire.

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

The data from the survey questionnaire underwent a reliability analysis using the measure of Cronbach's α to estimate the reliability of the core constructs in order to omit items of the questionnaire that lowered the reliability. Statistical tests of normality using normality probability plots (Q-Q plots) were performed for background variables and the six core constructs (Hair et al., 1998). Measures of means and standard distributions were computed for each core construct to compare the responses from the three student populations. A bivariate correlation analysis was conducted to explore relationships between core constructs, and to assess relationships between core constructs and individual student background factors. As a result of the normality probability test, Spearman's rank correlation was used for the background variables of previous knowledge of computers and time spent on use. As the distribution of all other variables corresponded well to normal distribution, Pearson's correlation coefficient was used for all other variables. The significant relationships between variables were interpreted with caution, and only the strongest relationships would be concerned as sufficient to build further research on. Finally, a factor analysis was performed to further analyse the characteristics of the relationships between the core constructs.

Document analysis

To create an understanding of the organisational context and a time-line for important events during the implementation process, documents from the three research settings were analysed throughout the case study (2004-2007). The documents comprised e. g. brochures, decision protocols, strategy statements, minutes from project group meetings and requirements specifications. To establish time-lines and decide which stage of the innovation process the case universities had reached, simple document summary forms were used (Miles & Huberman, 1994).

Within-case and cross-case analysis

Based on the data collection, within-case and cross-case analyses were done. Within-case analysis typically involves detailed case study descriptions for each research site (Eisenhardt, 1989). Descriptions of each case were written down and formed the basis of the within-case analysis, together with transcripts and notes from interviews and the statistical analysis of the students' survey. As the case study was theory-based, the transcriptions were analysed by a template analysis style (Malterud, 2001), where the text was organised according to the theoretical concepts of the research model.

Coupled with within-case analysis is cross-analysis, which is a search for patterns among a number of cases (Eisenhardt, 1989). Being an explanatory case study (Miles and Huberman, 1994) it aimed to describe and explain differences in degrees of acceptance among the universities. To evaluate the relationships between factors proposed by the research model, a pattern matching logic was used, combining the empirical pattern with the predicted pattern (Yin, 2003). In this respect, special attention was given to the impact of the organisational learning process on degrees of acceptance via the core constructs.

4. SUMMARY OF THE PAPERS AND THE LICENTIATE THESIS

In this chapter, summaries of the papers included in the doctoral thesis are provided.

4.1. PAPER I

The study constitutes the starting point in the thesis work of exploring factors that influence acceptance of virtual learning environments. Paper I (Keller & Cernerud, 2002) aims at exploring which factors influence students' perceptions of virtual learning environments in a blended learning environment from the perspective of TAM (research question 1).

The study was performed as a survey study at the School of Health Sciences and the School of Engineering, Jönköping University. The questionnaire items measured the constructs of perceived usefulness, perceived ease of use, and added educational value. The students' survey questionnaire is presented in Appendix 2a. To capture the influence of technical infrastructure on students' perceptions, a question about the extent of technical problems in use of the virtual learning environment was asked. Individual student background factors were determined and measured, such as educational programme, age, gender, previous knowledge of computers, attitudes to new technology, and learning styles. Attitudes of new technology were measured according to Rogers' (1995) five adopter categories. Learning styles were assessed by statements evaluating which one of Kolb's learning styles (1984) the students preferred. In the open-ended questions, students were given the opportunity to state their own opinion of advantages and disadvantages of using the virtual learning environment. To gain knowledge about

implementation and use of virtual learning environments at each school, semi-structured interviews were performed with key implementers (teachers serving as project managers) at the School of Health Sciences and the School of Engineering. The interview guide is presented in Appendix 2b. The findings from the interviews formed the basis for analysing the organisational factors which influenced the outcomes of the implementation process.

The responses of the closed questions were analysed by multiple regression analysis. Advantages and disadvantages of use of the virtual learning environment were categorised in a qualitative content analysis. The statistical analysis showed that 48% of the students reported perceived ease of use, while between 13 and 35% of the students stated the occurrence of perceived usefulness and added educational value. A factor analysis resulted in the three constructs of perceived usefulness, perceived ease of use and added educational value being one construct: perception. The occurrence of technical problems was found to influence students' perceptions negatively. The other findings of the multiple regression analysis in most ways contradicted earlier findings of students' perceptions of information systems. There was no relationship between the age or learning style of the student and perceptions of the virtual learning environment. Women showed more positive perceptions than men, as did students with less prior knowledge of computers. Furthermore, students adopting new technologies slower than their peers reported more positive perceptions of the virtual learning environment. The most influential background factor in affecting students' perceptions of the virtual learning environment was found to be which university college (school) the student belonged to.

The most commonly reported advantage of the virtual learning environment was that it contributed to access of information independently of time and space. This advantage was mostly reported

from female students of the School of Health Sciences. The most prominently stated disadvantage was inconsistent use of the virtual learning environment among teachers, resulting in different kinds of use or no use at all. This disadvantage was mostly reported from male students of the School of Engineering. The findings from the multiple regression analysis showed the background factor, school, to be the strongest determinant of students' perceptions of the virtual learning environment. This finding led to the conclusion that organisational factors, more than individual student background factors influenced students' perceptions of virtual learning environments. TAM was found to be insufficient as a research model in capturing these factors.

4.2. PAPER II

In paper I (Keller & Cernerud, 2002), a conclusion was made hypothesising that organisational factors were more influential in affecting students' perceptions of virtual learning environments than individual student background factors. Furthermore, TAM was also found to be insufficient in capturing factors of an organisational origin. Thus, the aim of paper II was to review alternative perspectives on implementing virtual learning environments. As such, the paper constitutes the first step towards a research model for acceptance of virtual learning environments among academic staff and students in blended learning environments (research question 4).

Paper II (Keller, 2005a) is a conceptual-analytical contribution, describing three different perspectives of implementation and acceptance of new technologies. Literature and library article databases (EBSCO and Elsevier Science) of organisation theory, management and information systems research were searched with keywords such as *implementation, implementation process, technology acceptance, user acceptance, user resistance, innovation, diffusion, learning, learning process* and *organisational learning*.

The aim of the search was to identify perspectives that together could form an as holistic view as possible to mirror the process of implementation and acceptance. The theoretical models should be able to explain acceptance of new technology on an individual and organisational level.

Through the literature studies a picture emerged where three perspectives were chosen: 1) an extended perspective of technology acceptance (Unified Theory of Acceptance and Use of Technology) mirroring an individual/factor perspective, 2) diffusion of innovations, considering both an individual and organisational process perspective and 3) the learning process perspective focusing on the learning theory of communities of practice on an organisational level. The three perspectives were analysed according to their core conceptual constructs. The analysis is summarised in table 13. Special regard was taken to how the concept of information system and user of information system was described within each perspective. Furthermore, the models were analysed to discern what implications for successful acceptance and use of virtual learning environment that could be identified. The analysis is summarised in table 14.

Table 13. A comparison of the presented implementation perspectives (Keller, 2005a).

	Implementation as technology acceptance	Implementation as diffusion of innovations	Implementation as a learning process
Basic concepts	Variables influencing decisions of acceptance or rejection by individual users at specific points	The individual decision process of adapting an innovation and the diffusion process of innovations in organisations	The learning process of different communities of practice within an organisation
Regards the VLE as	a new technology to be accepted or rejected by users	an innovation to be diffused in an organisation	a boundary object connecting different communities of practice
Regards the users of the VLE as	individual users making personal decisions of accepting or rejecting a technology	individuals making personal decisions of adopting or rejecting an innovation and an organisation adopting or rejecting an innovation	different communities of practice interacting through a boundary object
Considers the different roles of teachers and students	No	No	Yes

Table 14. *Implications for successful use and implementation of VLEs (Keller, 2005a).*

	Implementation as technology acceptance	Implementation as diffusion of innovations	Implementation as a learning process
Implications for successful use of the VLE	The VLE should enhance the resolving of educational tasks, be easy to use, and improve users' self-efficacy	The VLE should fill a performance gap, create positive visible outcomes, be consistent with existing beliefs, and not be complex to use	The VLE should provide modularity, abstraction, accommodation and standardization, support informal communication, and be designed for participation
Implications for successful implementation process	The implementation process should be supported by formal and informal leaders, and a reliable technological infrastructure.	The implementation process should be internally induced, be based on a consensus decision, and provide possibilities of trying the VLE beforehand.	The implementation process should allow peripheral participation, and consider the impact of the VLE on different communities of practice.

4.3. THE LICENTIATE THESIS

In paper I (Keller & Cernerud, 2002), a conclusion was made that TAM was not sufficient in explaining students' perceptions of virtual learning environments. In the licentiate thesis (Keller, 2005b), a retrospective analysis of the data from paper I was made from the three perspectives presented in paper II (Keller, 2005a): technology acceptance (UTAUT), diffusion of innovations and organisational learning.

In the analysis, the three theoretical perspectives, reviewed in paper II, were applied to the findings of paper I in order to find possible explanations of the results. From the results of the retrospective analysis, two main conclusions were made. First, organisational factors have a stronger impact on students' acceptance of virtual learning environments in a blended learning environment than individual user factors. Second, the combination of the three theoretical perspectives contributed to the understanding of students' acceptance of virtual learning environments by providing concepts describing the implementation process on both individual and organisational level. As a conclusion from the licentiate thesis, a research model for students' acceptance of virtual learning environments in a blended learning environment was presented, comprising a combination of the three theoretical perspectives of technology acceptance (UTAUT), diffusion of innovations and organisational learning.

4.4. PAPER III

In paper I (Keller & Cernerud, 2002), the influence of learning styles on students' perceptions of virtual learning environments was explored. In the study of paper I, no relationship was found between learning style and perceptions of virtual learning environment. The impact of learning style on performance in, and perceptions of, online learning is a topic frequently focused on in research on educational technology. Being of

great interest and importance in educational technology research, prompted a deeper investigation in order to draw valid conclusions on the impact of learning styles on acceptance.

Paper III (Keller & Hrastinski, 2007) applies a combined methodology of literature review and single case study in exploring the influence of learning styles on students' perceptions of online education. As such, it provides the answer to research question 2 of the thesis. The paper explores the influence of learning styles on students' perceptions of, and performance in, online education. The paper comprises a qualitative meta-analysis of nine research studies, and a single case study (n = 19) focusing on the learning styles of Kolb, and of Honey and Mumford. The single case study comprised a learning style inventory according to Honey and Mumford, a survey study on students' perceived participation in asynchronous and synchronous discussions in the virtual learning environment, and log analysis measuring students' actual participation in the discussions.

The meta-analysis presented in table 15 showed that students of different learning styles seem to perform equally well in online education, but that drop-out rates of students of less common learning styles in a certain course, seem to be higher, than for students of common learning styles. Findings of the meta-analysis were inconclusive when it came to perceptions of virtual learning environments. Some studies concluded that students preferring the learning style of active experimentation perceived online education more positively. Other studies stated that learning styles including reflective observation caused positive perceptions of online education, as students preferring these learning styles behave more extrovertly in asynchronous online discussions, than in classroom teaching on campus. The single case study showed that theorists (Honey & Mumford, 1985) perceived themselves as being more active in asynchronous online discussion than they actually were, and that

pragmatists (Honey & Mumford, 1985) thrived on the immediate feedback of synchronous online discussions.

The paper contributes in creating knowledge of the influence of learning styles on students' acceptance of virtual learning environments (research question 2). The findings imply that asynchronous communication in virtual learning environments generally might be preferred by students using reflective observation or theorizing as their main learning style, while synchronous communication is preferred by students preferring the learning style of active experimentation. The most important finding of the study was, however, that students' learning outcomes and perceptions of online education mainly seem to depend on the design of the course, rather than the learning style of the student.

Table 15. Research on implications of learning styles on student behaviour in online education (Keller & Hrastinski, 2007).

Authors	Learning style inventory	Dependent variable(s)	Findings
Shaw & Marlow, 1999	Honey & Mumford	Attitude	Theorists were negative to online education.
Terrell & Dringus, 1999	Kolb	Achievement, retention	No impact of learning styles on achievement. Retention rates were higher for divergers and accommodators.
Federico, 2000	Kolb	Attitude	Assimilators and accommodators demonstrated significantly more agreeable attitudes.
Jordanov, 2001	Kolb	Internet use	All students moved towards more active learning styles.
Terrell, 2002	Kolb	Completion of course	Convergers and assimilators completed the course to a higher extent.
Harris et al., 2003	Kolb	Performance	No impact of learning styles.
Downing & Chim, 2004	Honey & Mumford	Satisfaction	Reflectors behaved like extraverts in asynchronous discussions.
Terrell, 2005	Kolb	Performance	No impact of learning styles on performance.
Keller & Hrastinski, 2006	Honey & Mumford	Participation	Theorists perceived themselves as active participants. Pragmatists actually participated more than students of other learning styles.
Wang et al., 2006	Kolb	Achievement	Divergers and assimilators achieved better learning outcomes.

4.5. PAPER IV-VI

The research model presented in the conclusions of the licentiate thesis was further developed to become a research model hypothesised to explain acceptance of virtual learning environments among academic staff and students in blended learning environments. This research model was tested in the comparative, explanatory case study presented in paper IV-VI. Paper IV (Keller, 2006) presents the findings of semi-structured interviews with academic staff at the three research sites 2004-2005, and paper V (Keller, Hrastinski & Carlsson, 2007) describes and analyses students' acceptance of virtual learning environments in a comparative study between Sweden and Lithuania. Paper VI (Keller, 2007) comprises the complete case study.

Paper IV-VI contributes in answering research question 3 and research question 4 of the thesis. From the case study, conclusions are made on what factors influences acceptance of virtual learning environments among academic staff and students, and why certain factors seem to have a stronger impact on acceptance than others (research question 3). The findings of the case study also contribute in the creation of the descriptive and explanatory model for acceptance of virtual learning environments among academic staff and students in blended learning environments (research question 4).

The study was performed as a comparative, explanatory case study at three research sites: the Northern School of Public Health (NS), Sweden, the University of Tromsø (UT), Norway, and Kaunas University of Medicine (KMU), Lithuania. The three case universities offered master education in public health. The case study approach comprised semi-structured, qualitative interviews with academic staff, a students' survey questionnaire and document analysis. The research approach of the case

study is described to its full extent in section 3.5.5 of the thesis and in paper VI.

The findings of the case study showed that the differences in degrees of acceptance of virtual learning environments were substantial between the three case universities. A synthesis of the cross-case analysis is presented in table 16.

Table 16. A synthesis of the cross-case analysis (Keller, 2007).

Factors	NS	UT	KMU
General degree of acceptance	Low	Medium	High
Cultural keywords	Teaching on campus	Academic freedom	New, Future
Structure	Small Nordic university organisation	Large traditional university organisation	Large traditional university organisation
Strategic impact	Strong	Strong	Strong
Environmental keywords	Increasing competition	New educational structure	Transition of economy and society
Quality of lower-level learning	Adequate	Adequate	Adequate
Pace of higher-level learning	Slow	Medium	Fast
Performance expectancy	Low (staff and students)	Medium (staff) High (students)	High (staff and students)
Effort expectancy	High (staff) Low (students)	High (staff and students)	Low (staff) High (students)
Social influence	Low (staff and students)	Medium (staff and students)	High (staff and students)
Facilitating conditions	High (staff) Medium (students)	Very high (staff) Medium (students)	Medium (staff) High (students)
Visibility	Medium (staff) Low (students)	Medium (staff and students)	Low (staff) Medium (students)
Results demonstrability	Low (staff and students)	Medium (staff) High (students)	High (staff and students)
Voluntariness of use	Once web-based learning is implemented in a course or a programme, the use of the web-platform is mandatory for both teachers and students.		

The impact of the organisational *culture* on the acceptance of the virtual learning environment was prominent at all three universities. At NS, a strong organisational culture favouring education on campus worked against the virtual learning environment. At UT, the organisational culture focusing on academic freedom initially hampered the acceptance of the virtual learning environment. In contrast, the organisational culture at KMU which depicted concepts like “new” and “future” as something positive, seemed to work in favour of accepting the virtual learning environment.

Regarding *structure*, to be a small university with a decentralised organisation did not seem to influence the degree of acceptance of virtual environments positively. Conversely, the highest degree of acceptance was found at the larger of the two traditional university organisations (KMU), while the lowest degree of acceptance was found at the small and decentralised university (NS). This observation contradicts the findings of Duncan (1974) who states that a mechanistic, centralised structure tends to reinforce past behaviours, while an organic, more decentralised structure tends to allow changes in beliefs and actions to a higher extent.

At all three universities, the decision to implement web-based education was a part of the *strategic considerations* of the university management. Hence, the strategic impact of web-based learning was strong at all three universities as the *environment* surrounding higher education has been turbulent in all three countries. Strategies and environmental pressure did not prove to be sufficient in creating high degrees of acceptance at NS and UT, only at KMU.

The *lower-level learning* in association with the virtual learning environment, e.g. the development of new routines, seemed to have taken place on an accurate level at all three universities. The differences between the three universities were, however, prominent when it comes to the pace of *higher-level learning*, interpreted as insights, collective consciousness and new

definitions of direction due to web-based learning. Accurate lower-level learning did not create high degrees of acceptance. To achieve high degrees of acceptance, it was evident that higher-level learning must take place.

The degree of *performance expectancy* varied among academic staff at the three universities. It was experienced as low at NS, medium at UT and high at KMU. At NS, the advantages of the virtual learning environment were not yet discernable. At UT, the virtual learning environment was perceived as being a good way of delivering information to students. At KMU, the virtual learning environment was perceived to be highly useful in education and collaboration with other universities.

The degree of *effort expectancy* was high among academic staff at NS and UT, as the virtual learning environment was perceived to be easy to learn and to use. At KMU, the design and production of web-based courses were perceived to take a long time and to sometimes be difficult, leading to a low degree of effort expectancy.

The degree of *social influence* varied from low at NS, medium at UT and high at KMU. The degree of resistance was relatively high at NS, existent but fading at UT, and low at KMU. Strong support from the university management made web-based learning highly prestigious at KMU. Although the university managements of NS and UT have supported the use of web-based learning, this did not make the use of the virtual learning environment very prestigious in either organisation.

All three universities had formal organisations for technical and pedagogical support, creating degrees of *facilitating conditions* from being medium to very high. At UT, the supply of courses on the features of the virtual learning environment was almost too high for the academic staff to appreciate it to its full extent. At NS, the level of support was perceived to be on a high and adequate level by staff and at a medium level by

students. At KMU, the support organisation had a different focus than at the two Scandinavian universities. At NS and UT, support was provided by courses and by assisting when technical problems occurred. At KMU, support equalled design, production and publishing of web-based courses. This approach was more productive than supportive, which led to a somewhat lower perception of facilitating conditions at KMU.

The degree of *results demonstrability* varied among academic staff at the three universities. As tangible advantages of web-based learning had not yet occurred at NS, the degree of results demonstrability was low. At UT, the awareness of the usefulness of the virtual learning environment had with time increased among academic staff to a medium level. At KMU, the advantages brought by the virtual learning environment had been clearly discernable throughout the implementation process, which implied a high degree of results demonstrability.

The degree of *visibility* varied from medium to low at the three universities. Opportunities of visibility were, at the two Scandinavian universities, brought by introductory or continuing courses on the features of the virtual learning environment or by “talking to colleagues”. None of these situations seemed to be very common at KMU, which displayed a low degree of visibility.

When it comes to *voluntariness of use*, the three universities held the same position. Web-based learning should be used, but it was optional in which courses and programme the virtual learning environment was implemented. Once implemented in a course or a programme, the use of the virtual learning environment was mandatory for teachers and students.

Students from Norway and Lithuania showed the same patterns of rating of the core constructs, rating performance expectancy and effort expectancy relatively high and facilitating conditions lower. The students of NS showed the opposite pattern. Lithuanian students generally showed

the most positive perceptions of the virtual learning environment, while students of NS were the most negative. The negative perceptions of the students of NS seemed to be due to the culture of teaching on campus, which regarded the virtual learning environment as something negative. The Norwegian students fell somewhere in between the Lithuanian and Swedish students in the degree of acceptance. A comparison of students' responses to the survey questionnaire according to mean values and rating of core concepts is presented in table 17.

Table 17. Comparison of students' responses to the survey questionnaire (Keller, 2007).

Core constructs	Mean NS (rating)	Mean UT (rating)	Mean KMU (rating)
Performance expectancy	2.44 (3)	3.71 (1)	4.35 (3)
Effort expectancy	2.41 (5)	3.63 (2)	4.52 (1)
Social influence	2.42 (4)	3.37 (5)	3.55 (5)
Facilitating conditions	3.01 (1)	3.48 (4)	4.34 (4)
Results demonstrability	2.28 (6)	3.61 (3)	4.49 (2)
Visibility	2.66 (2)	3.19 (6)	3.11 (6)

Based on the findings of the case study, the varying degrees of acceptance were hypothesised to be dependent on organisational and national culture. High degrees of performance expectancy, results demonstrability and social influence were powerful in influencing the general degree of acceptance of virtual learning environments positively. Effort expectancy, facilitating conditions and visibility did not have the same impact on the general degree of acceptance. The degree of social influence was hypothesised to be mediated by culture.

The case study is presented in its full text version in paper VI (Keller, 2007).

5. CONCLUDING DISCUSSION

There is nothing more difficult to plan, more doubtful of success, nor more dangerous to manage than the creation of a new order of things.
Niccolò Machiavelli, The Prince, (16th century)

5.1. CONCLUSIONS

The overriding aim of the thesis was to create knowledge about factors influencing acceptance of virtual learning environments among academic staff and students in blended learning environments in higher education. The overall contribution of the thesis is the creation of a model extending the perspective of technology acceptance with the perspectives of organisational learning and diffusion of innovations to describe and explain acceptance of virtual learning environments among academic staff and students in blended learning environments. The three perspectives have, to the best of my knowledge, not previously been combined to constitute a descriptive and explanatory model in e-learning research or in information systems research. The combination of the perspectives could be considered as an answer to the call from researchers to broaden the technology acceptance perspective with variables related to change processes and adoption of innovations (e.g. Legris et al., 2003; Karahanna et al., 2006).

There were four research questions to be answered in the thesis. In the following section of the thesis, the answers to the research questions will be provided.

Research question 1. Which factors influence students' acceptance of virtual learning environments in blended learning environments from the perspective of TAM?

Conclusion 1: The factors inherent in the original version of TAM were not sufficient in explaining students' acceptance of virtual learning environments in blended learning environments. Organisational factors, such as teachers' voluntariness of use, or which implementation strategy the university college had chosen, influenced students' acceptance more than did individual student background factors.

Research question 2. What influence do learning styles have on students' acceptance of virtual learning environments?

Conclusion 2: The indications are that asynchronous communication in virtual learning environments generally might be preferred by students using reflective observation or theorizing as their main learning style, while synchronous communication is preferred by students using the learning style of active experimentation. However, students' learning outcomes and acceptance of virtual learning environments seem to depend on the design of the course, rather than the learning style of the student.

Research question 3. Which factors influence acceptance of virtual learning environments among academic staff and students from the perspectives of organisational learning, technology acceptance, and diffusion of innovations?

Conclusion 3: The contextual factor of culture seems to have a strong influence on degrees of acceptance, positively and negatively. High degrees of performance expectancy, social influence and results demonstrability were powerful in influencing generally high degrees of acceptance. Effort expectancy, facilitating conditions and visibility did not seem to be equally influential. The degree of social influence is hypothesised to be influenced by the contextual factor of culture.

Research question 4. Which factors would a descriptive and explanatory model of acceptance of virtual learning environments among academic staff and students in blended learning environments include, based on the three perspectives of organisational learning, technology acceptance and diffusion of innovations?

Conclusion 4: The research model of the case study was able to describe and explain acceptance of virtual learning environments among academic staff and students in blended learning environments. However, some factors seemed to be more influential in creating high degrees of acceptance than others (see conclusion 3). Furthermore, depending on their characteristics, some factors are more influenced by higher-level learning while others are more influenced by lower-level learning.

5.2. FACTORS INFLUENCING ACCEPTANCE

In this section, the factors influencing acceptance of virtual learning environments among academic staff and students are further discussed.

5.2.1. ON THE IMPACT OF CULTURE

Culture was found to be the most influential contextual factor in affecting the levels of acceptance of the virtual learning environments at the three universities, positively as well as negatively. According to Fiol and Lyles (1985), the norms inherent in the organisational culture will influence the behavioural and cognitive development that the organisation can accomplish. As such, culture has an impact on what higher-level learning the organisation will manage.

The strategic impact of the implementation process being equally important, and the quality of lower-learning being equally adequate at the three research sites, the pace of higher-level learning was slower and the general degree of acceptance lower at NS and UT, compared to KMU.

The difference is hypothesised to be due to differences in the values of users, inherent in the organisational and national culture. Hofstede (2001) defines culture as *“the collective programming of the mind that distinguishes the members of one group or category of people from another.”* (p. 9). This collective programming varies between countries. Hofstede developed four widely used constructs to distinguish national cultures on the basis of over 100,000 responses in multinational organisations: power distance, collectivism-individualism, masculinity-femininity, and uncertainty avoidance. It is reasonable to believe that these constructs might play a role in adopting information technology. This view is also shared by Leidner & Kayworth (2006). The construct of power distance is defined as: *“The extent to which the less powerful members of institutions and organisations within a country expect and accept that power is distributed unequally.”* (Hofstede, 2001, p. 98). DeVreede et al. (1998) found that a high degree of power distance influenced acceptance of group support systems positively. This was, according to the authors, due to subordinates being less likely to question decisions made by management in high power distance cultures. Although Lithuania is not specifically examined by Hofstede, it could be hypothesized that differences in e.g. power distance between the countries could affect degrees of technology acceptance. Sweden and Norway have low ranks, 47 and 48 among 53 studied countries, in Hofstede’s Power Distance Index Value (Hofstede, 2001). The low level of power distance implies that it is hard to achieve acceptance of innovations imposed by the management of an organisation in the two Scandinavian countries. Although the university managements of NS and UT have supported the use of web-based learning, this did not make the use of the virtual learning environment very prestigious in either organisation. The degree of power distance is hypothesised to be higher in Lithuania than in the two Scandinavian countries, and this might be one of the explanations of the differences in acceptance between the countries.

When examining the contextual factor of culture at the three research sites, it was evident that conflicts occurred between values embedded within the virtual learning environment and values of different user groups. According to Leidner and Kayworth (2006), an understanding of culture is important to the study of information technologies, as national, organisational and group culture can influence implementation and use of information technology. Culture is, in this sense, defined as shared values among members of an organisation. There are three forms of conflicts emerging from the interaction of values: system conflict, contribution conflict and vision conflict. First, system conflict is a conflict that surfaces when the values implicit in a specific information technology contradicts the values held by the users. At NS, the system conflict was strong, as the virtual learning environment, embedding values of communication through an IT artefact, was implemented in an organisational culture with values of holding lectures and seminars at campus as something indispensable. At KMU, a mild system conflict was evident as there were explicit notions of the virtual learning environment not being an adequate means of learning in courses of certain topics. These courses required that teachers and students met and talked face-to-face.

Second, contribution conflict refers to the disagreement between user's general values and how they perceive the contribution of information technology in their work. One example of a contribution conflict is that teachers mainly value information technology as a means of administration, while cherishing the notion of creating high quality in teaching and tutoring students. This kind of conflict was evident at UT, where the virtual learning environment, mainly used for asynchronous text based communication, was perceived as a means of information delivery, and not for learning. The shared values of the users at UT stated that high quality learning could only be accomplished on campus.

Third, vision conflicts occur when the values that users hold of technology in general is opposed by the values embedded within a specific information technology. No conflicts of this kind were discerned at the three research sites of the case study, as the focus of the study was virtual learning environments, not technology in general.

5.2.2. ON THE CORE CONSTRUCTS OF UTAUT AND IDT

The most powerful core constructs in creating high general degrees of acceptance of the virtual learning environments among academic staff and students were found to be performance expectancy, results demonstrability and social influence. The positive influence of performance expectancy comes as no surprise. A number of studies on technology acceptance have verified the explanatory value of the original core construct from TAM, perceived usefulness, on acceptance of virtual learning environments (Selim, 2003; Ong et al., 2004; Drennan et al., 2005). As results demonstrability (tangibility and communicability of usefulness) could be regarded as another side of performance expectancy (the individually perceived usefulness), it is reasonable that the two core constructs correspond well to each other. Social influence represents the expectations from others on an individual to use a technology. In a study on cultural aspects of UTAUT, Bandyopadhyay and Fraccastoro (2007) found that social influence based on culture provided additional explanatory power concerning consumers' intentions to use a technology. Also Van Slyke et al. (2004) found that culture had a strong impact on consumers' intentions to use online systems. This is in accordance with the findings of the case study, where the social influence to use the virtual learning environment was stronger at the Lithuanian university than at the two Scandinavian universities, and contributed in creating higher degrees of acceptance. Hence, it is hypothesised that the degree of social influence is mediated by organisational and national culture.

Interestingly, the interpretation of what is meant by facilitating conditions (pedagogical and technical support) varied between the two Scandinavian and the Lithuanian university. At NS and UT, pedagogical and technical support meant attending courses on the features of the virtual learning environment and receiving support with technical problems. At KMU, pedagogical and technical support denoted support in designing and publishing courses in the virtual learning environment.

The core constructs of effort expectancy, facilitating conditions and visibility did not seem to contribute to the same extent to create positive perceptions of the virtual learning environment. To experience ease of use, to obtain sufficient and adequate pedagogical and technical support, and to be able to see others using the virtual learning environment are all positive and valued experiences in themselves, but do not seem to push users “over the edge” when it comes to creating high degrees of acceptance.

5.3. A DESCRIPTIVE AND EXPLANATORY MODEL FOR ACCEPTANCE OF VIRTUAL LEARNING ENVIRONMENTS

The factors and organisational learning process included in the research model of the case study all contributed in explaining the degrees of acceptance among academic staff and students. No factors or processes need to be deleted from the model, but some factors seem to have a stronger impact than others. An organisational culture working in favour of the virtual learning environment, a faster pace of higher-level learning, a perception of usefulness, tangibility of usefulness and social influence throughout the organisation, were factors which were powerful in influencing high degrees of acceptance. As such, they could be regarded as critical success factors, defined by Rockart (1979) as those functions that must go well in order to achieve success in an organisation. On the other hand, a strategy depicting the importance of the virtual learning

environment, a decentralised organisational structure, environmental pressure, accurate lower-level learning, ease of use, pedagogical and technical support and visibility of use were not sufficient in creating general acceptance of the virtual learning environments in the case study. The relative influential strength of the factors and the organisational learning process are depicted in figure 16, where factors marked with dashed lines are less influential. As the factor of voluntariness of use indicates the conditions of use (mandatory or of free will), it is also considered to be a factor of great importance.

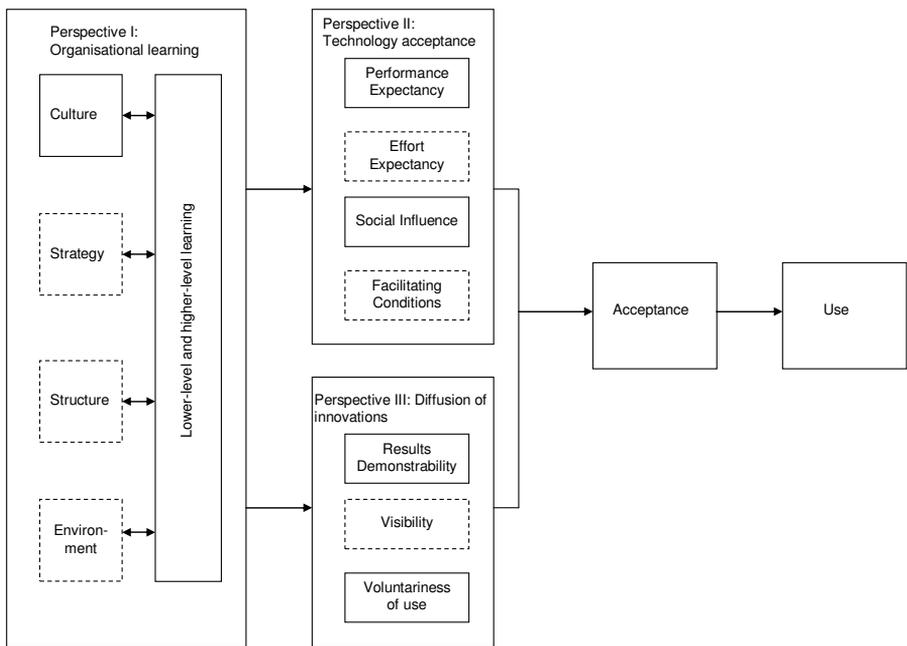


Figure 16. Descriptive and explanatory model for acceptance of virtual learning environments among academic staff and students in blended learning environments.

Furthermore, some factors seem to be more influenced by the higher-level learning of the university organisation, while others are more influenced by lower-level learning. A connection could be noticed from culture via higher-level learning with social influence and facilitating conditions, as the process of higher-level learning mediated values of the virtual learning environment being prestigious, and defined what constituted facilitating conditions. The factors of effort expectancy and visibility seemed to have a more close connection with lower-level learning, as they partly measure instances of (visibility) and results of (effort expectancy) this kind of learning. The factors of performance expectancy and results demonstrability seemed to be equally dependant on lower-level and higher-level learning.

5.4. IMPLICATIONS FOR PRACTICE

Culture and its impact on the acceptance of the virtual learning environment is a crucial issue that can predict the success or failure of the implementation process (Leidner & Kayworth, 2006). This proposition was confirmed by the findings of the case study. The shared values of academic staff and students in the university organisation must be considered as an influential factor by managers and implementers of virtual learning environments. Particularly, it is important to delineate what staff and students regard as good quality teaching and learning. If this kind of teaching and learning could not be accomplished by means of the virtual learning environment, acceptance among academic staff and students will be very hard to achieve.

Performance expectancy, results demonstrability and social influence were found to be most influential among the core constructs in creating a generally high degree of acceptance of virtual learning environments. It is thus important for managers and implementers to ensure that users perceive tangible usefulness and added value from the use of the virtual

learning environment early in the implementation process. It is also essential that the implementation process is supported throughout the whole university organisation, and that the use of the virtual learning environment is seen as prestigious. Moreover, resistance among staff and students should be recognized and dealt with constructively early in the implementation process. This is in accordance with the findings of Ginzberg (1981), who states the importance of reaching agreements on the use of an information system in early stages of the implementation process. Resistance to the implementation of the virtual learning environment due to cultural values has costs in time, energy and money. Conflicts due to resistance deprive the university organisation of time and energy that otherwise could have focused on improving the quality of learning in other ways. If conflicts and resistance among users are not dealt with, the university organisation has to seriously consider if the effort of implementing virtual learning environments is worth the costs.

The core constructs of effort expectancy, facilitating conditions and visibility were not found to be very influential in generating generally high levels of acceptance of the virtual learning environment. This does not, however, mean that efforts to provide ease of use, support and visibility of use should be neglected. The opportunity to experience ease of use, pedagogical and technical support, as well as visibility should be provided and facilitated by managers and implementers, but will probably not be sufficient in themselves in creating high degrees of acceptance.

The notions of virtual learning environments as providers of text-based asynchronous communication between teachers and students, and as means of storing, posting and accessing course material seems to be generally acknowledged and appreciated among academic staff and students. On the other hand, virtual learning environments are incapable of building relationships, and creating lively discussions. To counteract this notion, it is important for managers and implementers to consider the

cognitive and relationship building opportunities provided by synchronous media and tools combining video, audio and text, inherent in virtual learning environments. Possibly, the use of synchronous, richer media could create a more dynamic and lively learning environment, by providing learning in real-time, more equalling talking face-to-face. It is also important for implementers to consider that information technology that facilitates interaction without specifying their parameters (e.g. the features of the virtual learning environment that allows asynchronous and synchronous interaction) demands other kinds of implementation strategies than information technology executing discrete tasks (McAfee, 2006). The use of e.g. chat or videoconferencing might be perceived by teachers as a new and unknown way of using information technology. As a result, teachers need demonstrations on how the technology could be used for pedagogical purposes.

Finally, academic staff value learning informally about the virtual learning environment from colleagues. As a result, it is important for managers and implementers to provide such opportunities. It is also essential not to prevent colleagues from viewing each other's course material by restricting the access to courses in the virtual learning environment. In that way, a lively learning community could arise from the virtual learning environment, to facilitate the acceptance among both academic staff and students.

5.5. METHODOLOGICAL DISCUSSION

5.5.1. STRENGTHS AND LIMITATIONS OF THE RESEARCH APPROACH

To study a research object from a variety of theoretical models to look for complementary explanations is not a very common research approach in information systems research (Lapointe & Rivard, 2007). To combine models on different theoretical perspectives provides insights in more

areas associated with the research object, than the single theory might. In this thesis, classical models of technology acceptance and innovation diffusion on an individual level were combined with a model of organisational learning, which could explain whether acceptance occurred or not. When it comes to combining organisational theory and information systems research, Orlikowski and Barley (2001) argue that much can be gained from greater interaction between research on information technology and research on organisations. The fusion between the two perspectives is more adjusted to explain the nature of and consequences of techno-social phenomena, than the two perspectives isolated.

The limitations of the research design of the thesis are, to some extent, the same limitations that could be assigned to traditional technology acceptance research. All respondent data were self-reported and quantitative survey techniques were used to assess the occurrence of acceptance among students. The rate of use and time spent using the virtual learning environment could have been measured by e.g. log analysis, and interviews with students could have given a deeper understanding of how they perceived the virtual learning environment. Participant observation and narratives, e.g. diaries of system use could have been used to gain knowledge about students' perceptions. However, these methods would, for practical reasons, have to be restricted to a considerably lower number of students than the respondents of the case study ($n = 137$). By using survey questionnaires, a higher number of students could participate in the empirical studies of the thesis.

Other common critical issues mentioned against technology acceptance research are the black-boxing of the information technology artefact and, in the case of educational technology research, of the subject matter learned in the courses of the virtual learning environment. It is true that technology acceptance models do not focus on these factors. On the

other hand, characteristics of the technology and of the subject matter indirectly influenced the responses of academic staff and students when it came to e.g. performance expectancy, results demonstrability, effort expectancy and facilitating conditions. High degrees of performance expectancy and results demonstrability can probably not be perceived if the academic subject matter is not transferable to the virtual learning environment. Furthermore, the degrees of effort expectancy and facilitating conditions depict characteristics of the information technology artefact. The user of a virtual learning environment that is hard to learn and use will not perceive a high degree of effort expectancy. Users of a virtual learning environment plagued with technical problems will never perceive high degrees of facilitating conditions.

Statistical analysis was used to analyse the findings of the survey studies. The aim of the statistical analysis was not to create a statistical regression model. Instead, the aim was to describe relationships between factors in the three cases and to look for regularities or tendencies in the material in order to explain them (Ron, 2002). This could be seen as a weakness of the study, as a classical regression model might have produced more rigorous statistical proof of causal relationships between factors. But, as the empirical studies of the thesis involve few respondents and as research settings and respondents were chosen by theoretical sampling, the possibility of statistical generalisation is small. On the other hand, case study research could form a basis for generalising in the sense that empirical findings could be generalised to theoretical statements (Walsham, 1995; Robson, 2002; Lee & Baskerville 2003; Yin, 2003). The aim of the case study was to provide such a generalisation in order to test and further develop a descriptive and explanatory model for the acceptance of virtual learning environments among academic staff and students in blended learning environments.

5.5.2. RELIABILITY AND VALIDITY

To ascertain a high level of reliability and validity of the study, a number of measures were taken. In order to estimate the reliability of the students' survey questionnaire, reliability tests measuring Cronbach's α (Hair, 1998 et al.) were done. As a result of the reliability tests, questionnaire items that lowered the reliability were omitted. Furthermore, to increase the reliability of the interviews, the same interview guide and coding scheme were used for all respondents, and the interviews were performed at respondents' work places during similar circumstances.

To ensure the construct validity of the students' survey questionnaire, the same questionnaire items as in the original survey instruments (Venkatesh et al., 2003; Moore & Benbasat, 1991) were used, and adapted to the educational context (e.g. the concept of "information system" changed to "virtual learning environment"). As the items of the original survey instruments were already rigorously tested, it was presumed that their construct validity would be sufficient. In a similar way, interview guides were based on previously developed survey questionnaires (Venkatesh et al., 2003; Moore & Benbasat, 1991), and literature defining core constructs of organisational learning and diffusion of innovations (Fiol & Lyles, 1985; Rogers, 1995).

Internal validity concerns whether the findings of a study make sense and reflects the reality that it aims to describe and explain, and whether the conclusions are transferable to another research setting. To provide internal validity, the respondents were chosen to genuinely represent the academic staff and students involved in teaching and learning by the virtual learning environment. To avoid researcher bias (Lincoln & Guba, 1985) from the choice of respondents of the interviews, snowball sampling was used (Robson, 2002). The deans were identified as

respondents beforehand. After they had been interviewed, they served as informants to identify other respondents, and so on.

Flexible, qualitative research where all variables could not be controlled, such as case study research (Robson, 2002), does not apply the same concepts of validity as quantitative research. Maxwell (1992) has presented a typology of three different kinds of understanding involved in qualitative research: description, interpretation and theory. Each of the types of understanding has particular threats to its validity. The threat to validity of description is that what the researcher sees and hears is inaccurate or incomplete. For that reason, audio- or video-taping should be used when feasible. It is also important that notes taken are correct and complete. For reasons of description validity, most of the interviews of the case study were audio-taped and subsequently transcribed. Some respondents showed tendencies to withhold information when the interviews were audio-taped, so called respondent bias (Lincoln & Guba, 1985). In this case, the interviews were documented by the taking of notes during the interviews. After the interviews, the notes were completed into written down transcripts. The main threat to the validity of interpretation (Maxwell, 1992) is to impose a theory on the data rather than draw conclusions from the data. Regarding validity of theory, the main threat lies in not considering alternative explanations of the phenomenon that is studied. Regarding validity of interpretation and theory, the thesis work focused on evaluating theories to assess their explanatory value. Therefore, no interpretation or theory was considered to be sufficient to explain the phenomenon studied beforehand.

5.6. SUGGESTIONS FOR FURTHER RESEARCH

From the empirical findings of the thesis, five themes characterising the perceptions of virtual learning environments were identified. These

themes are, each one of them, interesting areas for further research on the acceptance of virtual learning environments.

Theme 1: The virtual learning environment should be used in a consistent way by teachers to enhance acceptance and learning among students. Teachers' voluntariness on an individual basis on choosing the virtual learning environment proved to be an ordeal for the students (see paper I). Teachers' voluntariness of use led to an inconsistent use of the virtual learning environment or to no use at all. As a result, students had to adapt to new approaches of use (or no use) of the virtual learning environment in every course. This was perceived as being very annoying. Conversely, in mandatory settings, students were generally pleased with the consistency of teachers' use of the virtual learning environment, while teachers were annoyed by being forced to behave in a certain way. Are there ways to compromise on voluntariness to appease both parties?

Theme 2: Text-based asynchronous communication enhances the quality of learning. It enables one-to-one communication between teachers and students and offers time for reflection and to enter deeply into course topics. Furthermore, students that are introverted or participate in a course given in a language, other than their native tongue, are able to "speak their mind" and share discussions and group work on equal terms. Therefore, students with reflective and abstract learning styles are hypothesised to appreciate and learn better from text-based asynchronous communication, than other students. To test this hypothesis further would be interesting.

Theme 3: Information could be accessed independently of time and space. Storing, posting and accessing course material and assignments by means of the virtual learning environment enhances the administration of courses. The general quality of teachers' course material has improved as all material has to be published digitally. Course material is constantly accessible from one source independent of time and space. The quality of "effective and dependable file archive" is a highly appreciated quality of virtual learning

environments. But what happens to learning by means of the virtual learning environment if it is only used for administrative purposes?

Theme 4: The virtual learning environment lacks features for building relationships, and for creating dynamic and lively learning opportunities. Text-based, asynchronous discussions are perceived as being uncreative, slow and aiming only at cognitive tasks. Synchronous discussions are not used as a learning tool at the three case universities, and academic staff describes difficulties in creating lively asynchronous discussions that are active over a longer period of time. When the focus of the communication between students or between students and teachers are building relations or discussing personal matters, the virtual learning environment is left for other means of communication, such as talking face-to-face, telephone conferences or external electronic mail. Moreover, students with pragmatic and active learning styles can be hypothesised to appreciate synchronous communication by means of richer media. Synchronous communication is hypothesised to increase participation in online education (Hrastinski, Keller & Carlsson, 2007). Teachers could increase the relationship-building characteristics of the virtual learning environment by using synchronous media (e.g. chat) or richer media (e.g. videoconferencing) to create a higher sense of presence and interaction. Hopefully, a lively and relationship-building learning environment will be easier to achieve with the development of web 2.0 and related tools of e.g. blogs, wikis and second life used for collaborative purposes, as well as information delivery. To explore how relationships can be built by means of these tools is an important issue for further research.

Theme 5: Informal learning from colleagues is important to develop knowledge of the features of the virtual learning environment and the pedagogical options provided. For academic staff, learning from colleagues informally in every day situations, such as coffee break discussions or observing another teacher's course, is a more influential learning tool than attending formal course sessions or reading manuals. From this perspective, it is important to provide opportunities for informal learning among colleagues, and for teachers to observe course material developed by other teachers in the virtual learning environment. To explore the learning outcomes of teachers having access only to formal learning sessions compared with learning outcomes of teachers frequently involved in informal learning, would be an interesting issue for further research.

The five themes could presumably create a starting-point for a design theory on virtual learning environments. Furthermore, to create a complete design theory, the impact of what is the core of higher education, the academic subject matter, also deserves to be explored.

REFERENCES

- Agarwal, R. (2000). Individual Acceptance of Information Technologies. In Zmud, R. (Ed.). *Framing the Domains of IT Management: Projecting the Future Through the Past*. (pp. 85-104). Pinnaflex Education Resources, Cincinnati, Ohio.
- Ajzen, I. (1991). The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes*, 50 (2), 179-211.
- Alavi, M. & 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.
- Alvesson, M. (2002). *Understanding Organizational Culture*. Sage Publications, London.
- Argote, L. & Greve, H. R. (2007). A Behavioral Theory of the Firm – 40 Years and Counting: Introduction and Impact. *Organization Science*, 18 (3), 337-349.
- Argyris, C. (1994). *On Organizational Learning*. Blackwell, London.
- Argyris, C. & Schön, D. A. (1978). *Organizational Learning: A Theory of Action Perspective*. Addison-Wesley, Reading, Massachusetts.
- Baggott, R. (2000). *Public Health: Policy and Politics*. MacMillan Press Ltd, Basingstoke.
- Bandyopadhyay, K. & Fraccastoro, K. A. (2007). The Effect of Culture on User Acceptance of Information Technology. *Communications of the Association for Information Systems*, 19 (2007), 522-543.
- Benbasat, I. & Barki, H. (2007). Quo Vadis TAM? *Journal of the Association for Information Systems*, 8 (4), 211-218.
- Bennett, S. & Lockyer, L. (2004). Becoming an Online Teacher: Adapting to a Changed Environment for Teaching and Learning in Higher Education. *Educational Media International*, 41 (3), 231-244.

- Blackboard. (2005). *Blackboard and WebCT Complete Merger*. Retrieved July 27, 2007 from <http://www.blackboard.com/webct>.
- Chakraborty, I., Hu, P. J. W. & Cui, D. (2007). Examining the Effects of Cognitive Style in Individuals' Technology Use Decision Making. *Decision Support Systems* (article in press).
- Chen, S. & Ford, N. (2000). Individual Differences, Hypermedia Navigation and Learning: An Empirical Study. *Journal of Educational Multimedia and Hypermedia*, 9 (1), 281-312.
- Cohen, M. D. & Sproul, L. E. (1991). Editor's Introduction. *Organization Science*, 2 (1), 1-3.
- Cole, R. A. (2000). Introduction. In Cole, R. A. (Ed.). *Issues in Web-Based Pedagogy. A Critical Primer*. (pp. ix-xii). Greenwood Press, Westport, Connecticut.
- Compeau, D. R. & Higgins, C. A. (1995). Computer Self-Efficacy: Development of a Measure and Initial Test. *MIS Quarterly*, 19 (2), 189-122.
- Cyert, R. M. & March, J. G. (1963). *A Behavioral Theory of the Firm*. Prentice-Hall, Englewood Cliffs, New Jersey.
- Davis, F. D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly*, 13 (3), 319-340.
- Davis, F. D., Bagozzi, R. P. & Warshaw, P. R. (1992). Extrinsic and Intrinsic Motivation to Use Computers in the Workplace. *Journal of Applied Social Psychology*, 22 (14), 1111-1132.
- Denton, J. (1998). *Organisational Learning and Effectiveness*. Routledge, London.
- Detels, R., McEwen, J., Beaglehole, R. & Tanaka, H. (Eds.). (2002). *Oxford Textbook of Public Health*. Oxford University Press, Oxford.
- DeVreede, G., Jones, N. & Mgya, R. J. (1998). Exploring the Application and Acceptance of Group Support Systems in Africa. *Journal of Management Information Systems*, 15 (3), 197-234.
- Downe-Wamboldt, B. (1992). Content Analysis: Method, Applications and Issues. *Health Care for Women International*, 13 (3), 313-321.

- Downing, K. & Chim, T. M. (2004). Reflectors as Online Extraverts? *Educational Studies*, 30 (3), 265-276.
- Drennan, J., Kennedy, J. & Pisarki, A. (2005). Factors Affecting Student Attitudes toward Flexible Online Learning in Management Education. *Journal of Educational Research*, 98 (6), 331-338.
- Driscoll, M. P. (1995). Paradigms for Research in Instructional Systems. In Anglin, G. J. (Ed.). *Instructional Technology: Past, Present and Future* (pp. 322-329). Libraries Unlimited, Englewood.
- Duncan, R. B. (1974). Modifications in Decision Structure in Adapting to the Environment: Some Implications for Organizational Learning. *Decision Sciences*, 5 (4), 705-725.
- Eisenhardt, K. (1989). Building Theories from Case Study Research. *The Academy of Management Review*, 14 (4), 532-555.
- Federico, P. (2000). Learning Styles and Student Attitudes towards Various Aspects of Network-Based Instruction. *Computers in Human Behavior*, 16 (4), 359-379.
- Fiol, C. M. & Lyles, M. A. (1985). Organizational Learning. *The Academy of Management Review*, 10 (4), 803-813.
- Fishbein, M. & Ajzen, I. (1975). *Belief, Attitude, Intention and Behavior. An Introduction to Theory and Research*. Addison-Wesley, Reading, Massachusetts.
- Foldspang, A. (2007). *European Public Health Core Competencies Project for Public Health Education*. Association of Schools of Public Health in the European Region (ASPHER), St Maurice.
- Gable, G. G. (1994). Integrating Case Study and Survey Research Methods: An Example in Information Systems. *European Journal of Information Systems*, 3 (2), 112-126.
- Garrison, D. R. & Anderson, T. (2003). *E-learning in the 21st Century. A Framework for Research and Practice*. RoutledgeFalmer, London.
- Ginzberg, M. J. (1981). Early Diagnosis of MIS Implementation Failure: Promising Results and Unanswered Questions. *Management Science*, 27 (4), 459-478.

- Glaser, B. & Strauss, A. (1967). *The Discovery of Grounded Theory: Strategies for Qualitative Research*. Aldine, New York.
- Governmental Offices of Sweden. (2001). *Proposition 2001/02:15. Den öppna Högskolan. [The Open University.]* Ministry of Education and Research, Stockholm.
- Graham, C. R. (2006). Blended Learning Systems. Definition, Current Trends and Future Directions. In Bonk, C. J. & Graham, C. R. *The Handbook of Blended Learning. Global Perspectives, Local Designs*. (pp. 3-21). Pfeiffer, San Francisco, California.
- Greenland, S. (1998). Introduction to Regression Modelling. In Rothman, K. J. & Greenland, S. (Eds.) *Modern Epidemiology*. (pp. 401-432). Lippincott-Raven, Philadelphia, Pennsylvania.
- Grob, H. L., Bensberg, F. & Dewanto, B. L. (2004). *Developing, Deploying, Using and Evaluating an Open Source Learning Management System*. In Proceedings of ITI: The 26th International Conference of Information Technology Interfaces, Cavtat, Croatia.
- Hair, J. F., Anderson, R. E., Tatham, R. L. & Black, W. C. (1998). *Multivariate Data Analysis*, 5th edition. Pearson Education, Upper Saddle River, New Jersey.
- Hardgrave, B. C. & Johnson, R. A. (2003). Toward an Information Systems Development Acceptance Model: The Case of Object-Oriented Systems Development. *IEEE Transactions on Engineering Management*, 50 (3), 322-336.
- Harper, W. R. (1971). The System of Correspondence. In Mackenzie, O. (Ed.). *The Changing World of Correspondence Studies*. Pennsylvania State University Press, University Park, Pennsylvania.
- Harris, R. N., Dwyer, W. O. & Leeming, F. C. (2003). Are Learning Styles Relevant in Web-Based Instruction? *Journal of Educational Computing Research*, 29 (1), 13-28.
- Hedberg, B. (1991). How Organizations Learn and Unlearn? In Nyström P. C. & Starbuck, W. H. *Handbook of Organizational Design*. (pp. 8-27). Oxford University Press, London.

- Heller, L. C., (1982). An Exploration of the Effect of Structure Variables on Mathematical and Word Problem-Solving Achievement. *Dissertation Abstracts International*, 44, 416. Doctoral dissertation, Rutgers University, New Jersey.
- Hoadley, C. & Pea, R. D. (2002). Finding the Ties that Bind: Tools in Support of a Knowledge-building Community. In Schumar, W. (Ed.). *Building Virtual Communities: Learning and Change in Cyberspace*. (pp. 321-354). Cambridge University Press, Cambridge.
- Hofstede, G. (2001). *Culture's Consequences. Comparing Values, Behaviors, Institutions, and Organisations Across Nations*, 2nd edition. Sage Publications, Thousand Oaks, California.
- Honey, M., McMillan Culp, K. & Carrigg, F. (2000). Perspectives on Technology and Education Research: Lessons from the Past and Present. *Journal of Educational Computing Research*, 23 (1), 5-14.
- Honey, P. & Mumford, A. (1985). *Lärstilsbandboken. [The Manual of Learning Styles.]* Studentlitteratur, Lund.
- Hrastinski, S. & Keller, C. (2007). An Examination of Research Approaches that Underlie Research on Educational Technology: A Review from 2000 to 2004. *Journal of Educational Computing Research* 36 (2), 175-190.
- Hrastinski, S., Keller, C. & Carlsson, S. A. (2007). *Towards a Design Theory for Synchronous Computer-mediated Communication in Online Education*. (pp. 208-224). In Proceedings of DESRIST 2007: The 2nd International Conference on Design Science Research in Information Systems and Technology, Pasadena, California, USA.
- Jonassen, D. H. & Grabowski, B. L. (1993). *Handbook of Individual Differences, Learning and Instruction*. Laurence Erlbaum Associates, Hillsdale, New Jersey.
- Jordanov, W. L. (2001). *An Examination of the Relationship between Learning Style and Technology Use*. Research paper presented at the Annual Meeting of the 30th Mid-South Educational Research Association, Little Rock, Arkansas, USA.
- Järvinen, P. H. (2004). *On Research Methods*. Report, University of Tampere.
- Karahanna, E., Straub, D. W. & Chervany, N. L. (1999). Information Technology Adoption Across Time: A Cross-Sectional Comparison of Pre-Adoption and Post-Adoption Beliefs. *MIS Quarterly*, 23 (2), 183-213.

- Karahanna, E., Agarwal, R. & Angst, C. M. (2006). Reconceptualizing Compatibility Beliefs in Technology Acceptance Research. *MIS Quarterly*, 30 (4), 781-804.
- Kaunas University of Medicine. (2003). *Faculty of Public Health*. Kaunas University of Medicine, Kaunas.
- Kaunas University of Medicine (2005a). *History and Rectors of Kaunas University of Medicine*. Retrieved April 16, 2007 from <http://www.kmu.lt/index.php?cid=904>.
- Kaunas University of Medicine. (2005b). *Faculty of Public Health*. Retrieved April 16, 2007 from <http://www.kmu.lt/index.php?cid=902>.
- Keller, C. (2005a). Virtual Learning Environments: Three Implementation Perspectives. *Learning, Media and Technology*, 30 (3), 299-311.
- Keller, C. (2005b). *Virtual Learning Environments in Higher Education. A Study of Students' Acceptance of Educational Technology*. Linköping Studies in Science and Technology, 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. (2007). *User Acceptance of Virtual Learning Environments: A Case Study from Three Northern European Universities*. (Submitted).
- Keller, C. & Cernerud, L. (2002). Students' Perceptions of E-learning in University Education. *Journal of Educational Media*, 27, (1-2), 55-67.
- Keller, C. & Hrastinski, S. (2006). *Learning Styles, Age and Perceptions of Online Discussions*. In Proceedings of ECEL 2006: The 5th European Conference on E-Learning, Winchester, United Kingdom.
- Keller, C. & Hrastinski, S. (2007). Do Learning Styles Matter in Online Education? In Buzzetto-Moore, N. A. (Ed.). *Principles of Effective Online Learning*. (pp. 121-135). Informing Science Press, Santa Rosa, California.

- Keller, C., Hrastinski, S. & Carlsson, S. A. (2007). *Students' Acceptance of E-learning Environments: A Comparative Study in Sweden and Lithuania*. (pp. 395-406). In Proceedings of the 15th European Conference on Information Systems, St. Gallen, Switzerland.
- King, W. R. & He, J. (2006). A Meta-Analysis of the Technology Acceptance Model. *Information & Management*, 43 (6), 740-755.
- Kolb, D. A. (1984). *Experiential Learning. Experience as the Source of Learning and Development*. Prentice-Hall, Englewood Cliffs, New Jersey.
- Krippendorff, K. (2004). *Content Analysis: An Introduction to its Methodology*, 2nd edition. Sage Publications, Thousand Oaks, California.
- Kwon, T. H. & Zmud, R. W. (1987). Unifying the Fragmented Models of Information Systems Implementation. In Boland Jr, R. J. and Hirschheim, R. A. (Eds.). *Critical Issues in Information Systems Research*. (pp. 227-251). John Wiley and Sons Ltd., Chichester.
- Lapointe, L. & Rivard, S. (2007). A Triple Take on Information Systems Implementation. *Organization Science*, 18 (1), 89-107.
- Lee, A. S. (1989). A Scientific Methodology for MIS Case Studies. *MIS Quarterly*, 13 (1), 33-50.
- Lee, A. S. & Baskerville, R. L. (2003). Generalizing Generalizability in Information Systems Research. *Information Systems Research*, 14 (3), 221-243.
- Lee, Y., Kozar, K. A. & Larsen, K. R. T. (2003). The Technology Acceptance Model: Past, Present, and Future. *Communications of the Association for Information Systems*, 12 (50), 752-780.
- Legris, P., Ingham, J. & Colletette, P. (2003). Why Do People Use Information Technology? A Critical Review of the Technology Acceptance Model. *Information & Management*, 40 (3), 191-204.
- Leidner, D. E. & Järvenpää, S. L. (1995). The Use of Information Technology to Enhance Management School Education: A Theoretical View. *MIS Quarterly*, 19 (3), 265-291.

- Leidner, D. E. & 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.
- Lincoln, Y. S. & Guba, E. G. (1985). *Naturalistic Inquiry*. Sage Publications, Newbury Park, California.
- Lu, J., Chun-Sheng, Y. & Chang, L. (2002). Learning Style, Learning Patterns, and Learning Performance in a WebCT-Based MIS Course. *Information & Management*, 40 (6), 497-507.
- Lyytinen, K. & Rose, G. M. (2003). The Disruptive Nature of Information Technology Innovations: The Case of Internet Computing in Systems Development Organizations. *MIS Quarterly*, 27 (4), 557-595.
- Malterud, K. (2001). Qualitative research: Standards, Challenges and Guidelines. *The Lancet*, 358 (9280), 483-488.
- March, J. (1991). Exploration and Exploitation in Organizational Learning. *Organization Science*, 2 (1), 71-87.
- Margerison, C. J. & Lewis, R. G. (1979). *How Work Preferences Relate to Learning Styles*. Management and Organisation Development Research Centre, Cranfield School of Management, Bedfordshire, England.
- Mason, R. (2003). On-Line Learning and Supporting Students: New Possibilities. In Tait, A. & Mills, R. *Rethinking Learner Support in Distance Education. Change and Continuity in an International Context*. RoutledgeFalmer, London.
- Matlay, H. (2000). Organisational Learning in Small Learning Organisations. *Education and Training*, 42 (4-5), 202-210.
- Maxwell, J. A. (1992). Understanding and Validity in Qualitative Research. *Harvard Educational Review*, 62 (3), 279-300.
- McAfee, A. (2006). Mastering the Three Worlds of Information Technology. *Harvard Business Review*, 84 (11), 141-149.
- Miles, M. B. & Huberman, A. M. (1994). *Qualitative Data Analysis. An Expanded Sourcebook*. Sage Publications, Thousand Oaks, California.

- Moore, G. C. & Benbasat, I. (1991). Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation. *Information Systems Research*, 2 (3), 192-222.
- Moore, G. C. & Benbasat, I. (1996). Integrating Diffusion of Innovations and Theory of Reasoned Action Models to Predict Utilization of Information Technology by End-Users. (pp. 132-145). In Kautz, K. & Pries-Heje, J. (Eds.). *Diffusion and Adoption of Information Technology*. Chapman and Hall Publishers, London.
- Moore, M. G. (2006). Foreword. In Bonk, C. J. & Graham, C. R. (2006). *The Handbook of Blended Learning. Global Perspectives, Local Designs*. (pp. xxiii-xxvii). Pfeiffer, San Francisco, California.
- Mårtensson, Y., Larsson, H. & Bergsten, P. O. (1998). *När världen vidgas – Hermodsstudenterna berättar/Hermods 100 år. [When the World opens up – Students of Hermods' tell their stories/Hermods' Institute of Correspondence Studies 100 years.]* Liber Hermods, Malmö.
- Narmaala, J. (2004). *Reflections on Technology Acceptance in Higher Education*. In Proceedings of the 12th European Conference on Information Systems, Turku, Finland.
- Ngai, E. W. T, Poon, J. K. L & Chan, Y. H. C. (2007). Empirical Examination of the Adoption of WebCT Using TAM. *Computers & Education*, 48 (2), 250-267.
- Nordic School of Public Health. (2003). *NHV 50 år. Jubileumsskrift. [Nordic School of Public Health 50 years. Anniversary Publication.]* Nordiska Högskolan för folkhälsovetenskap, Göteborg.
- Nordic School of Public Health. (2007). *Årsberättelse 2006. [Annual Report 2006.]* Nordiska högskolan för folkhälsovetenskap, Göteborg.
- Ong, C-S. & Lai, J-Y. (2006). Gender Differences in Perceptions and Relationships among Dominants of E-learning Acceptance. *Computers in Human Behavior*, 22 (5), 816-829.
- Ong, C. S., Lay, J. Y. & Wang, Y. S. (2004). Factors Affecting Engineers' Acceptance of Asynchronous E-learning Systems in High-Tech Companies. *Information & Management*, 41 (6), 795-804.

- Orlikowski, W. J. & Barley, S. R. (2001). Technology and Institutions: What Can Research on Information Technology and Research on Organizations Learn from Each Other? *MIS Quarterly*, 25 (2), 145-165.
- Orlikowski, W. M. & Iacono, S. C. (2001). Research Commentary: Desperately Seeking the “IT” in IT Research – A Call to Theorizing the IT Artifact. *Information Systems Research*, 12 (2), 121-134.
- Peters, O. (2001). *Learning & Teaching in Distance Education. Analysis and Interpretations from an International Perspective*. Kogan Page, London.
- Picciano, A. G. (2006) Blended Learning: Implications for Growth and Access. *Journal of Asynchronous Learning Networks* 10 (3), 95-102.
- Piccoli, G., Ahmad, R. & Ives, B. (2001). Web-Based Virtual Learning Environments: A Research Framework and a Preliminary Assessment of Effectiveness in Basic IT Skills Training. *MIS Quarterly*, 25 (4), 401-426.
- Robson, C. (2002). *Real World Research*, 2nd edition. Blackwell Publishing, Oxford.
- Rockart, J. F. (1979). Chief Executives Define Their Own Data Needs. *Harvard Business Review*, 57 (2), p. 81-93.
- Rogers, E. M. (1995). *Diffusion of Innovations*, 4th edition. The Free Press, New York.
- Rogers, E. M. & Shoemaker, F. F. (1971). *Communication of Innovations: A Cross-Cultural Approach*. The Free Press, New York.
- Romiszowski, A. & Mason, R. (2004). Computer-Mediated Communication. In Jonassen, D. H. (Ed.) *Handbook for Research for Educational Communications and Technology*. (pp. 397-431). Lawrence Erlbaum, New Jersey.
- Ron, A. (2002). Regression Analysis and the Philosophy of Social Science. A critical realist view. *Journal of Critical Realism*, 1 (1), 119-142.
- Ronning, R., McCurdy, D. & Ballinger, R. (1984). Individual Differences: A Third Component in Problem-Solving Instruction. *Journal of Research in Science Teaching*, 21 (1), 71-82.
- Ryan, S., Scott, B., Freeman, H. & Patel, D. (2000). *The Virtual University. The Internet and Resource-Based Learning*. Kogan Page, London.

- Saadé, R. & 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.
- Schultz, T & Nergell, M. (2004). IT-plattformar för distansutbildning. [*Virtual Learning Environments in Distance Education.*] National Agency for Services to Universities and University Colleges, Stockholm.
- Selim, H. M. (2003). An Empirical Investigation of Student Acceptance of Course Websites. *Computers & Education*, 40 (4), 343-360.
- Shaw, G. & Marlow, N. (1999). The Role of Student Learning Styles, Gender, Attitudes and Perceptions on Information and Communication Technology Assisted Learning. *Computers & Education*, 33 (4), 223-234.
- Shaw, N. G. (2003). Identifying Relationships Among Factors in IS Implementation. *Communications of the Association for Information Systems*, 11 (9), 155-165.
- Sigrén, P. & Holmkvist, H. (2005). *Syntes och analys av tidigare kravspecifikationer för upphandlingar av LMS inom den svenska högskola 2000 – 2004.* [*Synthesis and Analysis of Previous Requirement Specifications for Purchasing of LMS within Swedish Higher Education.*] University College of Borås and Swedish Net University, Härnösand.
- Sim, J. (1998). Collecting and Analyzing Qualitative Data: Issues Raised by the Focus Group. *Journal of Advanced Nursing*, 28 (2), 345-352.
- Simpson, O. (2002). *Supporting Students in Online, Open and Distance Learning.* Kogan Page, London.
- Swedish Agency for Network and Cooperation in Higher Education. (2007). *Årsredovisning 2006.* [*Annual Report 2006.*] Swedish Agency for Network and Cooperation in Higher Education, Härnösand.
- Terrell, S. R. (2002). The Effect of Learning Style on Doctoral Course Completion in a Web-Based Learning Environment. *The Internet and Higher Education*, 5 (4), 345-352.

- Terrell, S. R. (2005). Supporting Different Learning Styles in an Online Learning Environment: Does It Really Matter in the Long Run? *The Journal of Distance Learning Administration*, 8 (2).
- Terrell, S. R. & Dringus, L. (1999). An Investigation of the Effect of Learning Style on Student Success in Online Learning Environment. *Journal of Educational Technology Systems*, 28 (3), 231-238.
- The Joint Information Systems Committee (JISC). (2002). *MLEs and VLEs Explained*. Retrieved April 29, 2007 from http://www.jisc.ac.uk/whatwedo/programmes/programme_buildmle_hefe/mle_lifelonglearning_info/mle_briefingpack/mle_briefings_1.aspx
- Thompson, R. L., Higgins, C. A. & Howell, J. M. (1991). Personal Computing: Toward a Conceptual Model of Utilization. *MIS Quarterly*, 15 (1), 124-143.
- Triandis, H. C. (1977). *Interpersonal Behavior*. Brooke/Cole, Monterey, California.
- University of Tromsø. (2005). *Universitetet i Tromsø. Verdens nordligste universitet – Studietilbud 2005/2006*. [University of Tromsø. *The Northernmost University of the World - Educations 2005/2006*.] Universitetet i Tromsø.
- Van Slyke, C., Lou, H., Belanger, F. & Sridhar, V. (2004). *The Influence of Culture on Consumer-Oriented Electronic Commerce Adoption*. In Proceedings of SAIS 2004: The 7th Annual Conference of the Southern Association for Information Systems, Savannah, Georgia, USA.
- Venkatesh, V. & Davis, F. D. (2000). A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies. *Management Science*, 46 (2), 186-204.
- Venkatesh, V., Morris, M. G., Davis, G. B. & Davis F. D. (2003). User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly*, 27 (3), 425-478.
- Walsham, G. (1995). Interpretive Case Studies in IS Research: Nature and Method. *European Journal of Information Systems*, 4 (2), 74-81.
- Wang, C. L. & Ahmed, P. K. (2003). Organisational Learning: A Critical Review. *The Learning Organization*, 10 (1), 8-17.

- Wang, K. H., Wang, T. H. Wang, W. L. & Huang, S. C. (2006). Learning Style and Formative Assessment Strategy: Enhancing Student Achievement in Web-Based Learning. *Journal of Computer Assisted Learning*, 22 (3), 207-217.
- Wang, M. Y. & Hwang, M. J. (2004). The E-learning Library: Only a Warehouse of Learning Resources? *The Electronic Library*, 22 (5), 408-415.
- Webster, J. & Watson, R. (2002). Analyzing the Past to Prepare for the Future: Writing a Literature Review. *MIS Quarterly*, 26 (2), xiii-xxiii.
- Weiss, J. (2006). Introduction: Virtual Learning and Learning Virtuality. In Weiss, J., Nolan, J., Hunsinger, J. & Trifonas, P. (Eds.). *The International Handbook of Virtual Learning Environments. Part One.* (pp. 1-33). Springer, Dordrecht.
- Westerberg, P. & Mårald, G. (2004). *Nätuniversitetet och IT-stödd distansutbildning – Attityder och erfarenheter hos prefekter, kursansvariga och studenter. [Netuniversity and IT-supported Distance Education – Attitudes and Experiences among Deans, Course Managers and Students.]* Umeå Center for Evaluation Research, Umeå University.
- Williams, A., Dobson, P. & Walters, M. (1993). *Changing Culture: New Organisational Approaches*, 2nd edition. Institute of Personnel Management, London.
- Williams, L. M., Paprock, K. & Covington, B. (1999). *Distance Learning. The Essential Guide.* Sage Publications, Thousand Oaks, California.
- Wilson, B. G. (1996). *Constructivist Learning Environments: Case Studies in Instructional Design.* Educational Technology Publications, Englewood Cliffs, New Jersey.
- Wise, R. E. (1980). The Differential Employment of Cognitive Skills as a Function of Increasing Iconic Stimulus Complexity. *Dissertation Abstracts International*, 41, 3963. Doctoral dissertation, Penn State University, Pennsylvania.
- Yin, R. K. (2003). *Case Study Research. Design and Methods*, 2nd edition. Sage Publications, London.
- Zhang, D. & Nunamaker, J. F. (2003). Powering E-learning in the New Millennium: An Overview of E-learning and Enabling Technology. *Information Systems Frontiers*, 5 (2), 207-218.

Appendix 1. Related publications

- Hrastinski, S. & Keller, C. (2006). *Research Approaches on Educational Technology: An Initial Review of Recent Research*. In Proceedings of the 3rd Netlearning Conference, Ronneby, Sweden.
- Keller, C & Hrastinski, S. (2006). *Learning Styles, Age and Perceptions of Online Discussions*. In Proceedings of ECEL 2006: The 5th European Conference on E-Learning, Winchester, United Kingdom.
- Hrastinski, S. & Keller, C. (2007). Computer-Mediated Communication in Education: A Review of Recent Research. *Educational Media International*, 44 (1), 61-77.
- Hrastinski, S. & Keller, C. (2007). An Examination of Research Approaches that Underlie Research on Educational Technology: A Review from 2000 to 2004. *Journal of Educational Computing Research*, 36 (2), 175-190.
- Hrastinski, S. & Keller, C. (2007). *När är det lämpligt att stödja synkron kommunikation i nätbaserade kurser?* Rapport, LearningNet, mars 2007, <http://webnews.textalk.com/se/article.php?id=249502&context=60356>.
- Hrastinski, S., Keller, C. & Carlsson, S. A. (2007). *Prescriptive Guidelines for when to Use Synchronous Communication in E-Learning Environments*. (pp. 358-369). In Proceedings of the 15th European Conference on Information Systems, St. Gallen, Switzerland.
- Hrastinski, S., Keller, C. & Carlsson, S. A. (2007). *Towards a Design Theory for Synchronous Computer-mediated Communication in Online Education*. (pp. 208-224). In Proceedings of DESRIST 2007: The 2nd International Conference on Design Science Research in Information Systems and Technology, Pasadena, California, USA.
- Keller, C. & Cernerud, L. (2007). *Acceptance of E-learning Environments in Public Health Education: A Comparative Research Project in Sweden, Norway and Lithuania*. Accepted to The 29th ASPHER Annual Conference 07, Valencia, Spain.
- Keller, C., Lindh, J. & Hrastinski, S. (2007). *E-learning Use in Higher Education. The Impact of Organisational Factors*. Accepted to ECEL 2007: The 6th European Conference on E-learning, Copenhagen, Denmark.

Appendix 1. Related publications

Lindh, J., Keller, C. & Hrastinski, S. (2007). *E-learning Use in Higher Education: Driving Factors, Barriers and Strategies*. In Proceedings of the 6th Hawaii International Conference on Statistics, Mathematics and Related Fields 2007, Honolulu, Hawaii, USA.

APPENDIX 2a. Students' survey questionnaire, paper I

BACKGROUND VARIABLES

<p>1. Gender</p> <p><input type="checkbox"/> Female</p> <p><input type="checkbox"/> Male</p>	<p>2. Age</p> <p><input type="checkbox"/> 18-20 years</p> <p><input type="checkbox"/> 21-24 years</p> <p><input type="checkbox"/> 25-30 years</p> <p><input type="checkbox"/> older than 30</p>
<p>3. Training programme</p> <p><input type="checkbox"/> Programme of Occupational Therapy</p> <p><input type="checkbox"/> Programme of Biomedical Laboratory Science</p> <p><input type="checkbox"/> Programme of Medical Imaging</p> <p><input type="checkbox"/> Programme of Prosthetics and Orthotics</p> <p><input type="checkbox"/> Programme of Nursing</p> <p><input type="checkbox"/> Programme of Social Work</p> <p><input type="checkbox"/> Programme of Computer Engineering</p> <p><input type="checkbox"/> Programme of Electrical Engineering</p>	<p>4. In what way would you describe your previous knowledge of computers and their use before applying to university college? Chose the appropriate category below.</p> <p><input type="checkbox"/> I had no previous knowledge.</p> <p><input type="checkbox"/> I had basic knowledge. I could e.g use the Internet send e-mail and create simple documents.</p> <p><input type="checkbox"/> I had fairly good knowledge. I could e.g use the Office application programs, Word, PowerPoint and Excel.</p> <p><input type="checkbox"/> I had very good knowledge. I could e.g create databases and web pages, and use programming languages.</p>
<p>5. How quickly do you accept and use new technology in general? To what user category do you belong? Choose <u>one</u> of the alternatives below.</p> <p><input type="checkbox"/> I am willing to try new technologies, even though there could be risks involved.</p> <p><input type="checkbox"/> I accept new ideas early, but after certain consideration.</p> <p><input type="checkbox"/> My decisions on accepting new ideas are based on careful consideration, but I accept innovations more early than the average person.</p> <p><input type="checkbox"/> I am sceptical to new technologies and start to use them only when a majority already does.</p> <p><input type="checkbox"/> I accept new technology only when it is a part of tradition or common knowledge.</p>	<p>6. What is in your opinion the best way of learning course content? Choose <u>one</u> of the alternatives below.</p> <p><input type="checkbox"/> In a theoretical way, through lectures or to read the course content.</p> <p><input type="checkbox"/> In a practical way, through concrete examples and practice.</p> <p>7. What is in your opinion the best way of confirming the learning of course content? Choose <u>one</u> of the alternatives below.</p> <p><input type="checkbox"/> Through reflecting upon the course content.</p> <p><input type="checkbox"/> Through testing the course content in action.</p>

APPENDIX 2a. Students' survey questionnaire, paper I

THE WEB PLATFORM

Below, seven statements are made about the web platform. Mark to what extent you disagree/agree with each statement.

8. The use of the web platform has improved the pedagogical value of the courses	<input type="checkbox"/> I disagree totally	<input type="checkbox"/> I disagree to a large extent	<input type="checkbox"/> I agree to a large extent	<input type="checkbox"/> I agree totally	<input type="checkbox"/> I do not know
9. The use of the web platform has facilitated my studies	<input type="checkbox"/> I disagree totally	<input type="checkbox"/> I disagree to a large extent	<input type="checkbox"/> I agree to a large extent	<input type="checkbox"/> I agree totally	<input type="checkbox"/> I do not know
10. The web platform has increased flexibility in my studies	<input type="checkbox"/> I disagree totally	<input type="checkbox"/> I disagree to a large extent	<input type="checkbox"/> I agree to a large extent	<input type="checkbox"/> I agree totally	<input type="checkbox"/> I do not know
11. The web platform has improved communication with other students	<input type="checkbox"/> I disagree totally	<input type="checkbox"/> I disagree to a large extent	<input type="checkbox"/> I agree to a large extent	<input type="checkbox"/> I agree totally	<input type="checkbox"/> I do not know
12. The web platform has improved communication with teachers and tutors	<input type="checkbox"/> I disagree totally	<input type="checkbox"/> I disagree to a large extent	<input type="checkbox"/> I agree to a large extent	<input type="checkbox"/> I agree totally	<input type="checkbox"/> I do not know
13. The web platform has improved my possibilities to solve problems connected to my training programme	<input type="checkbox"/> I disagree totally	<input type="checkbox"/> I disagree to a large extent	<input type="checkbox"/> I agree to a large extent	<input type="checkbox"/> I agree totally	<input type="checkbox"/> I do not know
14. The web platform is easy to understand and use	<input type="checkbox"/> I disagree totally	<input type="checkbox"/> I disagree to a large extent	<input type="checkbox"/> I agree to a large extent	<input type="checkbox"/> I agree totally	<input type="checkbox"/> I do not know

APPENDIX 2a. Students' survey questionnaire, paper I

Miscellaneous

15. To what extent has your use of the web platform been disrupted by technical problems?

Never

Sometimes

Often

Very often

16. What is, in your opinion, the most important advantage (state only one advantage) of using the web platform?

.....
.....
.....

17. What is, in your opinion, the most important disadvantage (state only one disadvantage) of using the web platform?

.....
.....
.....

APPENDIX 2b. Interview guide, paper I

Aim: To describe to which extent and in which ways the students have used the web platform, and if the use of the platform differs between university colleges.

When did you first begin to use the web platform?

What were the reasons for introducing web-based education?

Why has your university college selected this web platform (PingPong®)?

What overriding aim has the management of the university college for the use of the web platform?

In which courses and programmes is the web platform used?

What functions of the platform are used? For what purposes are the different functions used?

Is there a formal policy for using the web platform decided by the management of the university college? What does the policy imply?

Are there courses at your university college which are not possible to deliver through web-based learning? State the reasons why.

APPENDIX 3. Students' survey questionnaire, paper V-VI, English version

7. a) How often do you use Fronter?

- Never
 Once a year
 Several times a year
 Once a month
 Several times a month
 Once a week
 Several times a week
 Once a day
 Several times a day

b) State the average time period you spend on Fronter each time you use it.

- 1-2 hours
 3-4 hours
 5-8 hours
 More than 8 hours

8. How would you describe your previous knowledge of computers and use of application programs before attending the education programme? Choose the category below that describes your previous level of knowledge most accurately.

- I had no previous knowledge about computers and use of application programs.
 I had basic knowledge. I could use the Internet, send e-mails and create simple documents.
 I had good knowledge. I could use application programs like Word, PowerPoint and Excel to create documents and presentations.
 I had advanced knowledge. I could create databases and/or web sites and use programming languages.

9. How confident do you feel in using computers and application programs? Choose the category below on the five-point scale below that describes your sense of confidence most accurately.

- Not at all confident

 Moderately confident

 Totally confident

Part II. Fronter

In this part of the questionnaire, a number of statements are made about the use of Fronter. Mark to what extent you agree with each statement.

1. I find Fronter useful in my education.	<input type="checkbox"/> I disagree completely	<input type="checkbox"/> I disagree partly	<input type="checkbox"/> I agree partly	<input type="checkbox"/> I agree completely	<input type="checkbox"/> I do not know
2. Fronter enables me to accomplish my educational tasks more quickly.	<input type="checkbox"/> I disagree completely	<input type="checkbox"/> I disagree partly	<input type="checkbox"/> I agree partly	<input type="checkbox"/> I agree completely	<input type="checkbox"/> I do not know
3. Using Fronter improves my educational performance.	<input type="checkbox"/> I disagree completely	<input type="checkbox"/> I disagree partly	<input type="checkbox"/> I agree partly	<input type="checkbox"/> I agree completely	<input type="checkbox"/> I do not know

APPENDIX 3. Students' survey questionnaire, paper V-VI, English version

4. Fronter increases the possibilities of communication with other students.	<input type="checkbox"/> I disagree completely	<input type="checkbox"/> I disagree partly	<input type="checkbox"/> I agree partly	<input type="checkbox"/> I agree completely	<input type="checkbox"/> I do not know
5. Fronter increases the possibilities of communication with teachers/tutors.	<input type="checkbox"/> I disagree completely	<input type="checkbox"/> I disagree partly	<input type="checkbox"/> I agree partly	<input type="checkbox"/> I agree completely	<input type="checkbox"/> I do not know
6. Fronter is easy to use.	<input type="checkbox"/> I disagree completely	<input type="checkbox"/> I disagree partly	<input type="checkbox"/> I agree partly	<input type="checkbox"/> I agree completely	<input type="checkbox"/> I do not know
7. Using Fronter makes it easier for me to plan and control my course work.	<input type="checkbox"/> I disagree completely	<input type="checkbox"/> I disagree partly	<input type="checkbox"/> I agree partly	<input type="checkbox"/> I agree completely	<input type="checkbox"/> I do not know
8. Using Fronter is never frustrating.	<input type="checkbox"/> I disagree completely	<input type="checkbox"/> I disagree partly	<input type="checkbox"/> I agree partly	<input type="checkbox"/> I agree completely	<input type="checkbox"/> I do not know
9. It was easy to learn and understand Fronter.	<input type="checkbox"/> I disagree completely	<input type="checkbox"/> I disagree partly	<input type="checkbox"/> I agree partly	<input type="checkbox"/> I agree completely	<input type="checkbox"/> I do not know
10. My interaction with Fronter is clear and understandable.	<input type="checkbox"/> I disagree completely	<input type="checkbox"/> I disagree partly	<input type="checkbox"/> I agree partly	<input type="checkbox"/> I agree completely	<input type="checkbox"/> I do not know
11. I can without effort get Fronter to do what I want it to do.	<input type="checkbox"/> I disagree completely	<input type="checkbox"/> I disagree partly	<input type="checkbox"/> I agree partly	<input type="checkbox"/> I agree completely	<input type="checkbox"/> I do not know
12. It is easy to remember how to perform tasks in Fronter.	<input type="checkbox"/> I disagree completely	<input type="checkbox"/> I disagree partly	<input type="checkbox"/> I agree partly	<input type="checkbox"/> I agree completely	<input type="checkbox"/> I do not know
13. To use Fronter does not require a lot of mental effort.	<input type="checkbox"/> I disagree completely	<input type="checkbox"/> I disagree partly	<input type="checkbox"/> I agree partly	<input type="checkbox"/> I agree completely	<input type="checkbox"/> I do not know
14. Teachers/tutors encourage my use of Fronter.	<input type="checkbox"/> I disagree completely	<input type="checkbox"/> I disagree partly	<input type="checkbox"/> I agree partly	<input type="checkbox"/> I agree completely	<input type="checkbox"/> I do not know
15. Other students encourage my use of Fronter.	<input type="checkbox"/> I disagree completely	<input type="checkbox"/> I disagree partly	<input type="checkbox"/> I agree partly	<input type="checkbox"/> I agree completely	<input type="checkbox"/> I do not know
16. The university and university management support the use of Fronter.	<input type="checkbox"/> I disagree completely	<input type="checkbox"/> I disagree partly	<input type="checkbox"/> I agree partly	<input type="checkbox"/> I agree completely	<input type="checkbox"/> I do not know

APPENDIX 3. Students' survey questionnaire, paper V-VI, English version

17. I have the knowledge necessary to use Fronter.	<input type="checkbox"/> I disagree completely	<input type="checkbox"/> I disagree partly	<input type="checkbox"/> I agree partly	<input type="checkbox"/> I agree completely	<input type="checkbox"/> I do not know
18. Fronter is compatible with other application programs that I use.	<input type="checkbox"/> I disagree completely	<input type="checkbox"/> I disagree partly	<input type="checkbox"/> I agree partly	<input type="checkbox"/> I agree completely	<input type="checkbox"/> I do not know
19. A specific person or group is available for support when problems occur.	<input type="checkbox"/> I disagree completely	<input type="checkbox"/> I disagree partly	<input type="checkbox"/> I agree partly	<input type="checkbox"/> I agree completely	<input type="checkbox"/> I do not know
20. Using Fronter suits my style of learning and studying.	<input type="checkbox"/> I disagree completely	<input type="checkbox"/> I disagree partly	<input type="checkbox"/> I agree partly	<input type="checkbox"/> I agree completely	<input type="checkbox"/> I do not know
21. I would have no difficulty explaining the advantages of Fronter to others.	<input type="checkbox"/> I disagree completely	<input type="checkbox"/> I disagree partly	<input type="checkbox"/> I agree partly	<input type="checkbox"/> I agree completely	<input type="checkbox"/> I do not know
22. Using Fronter improves my prestige among teachers/tutors.	<input type="checkbox"/> I disagree completely	<input type="checkbox"/> I disagree partly	<input type="checkbox"/> I agree partly	<input type="checkbox"/> I agree completely	<input type="checkbox"/> I do not know
23. Using Fronter improves my prestige among other students.	<input type="checkbox"/> I disagree completely	<input type="checkbox"/> I disagree partly	<input type="checkbox"/> I agree partly	<input type="checkbox"/> I agree completely	<input type="checkbox"/> I do not know
24. I have seen what teachers/tutors accomplish using Fronter.	<input type="checkbox"/> I disagree completely	<input type="checkbox"/> I disagree partly	<input type="checkbox"/> I agree partly	<input type="checkbox"/> I agree completely	<input type="checkbox"/> I do not know
25. I have seen what other students accomplish using Fronter.	<input type="checkbox"/> I disagree completely	<input type="checkbox"/> I disagree partly	<input type="checkbox"/> I agree partly	<input type="checkbox"/> I agree completely	<input type="checkbox"/> I do not know
26. I have had the opportunity to try and learn Fronter before I actually had to use it.	<input type="checkbox"/> I disagree completely	<input type="checkbox"/> I disagree partly	<input type="checkbox"/> I agree partly	<input type="checkbox"/> I agree completely	<input type="checkbox"/> I do not know

Part III Miscellaneous

27. How often do you experience technical problems whilst using Fronter? Choose the alternative below that describes the situation most accurately.

- | | | | | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> |
| Never | Once a year | Several times a year | Once a month | Several times a month | Once a week | Several times a week | Once a day | Several times a day |

APPENDIX 3. Students' survey questionnaire, paper V-VI, English version

28. a) Are there parts of your education where Fronter could not be used?

Yes No I do not know

b) If your answer is yes, describe what parts, and the reasons why Fronter could not be used.

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.....

29. State the 3-5 greatest advantages in using Fronter.

1.

2.

3.

4.

5.

30. State the 3-5 greatest disadvantages in using Fronter.

1.

2.

3.

4.

5.

