Learning to Use Office Applications: Understanding the Antecedents of Adaptive IT Use

Bertta Sokura
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Abstract

The students now starting their university studies are digital natives – the first generation that has grown up surrounded by IT gadgets with a wide variety of applications for business, public services, communications, and entertainment. However, there is a bigger-than-ever need to train specific applications such as spreadsheets so as to help users maximize the benefits of IT. Without proper training, IT can turn out to be a big challenge or even an obstacle for many users.

This dissertation studies the learning process in the IT training context. The overall goal is to model how training influences different outcomes of learning: changes in IT beliefs and attitudes, IT-related anxiety, and the ability to apply the learned IT skills in novel situations, that is, learning transfer. The research questions are 1) How does IT training influence IT anxiety, IT beliefs, and attitudes? 2) How does IT training-related flow experience influence learning transfer? 3) What are the antecedents of IT training-related flow experience?

These three questions have informed the research efforts reported in the four research papers included in this dissertation, each examining different theoretical perspectives from the viewpoint of the individual learner. The main theoretical contribution of this dissertation is the theoretical IT Learning Process (ITLP) framework that is developed and tested in the context of office application training. The framework is based on the literature on information systems (IS), human behavior, flow, learning and learning transfer, and motivation. The key findings of the dissertation are as follows: First, the notion of ease of use is independent of computer anxiety. Secondly, user beliefs and attitudes change during the IT learning process, due to perceptions of usefulness, rather than satisfaction. Thirdly, extrinsic motivation is more likely to cause a flow state than vice versa. Fourthly, students gain flow experience when learning to use a spreadsheet application. Flow, in turn, is the major determinant of learning transfer. A successful learning process enables deeper learning transfer; that is, users gain adaptive IT abilities.

The dissertation also provides recommendations for practical training arrangements, discusses the limitations of the research, and suggests some avenues for future research. To conclude, IT training can be highly cost-effective by significantly increasing the performance of users, be they digital natives or from an older generation. Even experienced IT users should, from time to time, pause and ponder how they are using IT. Are they laboriously and manually doing things that could be done by applying the features of the application?

Keywords IT learning, IT training, adaptive IT use, learning transfer, flow, IS acceptance, longitudinal study, structural equation modeling (SEM)
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Tiivistelmä


Näitä kolme tutkimusyksymystä ovat viitoittaneet tutkimustyötä, joka on raportoitu neljässä väitöskirjaa sisältyvässä tutkimuspapereissa. Niissä kaikissa tutkitaan eri teoreettisia lähestymistapoja yksittäisen oppijan näkökulmasta pääasiassa pitkittäisillä kyselytutkimuksilla.

Väitöskirjan tärkein tieteellinen kontribuutio on teoreettisen tietotekniikan oppimisprosessi-viiteeksynyn (IT Learning Process (ITLP)) kehittäminen ja testaus toimisto-ohjelmien koulutuksen yhteydessä. Väitöskirjan keskeiset johtopäätökset ovat:


Väitöskirja antaa myös suosituksia käytännön opetusjärjestelyille, esittelee tutkimuksen rajoitukset ja ehdottaa jatkatutkimusaiheita. Yhteenvertona voidaan todeta, että tietotekniikkakoulutus lisää merkittävästi käyttäjien tehokkuutta o vatka he digiinioiteja tai vanhemman sukupolven edustajia. Tietotekniikkakoulutusta ei pitäisikään ajatella vain kustannuksena vaan keinona tehostaa organisaatioiden toimintaa. Myös kokoneiden käyttäjien kannattaisi aika ajoin pysähtyä pohtimaan tietotekniikan käyttötapojan. Tekevätkö he työläisiä ja manuaalisesti asioita, joilla voisi tehdä käyttäen sovelluksen ominaisuuksia?

Avainsanat tietotekniikka, koulutus, oppiminen, tietotekniikan soveltava käyttö, flow, pitkittäistutkimus, rakenne-yhtälömaili (SEM)

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The research project leading to the writing of this dissertation has been an extremely interesting and challenging episode in my lifelong learning path. After almost 30 years of practical work in the IT area – coding programs, developing systems, consulting, and teaching computing skills to students of varying ages and developing the related practical examinations – I felt compelled to look into the subject more deeply. This guided me to my present research topic.

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Dedicated to my Aunt Saimi.

Kirkkonummi, February 2016

Bertta Sokura
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PART I: OVERVIEW OF THE DISSERTATION
1. Introduction

This chapter provides an overall introduction to the dissertation. First, the research background and motivation are deliberated. Second, objectives and research questions based on the research gap are set. Third, the key research concepts and research contexts are presented. Finally, a description of the structure of the dissertation closes the chapter.

1.1 Background and motivation

In recent years, a radical change has taken place from organizational to ubiquitous computing. Laptops, tablets, and smartphones with broadband or wireless internet connections are in everyday use in organizations, schools, and homes. Information technology (IT) is ubiquitous and embedded in the everyday life of each and every one of us. The students now starting their university studies are digital natives – the first generation that has grown up surrounded by IT gadgets with a wide variety of applications for business, public services, communications, and entertainment. The general opinion is that digital natives know everything about IT gadgets and applications and can use them efficiently by nature and without training. Applications such as office tools have, however, become more complicated and now provide a host of specific functions and activities in addition to their basic functionalities. Hence, there is a bigger-than-ever need to train specific applications and computer skills so as to help users maximize the benefits of IT. Without proper training, IT can turn out to be a big challenge or even an obstacle for many users.

The situation in IT training is even worse now than at the beginning of computer history, when user training was the responsibility of computer suppliers. The computer manufacturers had their own operating systems specific to their computer architecture and, furthermore, had special applications that worked only in their computers. After PCs came onto the market in the 1980s the situation changed dramatically. Control slipped away from centralized IT departments to innovative users. User training related to office applications became less frequent in organizations.
The 21st century has seen repeated reports of deficient IT skills among employees and students – possibly because the teaching of the IT skills necessary for working and studying seems to be nobody’s responsibility. Should it lie in the education system at, for example, the secondary or tertiary levels? In Finland, programming and the touch-type system will now be taught to elementary school students embarking on their study paths. Should they be taught the effective use of personal productivity tools as well?

In addition to teaching the use of IT applications, there is a need to do research on the influences on, and outcomes of, IT training. Prior research has shown that user training has a big influence on individuals’ technology acceptance and use (Igbaria 1990; Igbaria 1993; Venkatesh 1999; Venkatesh and Bala 2008; Venkatesh et al. 2003). It has also been shown that training impacts user attitudes positively (Igbaria 1990; Igbaria 1993). Furthermore, training improves computer self-efficacy (Venkatesh and Davis 1996), that is, one’s confidence in one’s own computer competence. Self-efficacy, in turn, increases user acceptance and use of IT. Venkatesh and Davis (1996) even argue that self-efficacy is more effective than improved interface design in encouraging user acceptance. Furthermore, the training methods and especially the use of an intrinsic motivator during training increase learning (Venkatesh 1999). In addition, it is important to perform both pre-training and post-training analyses to achieve effective training (Agarwal et al. 2014). Finally, motivation, in general, has a strong impact on learning and IT use (Davis et al. 1992).

With respect to learning to use IT applications, Information Systems (IS) literature has previously focused on adoption theories such as the Technology Acceptance Model, TAM (Davis et al. 1989) and the Unified Theory of Acceptance and Use of Technology, UTAUT (Venkatesh et al. 2003). In these theories, the object of interest is the intention to use or the use of particular information systems measured by quantitative variables such as frequency of use or the time spent using such systems. These theories often omit what is happening in the minds of the learners, that is, the positive or negative factors that have an impact on learning during the IT learning process.

It is commonly agreed that training decreases computer anxiety (Igbaria 1990; Martocchio 1994; Popedavis and Vispoel 1993; Shelley 1998; Torkzadeh and Angulo 1992; Torkzadeh and Koufteros 1993). However, these studies are set only in a context of users with limited computer skills and experience who are learning new technologies. Nor are changes in computer anxiety levels compared with simultaneous changes in any other variables, such as the perceived ease of use. Furthermore, there is a lack of longitudinal studies related to computer anxiety.

It has also been demonstrated that attitudes tend to change over time during the process of learning computer applications (Szajna and Scamell 1993;
Venkatesh et al. 2000). Very positive attitudes or expectations decrease and negative expectations increase in the long run (Szajna and Scamell 1993). However, Szajna and Scamell (1993) argue that very positive attitudes stay at a higher level than negative or neutral attitudes. Less attention has been paid to the factors that influence changes in attitude.

A multitude of flow studies (Csikszentmihalyi and Schiefele 1993; Rathunde and Csikszentmihalyi 1993; Schmidt et al. 2010; Shernoff et al. 2003) have reported the powerful role of flow in learning. Yet, little research can be found that explores flow experience (e.g., Ghani and Deshpande 1994; Pilke 2004) when learning to use office applications such as spreadsheets. In addition, the results of the relationship between user beliefs and flow or other hedonic experiences are contradictory. Earlier IS literature (See Davis et al. 1992; Trevino and Webster 1992a) argues that perceived usefulness affects the flow experience, whereas current IS literature (See Agarwal and Karahanna 2000; Saadé and Bahli 2005; Venkatesh 1999) maintains that flow is an antecedent to perceived usefulness.

In IT learning – especially when learning to use office applications – it is essential to understand the process by which newly learned skills and knowledge can be applied to new situations. One way to measure this transfer is the concept of learning transfer (LT). Learning transfer can be defined as the impact of improvement in one mental function on the efficiency of other functions (Thorndike and Woodworth 1901) or more simply, as the process by which past experiences affect learning and performance in a new situation (Ellis 1965). Furthermore, the extent to which newly acquired knowledge can be transferred to novel contexts depends on the characteristics of the learning process that produced that knowledge. It has been demonstrated, for example, that the teaching method can profoundly influence the balance of efficiency and innovativeness in transfer (Schwartz et al. 2005). In connection with learning to use IT, Choi et al. (2007) and Ho and Kuo (2010) find a positive relationship between flow experience and learning outcomes (LO), a construct close to learning transfer.

Conventionally, IT use has been measured by the amount of time spent, or the frequency or number of tasks accomplished (Sun and Zhang 2005). Neither measure is without concern, as neither may reflect users’ active roles in using technology. The IT use construct is seen as simply assuming that more use will produce more benefits, without considering the nature of this use. In order to measure the nature of IT use, the constructs of adaptive system use (ASU) and information system infusion (IS infusion) have been presented respectively by Sun (2012) and by Fadel (2012). Sun observes ASU at the application feature level and defines it as the “user’s revisions regarding what and how features are used” (p. 455). Fadel, in turn, defines IS infusion as “the degree to which the
system is used deeply, or to its fullest extent, for improving organizational or individual performance” (p. 1). Furthermore, according to Gray and Meister (2004), cognitive adaptation involves changes in the underlying structures of understanding. In this dissertation, these three approaches together create the basis for understanding adaptive IT use. Hence, adaptive IT use is here seen as the users’ revision of what and how system features are used, or how deeply the system is used. Both of these also involve changes in the underlying structures of understanding. Adaptive IT use and the earlier presented construct of learning transfer are needed in order to adapt IT skills learned in one context for use in new contexts. Adaptive IT use is also regarded as a change from automatic or habitual thinking to more active thinking when using information systems repeatedly. In other words, it is a cognitive adaptation.

Only a few studies have been published on adaptive IT use and its antecedents (e.g., Choi et al. 2007; Elie-Dit-Cosaque and Straub 2011; Ho and Kuo 2010; Sun 2012). Hence, there still is the gap between IT use research and the increasingly adaptive actual use, although eminent IS researchers have drawn attention to it for some time now. For example, Bembasat and Barki (2007) invite “researchers to broaden their perspective of system use from one that extensively focuses on a narrow ‘amount’ view of users’ direct interaction with systems to one that also includes users’ adaptation, learning, and reinvention behaviors around a system” (p. 215). Consequently, more attention should be paid to studying the characteristics of the learning process that enable successful learning transfer which, in turn, results in adaptive IT use.

In this dissertation, I will focus on how to overcome these challenges in learning to use IT adaptively. First, the dissertation provides new insights into the role of computer-related anxiety in learning to use IT. Second, it highlights the reasons for changes in attitudes during the IT learning process. Third, it offers one explanation or path for successful learning transfer for adaptive IT use, that is, user beliefs (motivation) ->flow experience -> successful learning transfer. Finally, this dissertation develops a theoretical framework for the IT Learning Process (ITLP) in the IT training context.

The dissertation consists of this introductory part and four original research papers that examine the topic – learning to use IT in the context of office applications – from a multitude of perspectives. Paper 1 examines the role of anxiety, Paper 2 scrutinizes the changes in attitudes, and Papers 3 and 4 concentrate on studying how flow experience operates in learning transfer. The rest of this introductory chapter presents the objectives and research questions of this dissertation (Section 1.2), discusses the key concepts (Section 1.3) and presents the research context (Section 1.4). Finally, the structure of the dissertation is presented in Section 1.5.
1.2 Objectives and research questions

This dissertation studies the learning process in the IT training context. The overall goal is to model how training influences different outcomes of learning: changes in IT beliefs and attitudes, IT-related anxiety, and the ability to apply the learned IT skills in novel situations (learning transfer). In particular, I seek to identify characteristics of the training process that can be combined to produce higher-quality learning experiences, that is, flow experiences, which, in turn, increase learning transfer.

The goals of this dissertation can be stated in the form of the following research questions:

RQ1: How does IT training influence IT anxiety, IT beliefs, and attitudes?
RQ2: How does IT training-related flow experience influence learning transfer?
RQ3: What are the antecedents of IT training-related flow experience?

These research questions are answered by the four papers as follows: Papers 1 and 2 address the first research question. Paper 3 accounts for the second research question. Finally, the last research question is dealt with in the findings of Paper 4.

1.3 Key concepts: Learning and training

The key concepts of this dissertation are learning and training. Learning can be approached by different learning theories and philosophies. The number of these theories, philosophies and teaching methods has increased dramatically in recent years. In this dissertation, learning means a change in behavior or understanding, and it is a process. To recognize how and why changes in behavior and understanding happen, cognitive learning theory, social learning (Bandura 1971) and experiential learning (Kolb 1984) are applied in this dissertation. These theories are briefly presented later in Chapter 2: Development of the theoretical framework.

In general, training can be seen as the acquisition of knowledge, skills, and competencies as a result of the teaching of practical skills and knowledge that relate to specific useful competencies. In addition, training has the specific goal of improving one’s capabilities, capacities, and performance. Continued training beyond initial qualifications is needed to maintain, upgrade and update skills throughout one’s studies and working life. Merriam Webster (http://www.merriam-webster.com/dictionary/training) defines training as “a process by which someone is taught the skills that are needed for an art, profession, or job”. In this dissertation, training is defined as a combination of both definitions; during training both the trainer and the trainees learn. Students observe when the teacher is demonstrating and they also observe how
their peers are working. IS application skills are achieved in this type of interaction between learning and training.

1.4 Research context: Training to use office applications

The context of this thesis is a learning environment where participants practice the use of office applications. The participants were mainly first year students at the Aalto University School of Business (BIZ) (earlier Helsinki School of Economics (HSE)).

The contexts for the data collection in this research are the Computer Driving License examination (CDL) and the Fundamentals of Personal Computing (FPC). CDL is one attempt to improve and standardize user training for office applications in Finland. The CDL examination was developed by Tieke, the Finnish Information Society Development Centre, and launched in 1994. The aim of the A level examination in CDL is to measure the computing skills needed in working life, including the most important areas of ICT skills. A person who has concluded the A level is able to independently use a microcomputer, operate competently with selected software and recognize different application fields of ICT, and is familiar with the basic concepts of information technology. Originally, the examination consisted of seven modules: Operating System and Data Management, Word Processing, Internet and e-mail, Spreadsheets, Databases, Presentation Graphics, and Basic Concepts of IT. The last module is a theory test that can be taken as a hands-on test or as a written test. The other modules are hands-on skill tests.

CDL is a nationwide examination that over 270,000 citizens in Finland have taken. The European Computer Driving License (ECDL), which is in use in 150 countries and which over 13 million individuals have already taken, is based on this Finnish innovation. The A level CDL examination was in use at HSE in 1998-2005. The course was voluntary. However, students who wanted to gain hands-on experience with office applications and/or to receive a certificate of their computing skills for job applications participated actively in these classes.

The FPC course, in turn, was aimed at increasing students’ computing skills on an academic level, at HSE. The FPC course was developed as a result of student surveys and personnel interviews conducted in 2003-2005. The freshmen were asked to evaluate their computing skills, how they had gained their skills, how they could help others, and what kind of expectations they had for the training at HSE. The faculty of HSE were asked about their expectations

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1 The Computer Driving License is a standardized, widely used examination developed by Tieke (www.tieke.fi) for providing basic computing skills. It is a hands-on test including the most common software such as word processing, spreadsheet, graphics, databases, and operating systems.

2 The Fundamentals of Personal Computing is a tailored ICT course for the business students at the Aalto University School of Business (BIZ), previously Helsinki School of Economics (HSE).
of the students’ computing skills. Based on this information a new course, FPC, was tailored for the needs of the university and the students.

The FPC course was put into operation in fall 2005 along with the reform of the degree structure at HSE. The new degree structure was based on the European Bologna Process (Keeling 2006). The course was compulsory for all Bachelor level students, and it introduced ICT tools that would be necessary in their studies and later at work: spreadsheets (MS Excel), word processing (MS Word), presentation graphics (MS PowerPoint), information search (Journals database in the university library), and reference management (RefWorks). The course focused on the advanced features of these tools and their utilization in studies and at work. Even though it was possible to pass the course through a proficiency test, the majority (75%) of the students took part in the voluntary contact teaching lessons. The FPC course received an honorable mention at the national level from the Association of the Masters and Bachelors of Economic Sciences in 2011.

The CDL examination and the FPC course were used for data collection in this dissertation. In Paper 1, “The Role of Training in Decreasing Anxiety among Experienced Computer Users”, the respondents were students attending CDL courses in 2004-2005. For the longitudinal study the data was collected by means of two sets of questionnaires upon completion of the first and last laboratory sessions. Having a longitudinal set of data made it possible to investigate the potential changes at the level of the key constructs. In Papers 2-4, in turn, the sample consisted of the students who attended FPC courses in 2006, 2010, and 2012. Paper 2, “Changes in User Beliefs and Attitudes during the Learning Process of Office Applications”, also presents a longitudinal study in which the data was collected by means of three sets of questionnaires upon completion of the first, middle, and last laboratory sessions in fall 2006. The main idea was to examine the changes in the key constructs during the learning process and to try to understand what the driving force behind these changes was. Paper 3, “Flow Experiences in Learning to Use a Spreadsheet Application”, explored the participants’ flow experiences and their impact on learning transfer. Finally, in Paper 4, “Learning to Use IT Adaptively: Flow Experience Increases Transfer of Learning”, the relationship between flow experience and user beliefs, as well as their impact on learning transfer, was re-examined.

The timeline of this dissertation is quite long. The data collection started in 2004, and the latest data collection took place in fall 2012. The participants’ computer experience increased from 7.5 years (in 2004) to 9 years (in 2006). In the study in fall 2010, computer experience was asked in terms of school grades, instead of years. The participants were “digital natives”, in other words, users who have grown up in a digital world with electronic gadgets. However, it was not only computer experience that accumulated during this time period, but
also the number of software versions available. All interfaces taught were graphical. Operating systems changed from Windows 97, through Windows Vista to Windows 7, and the MS Office from version 97 through versions 2003 and 2007 to version 2010.

1.5 Structure of the dissertation

Following this introductory chapter, the theoretical framework and empirical work that comprise this dissertation are presented. In Chapter 2, the key constructs are defined and the theoretical framework is developed. Chapter 3 presents the methodological approaches of the study and Chapter 4 reviews the results by papers. I conclude the introductory part of the dissertation with discussion and present the theoretical contributions and practical implications in Chapter 5. The limitations of this study are also discussed and suggestions for further research are given.

The second part of this dissertation consists of four papers. The positioning of each individual paper within the dissertation is described in Appendix A.
2. Development of the theoretical framework

As stated earlier, the overall goal is to *model how training influences different outcomes of learning: namely, changes in IT beliefs and attitudes, IT-related anxiety, and the ability to apply the learned IT skills in novel situations (learning transfer)*. In order to reach this goal, a theoretical framework that builds on the relationships between training, IT use measured as intention to use (INT), learning transfer (LT), and different user-related factors such as anxiety (ANX), attitudes (ATT) and flow experience (FE) will be developed.

First, four approaches to learning, and their ability to explain how learned knowledge and skills will be used, are discussed. Second, the training-related and learning-related dependent variables in the IS literature are reviewed. Third, the user-related factors appearing in IS studies and their relation to training are reviewed and the most robust constructs are accepted for the theoretical framework. Finally, a theoretical framework for the IT Learning Process (ITLP) is proposed by integrating these main streams of IT learning-related studies.

2.1 Learning and different abilities

Theories approach learning from different points of view. This dissertation briefly discusses four learning theories, that is, behavioristic, social, cognitive and experiential learning theories. The behavioristic approach to psychology, originating from Pavlov (1849-1936) and Watson (1878-1958), is based on the suggestion that behavior can be researched scientifically without referring to inner mental states. Behavioristic Learning Theory holds visible changes in behavior as a sign of the learning process. Bandura’s Social Learning Theory (1971), in turn, emphasizes the importance of interaction, observation and modeling in a social context. Cognitive Learning Theory, based on gestalt psychology, tries to explain why the human brain has the most incredible ability to process and interpret information holistically when learning things. It highlights the importance of internal mental processes and internal cognitive
Development of the theoretical framework

As stated earlier, central to learning is that it is a process changing behavior or understanding (Kolb 1984, p. 38). Säljö (1979) categorizes the depth of the changes (1 = most lightweight, 5 = deepest) as follows:

1. Learning is a quantitative increase in knowledge, that is, learning is acquiring new information and knowledge.
2. Learning is storing information that can be reproduced.
3. Learning is acquiring facts, skills, and methods that can be retained and used when needed.
4. Learning is making sense or abstracting meaning.
5. Learning is understanding reality in a different way.

In Säljö’s categorization, the first three measure the ability to reproduce new knowledge and to repeat the learned skills and methods when needed. These three categories may be seen as representing the behavioristic approach to learning (Thorndike and Woodworth 1901) that emphasizes visible changes in behavior, stimuli in the external environment and behavioral objectives used in training to increase learners’ competence and skills (Merriam et al. 2006). Learning is simply seen as acquiring skills and methods that can be retained and used as necessary. Conventionally, in the IT training context, learning has been measured as the frequency of use or the use of different application features, that is, measuring the ability to use a particular application in a simple way.

According to Bandura’s Social Learning Theory (1971), learning is seen as social. Behavioral response patterns can be created through observational learning, where observation of a model’s behavior enables the observer to reproduce or ‘model’ it (Bandura 1969; Bandura 1971). Learning involves the relationship between trainers, trainees and the environment. In classroom settings, the students are taught practical skills by demonstrating or showing them how to use computer applications. After that they practice using these applications over and over again to become more skilled in computing. Thus, the social learning approach also seems to represent the first three categories and especially emphasizes the third category, that is, the acquisition of skills and methods that can be retained and used when needed.

Another way to examine the depth of learning is to apply the concept of learning transfer. The depth of changes in behavior and transfer are key issues of learning, because they determine how well the newly learned skills or knowledge can be used in the future. At a low level of transfer, information is recalled more easily in a situation that is similar to the learning context (Godden and Baddeley 1975). The extent of the learning transfer concept has expanded from the classic definition of “the degree to which a behavior will be repeated in
Development of the theoretical framework

a new situation” (Detterman and Sternberg 1993, p.4) to include flexible adaptation of old responses to new settings and preparation for future learning (Bransford and Schwarz 1999). Current definitions (Bransford and Schwarz 1999; Byrnes 1995) of the concept agree that learning transfer is the ability to extend what has been learned in one context to new contexts.

As stated above, the depth of learning transfer can vary. Gray and Meister (2004) categorize this depth into three levels as follows (from the lowest to the highest): cognitive replication, adaptation, and innovation. Replication refers to efficiency; one can reapply what has been learned in one context to new contexts. Adaptation, in turn, involves changes in the underlying structures of understanding. Innovation is a radical change in the use of applications. The higher the number of features available in IT applications and the more varied its potential use situations are, the more critical is efficient learning transfer to the successful use of IT.

In Säljö’s categorization, learning transfer at the level of cognitive adaption may be seen as belonging to depth categories four and five; that is, learning is both making sense or abstracting meaning, and understanding reality in a different way. In these two depth categories, the learning process is seen as an internal, mental process. Furthermore, the principle of learning is internal, cognitive structuring. These features are very similar to those of cognitive learning theory (Merriam et al. 2006). In general, the cognitive orientation to learning assumes that a human’s memory system is an active organized processor of information and that prior knowledge plays an important role in learning. Kolb’s experiential learning also emphasizes the importance of prior knowledge and changes in behavior (Kolb 1984).

By measuring learning as the result of internal, cognitive structuring and transformation of experience, it might be possible to measure the ability to adapt, not only to repeat, similar to the behavioristic and social learning approach. As the results of learning and the learning process cannot be measured in one way only, the following figure illustrates this phenomenon.
Development of the theoretical framework

Figure 1. A synthesis of the approaches to learning and the depth of changes in behavior, and their outcomes of learning

Figure 1 summarizes the four learning theories and Säljö’s categorization of depth of changes in behavior, and outcomes of learning. Outcomes of learning can be quantitative, that is, they can measure the ability to store and repeat learned knowledge and skills. These skills and knowledge are mainly based on the behavioristic and social learning approaches to learning. On the other hand, the learning outcomes can be more advanced/adaptive or qualitative, that is, they can measure the ability to adapt the learned knowledge and skills in new contexts. Innovative uses may also appear in successful situations. Qualitative outcomes are based mainly on the cognitive or experiential approaches to learning.

However, a precise demarcation between quantitative and qualitative is not relevant, as both outcomes include much repetition and use of acquired skills (see the figure above). In addition, innovative uses may often occur later, after more experience is gained.

2.2 Measuring the dependent variables intention and learning transfer

In this section, I will review the literature on IT learning and training. As the dependent variables explain the phenomenon under investigation, I will first focus on them. The prior IT learning and training literature identifies three main approaches (the intention, actual use, and feature-centric approaches) that can be employed to measure not only technology adoption and use, but also the impact of training. After presenting some critique on the above metrics, I
will present an alternative approach for research design in the IT training context.

Volitional behavior has conventionally been predicted by intention (Fishbein and Ajzen 1975). Davis and his colleagues (1989) also found in their Technology Acceptance Model (TAM) that behavioral intention to use a system correlates significantly with IT use. This phenomenon has since been commonly postulated in many technology adoption-related studies, and thus the focus has often been on behavioral intention to use a system rather than its actual use. As stated earlier, the IT use construct is often understood to simply assume that more use will produce more benefits, without considering the nature of this use. One issue that is omitted here is the implications of self-reported system-usage measures and computer-recorded measures. These implications will be discussed in Chapter 5.

The third way to measure IT use is the feature-centric approach. For example, Srinivasan (1985) suggested two constructs for measuring IT use. First, he suggested more detailed features for perceived effectiveness (that is, user satisfaction) measures, such as report contents, report format, problem solving capabilities, and system stability. His second construct comprised behavioral measures, including frequency of use, time spent per session, the number of reports, and user type. Further feature-centric definitions and models of IT use have since been developed (e.g., Jasperson et al. 2005). Burton-Jones and Straub (2006, p.231), in turn, defined IT use as “an individual user’s employment of one or more features of a system to perform a task”. Barki et al (2007) proposed adding use-related activities, such as how users learn to use new software features, to the IT use concept. Although these feature-centric approaches have enriched the understanding of technology use, DeSanctis and Poole (1994, p.124) draw attention to the “repeating decomposition problem: there are features within features (e.g., options within software options) and contingencies within contingencies (e.g., tasks within tasks). So how far must the analysis go to bring consistent, meaningful results?”.

The frequency with which an individual uses a certain feature of IT for a particular purpose is losing its ability to accurately characterize behavior, considering that multipurpose IT serves varying ends of everyday life. Rather, the ability to adapt the technology to these ends as they emerge should be seen as the goal of IT training.

One attempt towards multipurpose use of IT is adaptive IT use (AITU). Adaptive IT use is an innovative behavior that can be either planned or unplanned. According to Janssen (2000, p.4), it can “be achieved in a variety of ways, including both preplanning and improvisation [unplanned innovation]”. Sun (2007, p. 40) defines adaptive IT use as “users’ appropriation behavior toward modifying the technology’s feature set, as well as the spirit of the feature
set, in an adaptive manner, to cope with individual needs and technological or organizational environments”. An “adaptive manner” means, for example, that an individual decreases the feature set by ceasing to use certain features and expands the feature set by experimenting with new features. For instance, the LOOKUP function may be used instead of the IF function in spreadsheet applications. Furthermore, users can combine or recombine the feature set of an application. An example of combining features in the spreadsheet context could be nested IF. In the AITU model by Sun (2007) it was originally assumed that personal innovativeness in IT, computer playfulness, triggers, computer self-efficacy, and facilitating conditions all affected AITU. After testing the AITU model it was found that only triggers (unexpected events, in this case discrepancies) and facilitating conditions affected AITU. However, the model is one step towards measuring IT use more dynamically, in contrast to the earlier presented static measures such as the amount of time, the frequency of use or the number of used features.

Later, Sun (2012) clarified the concept of adaptive IT use at the feature level by defining the constructs adaptive system use (ASU), features in use (FIU), and triggers. He defines FIU “as the basket of system features that are ready to be used by a particular user to accomplish a task” (p. 455). A person’s FIU is always in a state of flux. Furthermore, Sun (2012, p. 455) defines ASU “as the user’s revision regarding what and how features are used”; that is, ASU describes how people revise their use of IS at the feature level. ASU is claimed to have two dimensions (Sun 2012, p. 456): “revising the content of features in use and revising the spirit of features in use”. Revising the content of use means in practice trying out new features or substituting features. Revising the spirit of features in use, in turn, means combining features or repurposing features. Finally, Sun (2012) identified three types of triggers for ASU: novel situations, discrepancies, and deliberate initiatives. In summary, the most important constructs directly affecting ASU are discrepancies, facilitating conditions, novel situations, and personal innovativeness in IT.

In addition to the studies by Sun (2007, 2012), a few studies have focused on adaptive IT use and its antecedents (e.g., Choi et al. 2007; Elie-Dit-Cosaque and Straub 2011; Fadel 2012; Ho and Kuo 2010). While previous studies on adaptive use focused on strategies, this dissertation tries to predict adaptive IT use by the characteristics of the learning process that produces the needed knowledge.

Intention-based models and theories have also been used in the training/learning context (Hu et al. 2003), despite being too restricted to realistically measure the results of learning. In this research on learning to use office applications, the intention to use is not the most appropriate construct in its original meaning, as the efficient use of new multi-purpose technology calls for the ability to adapt it to new situations and needs. In addition, users cannot
choose whether they use a particular technology or not. Intention-based theories such as TRA (Fishbein, Ajzen 1975), TAM (Davis et al. 1989), Social Cognitive Theory (1977; Bandura 1982) and their adaptations (see Compeau and Higgins 1999; Compeau and Higgins 1995a; Compeau and Higgins 1995b) suggest intention, actual use or performance as the dependent variable. However, the dependent variable learning transfer is more dynamic in nature. This more dynamic construct attempts to measure how individuals use systems, rather than how much they use them, the frequency of use, and the features used.

The concept of learning transfer has been applied in the IT context to explain human-computer interaction for more than four decades. Domain-focused cognitive models have been used to explain how users learn and perform while interacting with IT (e.g., Card and Moran 1980; Olson and Olson 1990; Payne and Green 1986; Polson 1987; Schrott and Horrel 2000). Initially, the focus was on how knowledge is transferred from one application, such as a text editor (Singley and Anderson 1985; Singley and Anderson 1987-1988), to another application within the same application category, such as a word processing application.

IS transfer research would benefit from adopting a more contemporary, wider perspective on transfer, such as the conceptualization of learning transfer by Gray and Meister (see Section 2.1) or learning outcomes (LO) as the authors call it. In this dissertation, the constructs learning transfer and learning outcomes are used as synonyms.

Learning transfer can take place in the spreadsheet context of this research in many ways. A typical example of cognitive replication could involve the formula-creation skills required in spreadsheet applications. Cognitive adaptation, in turn, “refers to the extent to which an individual is able to change in the underlying structures of understanding in response to new developments” (Ho and Kuo 2010, p.25). In the spreadsheet use context, this refers to a deeper understanding of how to use a spreadsheet application’s feature set in a different way or for new purposes. One example of this could be trying out new features instead of familiar features or, as Sun (2012, p.456) defines it, “add[ing] new features to one’s FIU and thus expanding the scope of the FIU”. Furthermore, “innovation refers to the extent to which an individual is able to perform radical changes in knowledge use” (Ho and Kuo 2010). In the spreadsheet context, an example of innovative use could be to concatenate and combine different features for new purposes or, as Sun (2012, p.456) defines it, “using features in FIU together for the first time or using features of FIU in a new way”.

It seems that two steps, replication and adaptation (in this order) should be experienced and repeated many times before innovation can occur. In other
words, offering a diverse range of replication and adaptation assignments creates a good basis for innovative use later. Innovation and creative use in general take place after long experience with particular software.

Figure 2 illustrates the dependent variables of the framework: the conventional IT use construct and a newer learning transfer construct. IT use is measured as intention. Learning transfer has three dimensions: cognitive replication, cognitive adaptation and cognitive innovation.

![Diagram](image)

**Figure 2. Dependent variables: IT use (intention) and learning transfer**

The dashed lines in the above figure indicate that IT use is measured by intention, not by frequency of use, or used features, or adaptive IT use. Intention has been chosen because it has been the most frequently used in the prior literature.

In this IT learning context, trainees continually replicate the basic spreadsheet features, such as creating formulas, referring in formulas, copying and moving formulas and data, and visualizing data by creating graphs. Adaptation sometimes takes place, but innovation may not happen at all during the training course. It is expected that learning transfer will occur during and after the course, and that users will continue to replicate, adapt, and later maybe innovate with the help of the new skills learned.

In summary, the conventional intention construct is used to measure the future frequency and how well a behavior can be repeated. The learning transfer construct attempts to measure how well the learned skills can be repeated and adapted to novel situations, which may later result in innovative use. All-in-all, this phenomenon means a paradigm shift to adaptive IT use.

The other constructs of the theoretical framework and their relationships are presented in the following sub-sections.

### 2.3 User-related factors in developing the theoretical framework

The roots for developing the theoretical framework of this research lie in several theories focused on task value and the expectation of success (the Technology Acceptance Model (TAM), the Theory of Reasoned Action (TRA),
the Expectation Disconfirmation Theory (EDT), the Two stage model of cognition change (TSMCC), the Flow Theory (FT), the Learning transfer theory (LTT), and the Self-determination theory (SDT). In addition, the learning theories – cognitive learning theory, experiential learning theory (Kolb 1984) and social learning theory (Bandura 1971) – are constantly present.

Next, a theoretical framework for the learning process in the IT training context will be developed. It builds on the combination of relations between training and the key constructs of computer anxiety, attitudes, flow experience, IT use, and learning transfer.

Learning theories and the abilities they provide were discussed in Section 2.1. However, the measurement of learning cannot be considered as a straightforward process. Instead, the context determines what type of learning should take place and how it should happen. While one theory may be appropriate in one situation, it can be worthless, or even harmful, in another situation. In other words, in learning to use computer applications, the focus can be different in different learning situations. Sometimes it can be meaningful to try to decrease computer-related anxiety. From time to time, the simple giving of information may be enough to change learners’ attitudes. Last but not least, the focus can be on trying to support applied learning, in particular. These issues are discussed in the following sub-sections.

2.3.1 Relation of training and computer anxiety

In this sub-section, the literature related to a key construct, computer anxiety, is reviewed and the first part of the Information Technology Learning Process (ITLP) framework of this research is created.

Computer anxiety can be defined in terms of a psychological response, such as a phobia, or as a cognitive reaction, that is, an apprehension concerning the use of computers (Jancour et al. 1994). In this dissertation, computer anxiety is defined on the basis of the latter definition, meaning that people feel uncertainty and discomfort when working with computer applications.

The impacts of computer anxiety on learning and the diversity of user perceptions will also be shown. First, computer anxiety may have a negative impact on learning (Saade and Kira 2009). Second, several technology adoption-related studies have demonstrated that anxiety or computer anxiety is an important predictor of the use of information technology (Czaja et al. 2006; Igbaria 1993; Tung and Chang 2007).

Third, it has been shown that computer anxiety has a negative relationship with numerous important technology use-related constructs such as self-efficacy (SE), perceived ease of use (PEOU), and perceived usefulness (PU).

Self-efficacy has been defined as “people’s judgments of their capabilities to organize and execute courses of action required to attain designated types of
performances” (Bandura 1986, p.391). Self-efficacy is concerned not with the skills one has, but with the judgments of what one can do with whatever skills one possesses (Bandura 1986). Thus, self-efficacy is simply the person’s confidence to perform a particular task. Compeau and Higgins (1995a, p.192) define self-efficacy in the context of computer use as follows: “computer self-efficacy refers to a judgment of one’s capability to use a computer”. The authors point out that computer self-efficacy is not concerned with what one has done in the past, but more with judgments of what could be done in the future. In addition, computer self-efficacy is seen as holistic; that is, it is the ability to apply computer skills to broader tasks, rather than separate, simple tasks. Several researchers argue that computer anxiety and computer self-efficacy are negatively related (Bandura 1977; Chang 2005; Compeau and Higgins 1995a; Fagan et al. 2003; Henderson et al. 1995; Igbaria and Livari 1995).

Many studies have stated that there is a strong negative interdependence between computer anxiety and two salient beliefs – perceived ease of use (PEOU) and perceived usefulness (PU). PEOU and PU are the key constructs of the technology acceptance model (TAM) developed by Davis and his research group (Davis 1989; Davis et al. 1989). These constructs, in turn, have an impact on the intention to use new information technologies. PEOU has been defined as “the degree to which a person believes that using a particular system would be free of effort” (Davis 1989, p.320). PU, in turn, 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). However, PEOU’s impact on intention is expected to decrease when experience increases (Davis et al. 1989). Computer anxiety has been found to be an antecedent of PEOU (Chee Wei et al. 2006; Venkatesh 2000). In addition, there is a strong negative interdependence between anxiety and PU (Igbaria 1993).

In summary, it is important to decrease the level of computer anxiety, because it has a direct, negative influence on learning and IT use. In addition, computer anxiety impacts IT use indirectly through essential technology adoption constructs. Furthermore, it has been shown that, in addition to increasing computer experience (Chang and Wang 2008; Igbaria 1993) and computer knowledge (Kay 2008), training decreases anxiety (Beckers et al. 2006; Igbaria 1990; Martocchio 1994; Popedavis and Vispoel 1993; Shelley 1998; Torkzadeh and Angulo 1992; Torkzadeh and Koufteros 1993). Thus, the relationship between training and computer anxiety is added to the theoretical framework.
2.3.2 Relation of training and attitudes

This section discusses three background theories used in this research, that is, the Theory of Reasoned Action (TRA), the Expectation-Disconfirmation Theory (EDT), and the Two-Stage Model of Cognition Change (TSMCC). In addition, it describes briefly the related constructs – attitudes, satisfaction, and disconfirmation. Based on these theories, the second part of the framework of this research will be created.

In the theoretical framework of this dissertation, the most important basic assumption is that attitude is the major determinant of intention and behavior (Ajzen and Fishbein 1980, p. 62). Attitudes, in turn, are determined by beliefs (Ajzen and Fishbein 1980, p. 62); that is, attitudes can be characterized as an overall evaluation of the object. Thus, the attitudes influencing behavior may be, for example, the common feelings of how favorable or unfavorable an act will be. A multitude of studies have indicated that the attitudes influencing behavior are key determinants of the intention to use any information technology (Harris 1999; Igarria 1990; Igarria 1993; Lin and Bhattacherjee 2010; Ping and Heshan 2009).

The expectation-disconfirmation theory (EDT) that Oliver (1980) developed in a non-commercial context has subsequently been widely used as an aid in understanding consumer satisfaction, repurchase intentions, loyalty, and irrational behaviors mainly in the marketing context (see e.g., Oliver 1993). Before describing the basic idea of EDT, the key constructs – expectations, disconfirmation, and satisfaction – will be defined.

**Expectations**

Expectations are defined in the literature as follows: when consumers consider buying a product, they use earlier purchasing experiences or external information to form internal principles of comparison, which they then use in forming their expectations (Hu et al. 2003; Oliver 1980). Hence, in the teaching context, student expectations of possible enrollment in a training course are based on prior experience of other students and/or external information such as a syllabus. Thus, they build internal structures of comparison and use them in forming their expectations.
**Disconfirmation**
Disconfirmation is defined as users’ subjective judgments resulting from their comparisons between expectations and experiences. This definition is based on the concept of expectation congruency proposed by Spreng et al. (1984). Disconfirmation arises when user evaluations of product performance are different from their expectations of the product (Hu et al. 2003). In the IT training context, disconfirmation may arise when users’ experience of the usefulness of participating in a course fails to live up to their expectations.

**Satisfaction**
The satisfaction construct is widely used in adoption studies. It can be defined as targeting particular properties such as information quality or system quality. On the other hand, satisfaction can also be defined as overall satisfaction, that is, as an affective state or emotional reaction to experience (Kolb 1984; Oliver 1980). Thus it may represent an emotional reaction to the use of the entire application.

Initial expectations and disconfirmations together determine the satisfaction or dissatisfaction with the product. Based on this co-impact, users will decide whether to continue or discontinue the product usage (Oliver 1980). Although satisfaction is a broadly used construct in adoption studies and especially in continued adoption studies, it has been omitted from this framework, because general satisfaction is seen as an attitude.

**Expectation-disconfirmation theory**
The basic idea of the EDT model is that an individual has expectations before a purchase decision that influence his or her attitudes, which, in turn, influence the purchase intention. After purchase, there is a disconfirmation period. Oliver (1980) tested the relationships between expectation, disconfirmation, and the conventional criteria of attitude, satisfaction, and purchase intention in his study. However, the relationship between expectation and disconfirmation is complex (see Bhattacherjee and Premkumar 2004; Yi 1990), and the disconfirmation can be negative or positive.

The general opinion is that these two constructs are negatively related, as it is more likely that high expectations will be negatively disconfirmed and low expectations will be positively disconfirmed (see Bhattacherjee and Premkumar 2004; Yi 1990). The initial expectation and disconfirmation together determine the satisfaction or dissatisfaction with the product. Based on the previous co-impact, users will determine whether to continue product usage or not. Oliver (1980) also included attitudes, which are the most direct antecedent of behavioral intention (Fishbein and Ajzen 1975), in his EDT model. One
Development of the theoretical framework

adaptation from Oliver's EDT theory (1980) is the two stage model of cognition change (Bhattacherjee and Premkumar 2004).

Many IS studies have shown that training impacts user attitudes (Igbaria 1990; Igbaria 1993). However, training is not without challenges either, as user beliefs (Davis 1986; Davis 1989; Davis et al. 1989) and attitudes (Harris 1999; Igbaria 1990; Igbaria 1993; Igbaria and Chakrabarti 1990; Lin and Bhattacherjee 2010; Ping and Heshan 2009) may change over time (Bhattacherjee and Premkumar 2004; Szajna and Scamell 1993). In the long run, when expectations become more realistic, very positive attitudes or expectations decrease and negative attitudes increase. Nevertheless, positive attitudes stay at a higher level than negative or moderate attitudes (Szajna and Scamell 1993).

Although many theories and constructs have been carefully filtered in this section, only attitudes and the EDT construct ‘disconfirmation’ have been chosen for the theoretical framework of this research. This is because this part of the framework examines the impact of new knowledge and experience during the learning process. Students have expectations before they attend a course. During the course, their expectations are proved true or false and (dis)confirmation takes place. (Dis)confirmation, in turn, impacts attitudes and represents continuance. The other EDT construct ‘satisfaction’ is discarded, because it is very similar to the construct ‘attitudes’.

As the attitude construct includes important and holistic features impacting behavior and the disconfirmation construct seems to have an impact on it, they have been included in the framework of this study. As stated earlier, it has been demonstrated that training impacts user attitudes (e.g., Igbaria 1990; Igbaria 1993) and that attitudes may change over time, for example, during the learning process (see Bhattacherjee and Premkumar 2004; Szajna and Scamell 1993). Thus, the relationship between training and attitudes is justifiable. (Dis)confirmation, in turn, takes place between training and attitudes, because observations are made over time (Bhattacherjee and Premkumar 2004). Figure 4 illustrates this relation between training, (dis)confirmation, and attitudes and builds the second part of the ITLP framework.

Figure 4. Relation of training, disconfirmation, and attitudes
2.3.3 Relation of training and flow experience

The two previous sections deliberated the impact of new knowledge on computer anxiety and attitudes. In this section, the main topic is the quality of the learning process. Learning has been a common context for flow research (Csikszentmihalyi and Schiefele 1993; Rathunde and Csikszentmihalyi 1993; Schmidt et al. 2010; Shernoff et al. 2003). Although it has been shown that flow experience increases learning, only a few studies (e.g., Ghani and Deshpande 1994; Pilke 2004) have been conducted in the context of learning to use common applications such as spreadsheets. By studying flow, it is possible to study the quality of the learning process.

A theoretical model of the flow experience was first presented in 1975 by Csikszentmihalyi. According to this model, flow describes a state of complete immersion or engagement in an activity. Later, the flow experience was described comprehensively in many of Csikszentmihalyi’s articles and other writings. The basic idea in flow theory is that feelings vary from boredom to anxiety, and that flow depends on the balance between skills and challenges. A flow experience is possible when both skills and challenges are at a high level at the same time. Csikszentmihalyi (1990) also argues that an optimal experience of flow is something we make happen. In addition, “this feeling often involves painful, risky, or difficult efforts that stretch a person’s capacity, as well as an element of novelty and discovery” (Csikszentmihalyi 1997, p.9). Csikszentmihalyi (1996, 1997) has identified nine key elements of optimal experience as follows:

1. There are clear goals for every step of the way*.
2. There is immediate feedback on one’s actions.
3. There is a balance between skills and challenges*.
4. Action and awareness are merged.
5. Distractions are excluded from consciousness*.
6. There is no worry of failure.
7. Self-consciousness disappears.
8. The sense of time becomes distorted*.
9. The activity becomes an end in itself*.

In this research, five of the above-mentioned elements are adopted (marked by an asterisk on the list). When choosing the specific elements, their fit with the context – learning to use a spreadsheet application in face-to-face classroom settings – was considered. Flow is here defined as a state where one works with total involvement in reaching the goals, where skills and challenges are in balance, where one perceives the task as stimulating and where one is focused to the extent that time distortion occurs. The constructs used to measure the
flow experience are as follows: goals (clear goals every step of the way) measured by school grades, a balance between skills and challenges (Wu and Liang 2011), concentration (distractions are excluded from consciousness) (Ghani and Deshpande 1994), time distortion (the sense of time becomes distorted) (Wu and Liang 2011), and enjoyment (the activity becomes an end in itself) (Ghani and Deshpande 1994).

The majority of flow studies use only a few of the nine elements listed above. Five constructs were chosen in this dissertation because they were the most suitable for measuring the flow state when learning to use office applications. The three constructs that the trainer can directly impact are: setting clear goals, keeping students on the flow-channel by providing suitable, challenging tasks, and giving feedback. Feedback was not measured in this research. In practice, students get immediate feedback when they work on the tasks. The relation between training and the flow state is described in Figure 5.

![Figure 5. Relation of training and flow experience](image)

The constructs marked by italics (the Goal, that is, the clarity of the goal, and the Balance between skills and challenges) are those that can be impacted by the learning arrangements, and where trainees can make a flow experience happen by fully concentrating on the activity, and ultimately by experiencing time distortion and enjoyment.

### 2.4 Proposed IT Learning Process (ITLP) framework

The proposed theoretical framework for this IT Learning Process (ITLP) has been built by combining the previously presented relationships as follows. When participants practice their office application skills, their emotions (computer anxiety) and attitudes are impacted and changed by training. Decreased computer anxiety and those attitudes that are based on belief, expressed here as perceived usefulness, then impact the intention to use IT. In addition, trainers can create favorable conditions for learning and for learning
transfer by setting clear goals for assignments, by ensuring that students’ challenges and skills are in balance, and, last but not least, by giving immediate feedback. These advantageous conditions facilitate the flow experience that, in turn, affects learning transfer. Repetition of this cycle ensures that learning, that is, the acquisition of appropriate IT skills, takes place. After the course, the students will continue to use their acquired skills in other courses and in working life, their computing skills will increase via replication and adaptation, and finally they will be able to innovate.

Figure 6. The proposed ITLP framework

In the proposed ITLP framework, the dependent variables – intention to use and learning transfer – will define the future use of IT as follows. ‘Intention to use’ will not determine how IT is used, but only that IT will be used. How well IT is used will depend, in turn, on learning transfer. A good learning process – involving especially the experiences of flow – will promote successful learning transfer, which, in turn, will impact the quality of IT use. Figure 6 illustrates the proposed relationship between the constructs.

The next chapter describes the methodology of the study.
3. Methodology

This chapter presents the methodological approaches of this dissertation. First, the research approach will be discussed. Second, the research will be positioned within the IS discipline. Third, the data gathering and analysis methods will be presented by papers. Finally, the validity and reliability of the research will be discussed.

According to Babbie (1998, p. 90), the three most common and useful purposes of social research are exploration, description, and explanation. Furthermore, he argues that a study can have more than one of the above-mentioned research purposes. The research included in this dissertation falls mainly into the explanation category, but has descriptive purposes as well. The participants’ opinions on computer anxiety, beliefs, attitudes, perceived flow experiences, and learning transfer were collected using self-administered questionnaire forms. The data, which was mainly longitudinal, was analyzed using statistical techniques. It was collected in classroom settings, that is, in a real context of social life, and hence followed Babbie’s (1998) recommendations.

Several types of theories are included in the descriptive and explanatory categories. Gregor (2006) categorizes theories within the IS discipline into five types: theories for analyzing, theories for explaining, theories for predicting, theories for explaining and predicting, and theories for design and action. Theories for Explaining and Predicting (EP) best characterize the theories used and the models developed in this dissertation. EP theories tell what is, how, why, where, and what will be. They provide predictions and include both testable propositions and causal explanations (Gregor 2006).

The research design, data collection, and data analyses of this research follow the positivist survey research approach described by Babbie (1998) and Pinsonneault and Kraemer (1993).

This approach was chosen as surveys are appropriate for explanatory purposes and are especially appropriate when respondents are individuals (Babbie 1998, p. 256). In addition, Pinsonneault and Kraemer (1993) showed in their review of 122 survey studies that the quality of survey research varied significantly, depending on the research purposes. They found that explanatory studies had good overall quality. Furthermore, survey research can be the best means of
collecting original data for describing a population that is too large to be observed directly (Babbie 1998, p. 256). Finally, Babbie highlights surveys as being appropriate for measuring attitudes in large populations, which is one of the key topics in this dissertation.

### 3.1 Research approach

As stated above, this dissertation follows a positivist survey research approach. The positivist view of the surrounding world is objective. According to Chen and Hirschein (2004), research approaches differ in three aspects: ontological, epistemological, and methodological. **Ontology** addresses the nature of reality, in detail, whether there is an objective reality or not. **Epistemology**, in turn, discusses the relationship between the researcher and reality. Finally, **methodology** outlines how knowledge about the surrounding world can be created. Ontologically, positivists believe that reality is objective and independent of human experiences. Epistemologically, positivists focus on the testability of theories, with both verification and falsification of scientific knowledge being allowed. Methodologically, positivists apply hypothesis-testing research procedures. Hypotheses are drawn from theory and their truthfulness is tested. In addition, positivists use statistical and mathematical analyses.

More specifically, this dissertation is compatible with the characteristics of survey research as identified by Pinsonneault and Kraemer (1993). First, survey research is a quantitative method focusing on relationships between variables and requiring standardized information about the subjects being studied. The researcher defines independent and dependent variables and creates a specific model of the expected relationships, which are tested using collected observations of the phenomenon. Furthermore, survey methodology focuses on finding relationships that are common across data samples and aims to provide generalizable statements concerning the object of study. Second, the primary mode of the data collection is completed by asking participants structured and predefined questions, which define the unit of analysis and the data to be analyzed. Finally, the data gathered is a limited sample, but large enough to allow robust statistical analysis.

The above-mentioned principles are followed in this research. The data gathering and analysis methods are presented in detail in Section 3.3.

### 3.2 Positioning within the IS discipline

In the information systems discipline, studies can be classified according to how the interaction of individuals and their collectivities with the IT artifact take
place. Hence, IS research can be classified into five categories as follows (Sidorova et al. 2008):

1. IT and individuals
2. IT and groups
3. IT and organizations
4. IT and markets
5. IS development

The first four research themes examine how, and to what extent. The fifth research theme, IS development, examines the IT itself and how it is developed. This dissertation studies the interaction between IT and individuals, that is, how individuals learn to use IT.

Figure 7 provides an overview of the research approaches.

### Overview of research approaches

<table>
<thead>
<tr>
<th>Purpose of research</th>
<th>Explanatory</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Babbie 1998)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Research theme in IS discipline (Gregor 2006)</th>
<th>Theories for explaining and predicting</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Research approach (Babbie 1998; Pinsonneault and Kraemer 1993)</th>
<th>Positivist survey research approach</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Positioning the study within IS discipline (Sidorova et al. 2008)</th>
<th>IT and individuals</th>
</tr>
</thead>
</table>

**Figure 7. Overview of the research approaches**

In summary, the purpose of this research is explanation and it falls mainly under the themes of explaining and predicting. Furthermore, this dissertation follows the positivist survey research approach and examines the interaction between IT and individuals.

### 3.3 Data gathering and analysis methods

Data, mainly longitudinal, was collected through web surveys or paper and pen surveys. In the data analyses, hypotheses based on prior theories were tested using statistical analyses.

The constructs used in the questionnaires were validated by previous research. The questionnaire items were translated from English into Finnish. After that the questionnaires were reviewed by a small group from the IS faculty at Aalto University’s School of Business (BIZ) and modified as a result of their feedback. For revalidation, the questionnaires were tested by a sample of IS PhD students.
The empirical data was gathered through seven different sets of questionnaires from 963 mainly first year students participating in altogether 34 office application courses at BIZ during the years 2004-2012. In the final analyses (4), 421 eligible replies were included. The number of disqualified replies was quite high due to the longitudinal data collection. However, as the purpose of this research was to explain the impact of training, it was essential that it was targeted only at those students who had participated actively in the courses.

Three of the four studies are based on longitudinal data. Data was collected two or three times during each course. After that, a single record was created for each respondent for the purpose of analysis.

Paper 1 uses two data sets, one captured at the beginning of the CDL course and the other collected at the end of the same seven-week course. Paper 2, in turn, is based on longitudinal data collected at three time points during the seven-week FPC course. The focus of these longitudinal studies was to observe changes in the key user-related constructs during the learning process.

Paper 3 is a single survey context studying how flow experience impacts the learning process of a spreadsheet application. Paper 4 is again a longitudinal study re-examining the relationships between behavioral beliefs (=motivation), flow experience, and learning transfer in the IT training context.

A summary of the research methods used in the four papers is presented in Table 1.
Table 1. Summary of the research methods used by the papers

<table>
<thead>
<tr>
<th>Paper</th>
<th>Research method</th>
<th>Research objects</th>
<th>Context</th>
<th>Data collection and analysis</th>
<th>Data/ (time)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Longitudinal study; survey</td>
<td>Students’ opinions about the impact of CDL training</td>
<td>CDL-course, voluntary</td>
<td>Pen and paper survey, Correlation analysis, t-tests using SPSS</td>
<td>Data collection: two times: Sent 243, n=96 (2002-2005)</td>
</tr>
<tr>
<td>2</td>
<td>Longitudinal study; survey</td>
<td>Learners’ perceptions about the changes in attitudes and beliefs during the learning process</td>
<td>FPC-course (MS Excel, Word, PowerPoint, RefWorks), voluntary</td>
<td>Web survey, FacilitatePro, t-tests, SEM using Amos 9.0</td>
<td>Data collection: three times: t=60, t=141, t=159, after matching 99 single records (2006)</td>
</tr>
<tr>
<td>3</td>
<td>Survey</td>
<td>Students’ flow experiences during the learning process</td>
<td>FPC-course (MS Excel 2010), voluntary</td>
<td>Web survey, Webropol,t-tests, SEM using Amos 9.0</td>
<td>Sent 120, n=116 (2010)</td>
</tr>
<tr>
<td>4</td>
<td>Longitudinal study; survey</td>
<td>Re-examination of the relationship between behavioral beliefs, flow experience, and learning transfer</td>
<td>FPC-course (MS Excel 2010), voluntary</td>
<td>Pen and paper survey, SEM using Amos 21.0.0</td>
<td>Data collection: two times: t=90, t=116, after matching 113 single records (2012)</td>
</tr>
</tbody>
</table>

The data gathering and analysis methods are presented by papers in the following sub-sections.

3.3.1 Paper 1. Longitudinal survey (pen and paper) and correlation analysis

The objective of Paper 1 was to provide an overview of the learning process in the IT training context. First, to reach this objective, the longitudinal survey method was chosen. The longitudinal study made it possible to observe changes in key concepts during the learning process. Second, to get a general overview, it is important to offer all participants the possibility to share their perceptions and opinions. Hence, all students that attended the entire course could participate in this survey. Finally, the survey for this paper was conducted in the context of the CDL examination that, as a nationwide standardized examination, made it possible to obtain a more general overview of the impact of IT training.

The empirical data was collected through a paper and pen survey, which consisted of three sections. The first section focused on background information related to the respondents, such as their computer experience and interest in attending the course. The second section measured respondents’ perceptions of
computer anxiety and their technology acceptance characteristics. The TAM-related measurement scales were adapted from the Technology Acceptance Model (Davis et al. 1989) and the anxiety scales from the Computer Anxiety Rating Scale (Heinssen et al. 1987). Some wordings from TAM and the scale constructs were modified for the questionnaire to adapt them for the IT training context. The third section consisted of questions on the intention to apply the acquired skills and use the application in the future. The questionnaire items in the second and third sections were measured using the seven-point Likert scale with 1 anchored at totally agree, and 7 anchored at totally disagree. The same questions, excluding the first section, were also used in the second stage. The questionnaire items are available in Appendix 1.

The participants in this study were the students attending the CDL courses at HSE during 2004 – 2005. Altogether 243 students participated in this survey. The longitudinal data was collected through two sets of questionnaires at the end of the first and last laboratory sessions of the course. The responses at the two time points were matched with the student identification numbers. If the matching failed due to a missing identification number, for example, the response was rejected. Thus there was a high loss of data and altogether 96 response pairs were accepted for the analysis. However, this longitudinal set of data was sufficient for examining changes in the key constructs during the learning process.

The collected data was analyzed using the summary constructs (the mean) of each original construct before and after training. By analyzing only the response pairs, it was possible to measure changes at the individual level. Only the changes in computer anxiety and perceived ease of use were statistically significant, measured by partial t-tests. After that, the directions of the changes were analyzed. This analysis revealed that computer anxiety decreased with training, and that the perceived ease of use increased the most. Conversely, perceived usefulness decreased slightly. The third part of the data analysis focused on calculating the correlations of the change constructs in order to decide on the relation between the constructs.

The results of this study are reported in Chapter 4 and the full version of Paper 1 is provided in Part II of this dissertation.

3.3.2 Paper 2. Longitudinal web survey and SEM

The focus of the first study was to provide a general overview of the learning process in the IT training context. This second study examined the learning process in more detail. Hence, the data was collected at three time points instead of two. In addition, the Structural Equitation Modeling technique (SEM) was used as the analysis method and enabled the causality between all constructs in the whole model to be tested at the same time. These two features
Methodology

improved the validity of the study. As with the previous study and the other two studies, it was only the survey research that made it possible to gather and test all participating students’ perceptions and opinions.

The empirical data for this longitudinal study was collected through a web survey. Three different sets of questionnaires were used for collecting the data – the first at the first lecture of the course, the second in the middle of the course, and the third after the last laboratory session. The measurement scales were adapted from Bhattacherjee and Premkumar’s two-stage model of cognition change (2004). The questionnaire items were measured using the seven-point Likert scale with 1 anchored at totally disagree, and 7 anchored at totally agree. Semantic differential scales were also used in some questions. The questionnaire items are presented in Appendix 2.

The participants in this study were the students attending FPC courses at the Helsinki School of Economics (HSE) in fall 2007. A total of 169 students participated in this survey. The loss of data was high as only those questionnaires with matching IDs were accepted for the analysis (altogether 96). Again, having this longitudinal set of data made it possible to examine changes in the key constructs and the interdependencies between them.

The data was divided into testable propositions, and was tested using the statistical methods of paired t-tests and SEM.

The results of this study are reported in Chapter 4 and the full version of Paper 2 is presented in Part II of this dissertation.

3.3.3 Paper 3. Web survey and SEM

The two first studies were focused on providing an overview of the learning process, while also analyzing in more detail how training influences IT-related anxiety and changes in user beliefs and attitudes. The study presented in Paper 3 examined the ability to adapt the learned IT skills to new situations, that is, learning transfer. The web survey for this study was conducted in the context of spreadsheet training, which was a part of the FPC course. The transfer in this single-observation study was measured in two ways. At the end of the course, the course participants estimated their Excel skills (ES) and computing skills (CS) before and after training using the Finnish school grades (4 failed - 10 excellent). In addition, they reported their perceptions about learning transfer by answering the questionnaire related to the construct learning transfer.

The data was collected after the last spreadsheet laboratory session. The measurement scales were based on Csikszentmihalyi’s flow theory (1975), Thorndice’s learning transfer theory (1901), the TAM model (Davis et al. 1989) and later studies applying these theories. The questionnaire items of this study are available in Appendix 3. The questionnaire items were measured using the seven-point Likert scale with 1 anchored at totally disagree, and 7 anchored at
totally agree. Semantic differential scales were also used. In addition, Finnish school grades (4 failed - 10 excellent) were used and converted to the scale 1-7. This was done to ensure that each construct used the same scale.

The empirical data for this study was collected at the Aalto University School of Business (BIZ) in fall 2010, from altogether 120 students attending the FPC courses. For the final analysis, 116 responses were accepted. Three testable research hypotheses were derived from the research question and were tested using the statistical methods of paired t-tests and SEM.

The results of this study are reported in Chapter 4 and the full version of Paper 3 is available in Part II of this dissertation.

3.3.4 Paper 4. Longitudinal survey (pen and paper) and SEM

The fourth study re-examined the relationships between learning transfer, flow experience and extrinsic motivation (operationalized as perceived usefulness) in order to model determinants of capacity for adaptive IT use. As the chronological order of the measurements is critical to determining causation (Babbie 1998, p. 100) and the focus of this re-examination was to establish the extrinsic motivation -> flow experience causal relationship in IT learning, the extrinsic motivation (operationalized as PU) was measured earlier than the other constructs (flow experience and learning transfer).

The empirical data for this study was gathered through pen and paper surveys in the same context as Paper 3, that is, the spreadsheet sessions of the FPC course. Data was collected in two stages: in weeks 2 and 6 of the six weeks’ training period. The measurement scales were the same as in the previous study. The questionnaire items were measured using the seven-point Likert scale with 1 anchored at totally disagree, and 7 at totally agree. Semantic scales and Finnish school grades (4-10) were also used and converted to the scale 1-7, for the purpose of the consistent data analysis in the same way as in the previous flow study. The questionnaire items are provided in Appendix 4.

The respondents in this study were all the students attending any of the six parallel FPC courses at the Aalto University School of Business in fall 2012. Altogether 190 responses were received in the first survey round and 116 in the second survey round. After matching the single records with the student identification numbers, 113 records were accepted for the analysis. The duration of the FPC courses was exceptionally only six weeks, instead of seven-weeks. The group size of the six parallel FPC courses varied notably, from 12 to 72.

The results of this study are reported in Chapter 4 and the full version of Paper 4 is provided in Part II of this dissertation.
3.4 Validity and reliability

This section discusses four aspects of the validity, namely construct validity, convergent and discriminant validity and external validity, as well as the reliability of the four studies reported in this dissertation. The validity relates to the question of whether the study measures what it is meant to measure, while the reliability is concerned with whether the results of the study are stable and repeatable (Bryman and Bell 2003).

Construct validity is “an issue of operationalization or measurement between constructs” (Straub et al. 2004, p.388). In this study, construct validity was taken into account in the careful planning of the questionnaire. The established constructs were borrowed from previous published research that has adopted the theories of TRA (Fishbein and Ajzen 1975), Flow theory (Csikszentmihalyi 1975), Learning transfer theory (Thorndike and Woodworth 1901), Expectation disconfirmation theory (EDT) (Oliver 1980), the TAM model (Davis 1986; Davis et al. 1989) and the UTAUT model (Venkatesh et al. 2003). The scales used in the present research were also validated in prior research that adopted the above-mentioned theories. The questionnaire items were adapted for the IT learning context where necessary. A detailed description of the questionnaire items used and their sources is presented in the original papers. In addition, the questionnaire items are presented in Appendices 1 – 4.

Convergent validity refers to the homogeneity of the constructs used in the model (Straub et al. 2004). It was assessed through factor analysis and Cronbach’s Alpha internal consistency measure. Discriminant validity, in turn, refers to the separateness of the constructs (Eriksson 1998). It was evaluated through factor analysis. In addition, more detailed examinations were made of convergent and discriminant validity, as well as of the reliability of the constructs. First, the correlations between constructs were calculated to estimate whether the constructs correlate more highly with each other, within their parent factor, than with constructs outside their parent factor. Second, composite reliability (CR) and average variance extracted (AVE) were calculated and compared with the recommended thresholds. Finally, maximum shared variance (MSV) and average shared variance (AVS) were calculated in order to test whether they were less than AVE for all factors. In SEM studies, not only the convergent and discriminant validity of constructs, but also model fit indices, that is, estimates that describe how well a model fits the data, were reported. First of all, the model fit indices were addressed by the value of the Chi-square statistic divided by the degrees of freedom (Jöreskog et al. 2000). Moreover, in order to examine the goodness-of-fit of the whole causal model, many other fit criteria, such as the comparative fit index (CFI), the adjusted goodness of fit index (AGFI), the normalized fit index (NFI), and the root mean square error of approximation (RMSEA) were also applied. The discriminant
and convergent validity assessment procedures are illustrated in all four papers. The model fit indices, in turn, are presented in all the three SEM studies (Papers 2-4).

**External validity** questions whether the findings of the study can be generalized. In this study, no sample was created, because almost all students who actively attended the courses also participated in the studies. The population in this case was the students who had matriculated from a senior high school/upper secondary school and who had commenced business studies in a Finnish university. In addition, to increase external validity, the students were examined in a natural setting by longitudinal studies.

**Reliability** refers to the repeatability of a research. It includes issues related to the stability of the investigation and the internal consistency of the measures (Bryman and Bell 2003). Measurement stability was achieved by collecting data in classroom settings, where the researcher was present. In addition, as the questions were originally in English in the literature, they were translated into Finnish. Before the data collection, the wordings were tested by the researcher’s colleagues and corrected if needed. In addition, the questionnaires were tested by a sample of IS PhD students in order to review the instruments. Internal consistency was addressed by applying measures of discriminant and convergent validity as described earlier.

The phenomenon under examination, that is, the learning process during the office application courses, was approached through different theoretical lenses, making it possible to use theoretical triangulation and increase the validity of the study. Internal consistency was addressed by applying Cronbach’s Alpha measures for each of the latent constructs. Furthermore, the use of structural equation modeling made it possible to test all proposed causal relationships in Papers 2-4. Finally, the reliability of the measures was improved by using primarily longitudinal studies. Babbie (1998, p. 100) and Saunders (2007) argue that the time dimension plays a critical role in IT constructs and theories and improves the generalizability of research results.

Reliability at the variable level can be defined as the “extent to which a variable or a set of variables is consistent in what it is intended to measure. If multiple measurements are taken, the reliable measures will all be very consistent in their values” (Hair et al. 1998, p.3). Although many scholars (e.g., Churchill 1979; Nunnally 1978) recommend that researchers should primarily use multiple-item measures, single-item measures have been applied successfully in diverse fields of research, such as consumer research (Bergkvist and Rossiter 2009), usability research (Christophersen and Konradt 2011), management research (Nagy 2002), and psychology (Larsen et al. 2009). The main reason for using single-item measures is their advantages: Single-item measures may be easier and take less time to complete, are less frustrating, and less expensive
(Nagy 2002). In addition, the reliability, validity, and predictability of single-item measures have been shown to easily stand comparison with those of multiple-item measures (e.g., Christophersen and Konradt 2011). In this dissertation, multi-item measures have been used in all four studies. However, in flow studies, single-item measures have also been used for the components of flow experience (FE) and learning transfer (LT). The main reason for using single-item measures in the first flow study was to clarify the research model and make data analyses simpler. In the second flow study, in turn, the single-item measures had already been validated and the participants might have found multi-item measurements frustrating. In such a case, they might not want to answer the questionnaire at all, or they might answer carelessly, with the result that the quality of the research would suffer.

The individual research papers of this dissertation are summarized in the following chapter.
4. Summaries of the original research papers

In this chapter the four original research papers included in this dissertation are summarized. First, an overview of the papers is provided in Figure 8. Second, each paper is briefly presented. Finally, the papers are positioned in the proposed IT Learning Process (ITLP) framework. The original papers are provided in Part II of the dissertation.

**Figure 8. An overview of the four papers**
4.1 Summary of Paper 1

Sokura, B., Tuunainen, V. K., Öörni, A.: “THE ROLE OF TRAINING IN DECREASING ANXIETY AMONG EXPERIENCED COMPUTER USERS”

Paper 1 (see Table 2) addresses the first construct, IT-related anxiety, in research question 1 of this dissertation: “How does IT training influence IT anxiety, IT beliefs, and attitudes?”. More specifically, this paper examines the effect of CDL training on computer anxiety and behavioral beliefs about the use of office applications. In addition, the relative importance of self-efficacy was tested.

Table 2. Brief summary of Paper 1

<table>
<thead>
<tr>
<th>Title</th>
<th>Research questions</th>
<th>Method</th>
<th>Theories/Constructs</th>
<th>Results</th>
<th>Outlet</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Role of Training in Decreasing Anxiety among Experienced Computer Users</td>
<td>RQ1 (a): How does IT training influence IT anxiety? 1) How does CDL training influence user acceptance of information systems among relatively experienced users? 2) Does CDL training decrease computer anxiety? 3) What is the relative importance of self-efficacy?</td>
<td>Questionnaire (N = 96) 2004 – 2005 Correlation analysis, t-tests</td>
<td>TAM/ Perceived ease of use (PEOU), Perceived usefulness (PU) Intention to use (INT), Anxiety-literture/Axiety (ANX), Self-efficacy-literture/Self-efficacy (SE)</td>
<td>1) CDL training decreases individual computer anxiety level. 2) Reduced computer anxiety increases computer self-efficacy. 3) Reduced computer anxiety increases intention. 4) Reduced computer anxiety does not increase perceived ease of use</td>
<td>ECIS 2009</td>
</tr>
</tbody>
</table>

The main research questions of Paper 1 are as follows: 1) How does CDL training influence user acceptance of information systems among relatively experienced users? 2) Does CDL training decrease computer anxiety? 3) What is the relative importance of self-efficacy?

To respond to the research questions, four hypotheses were set based on prior literature.

The first hypothesis focused on the relationship between training and computer anxiety. Previous research had shown that training decreases anxiety (e.g., Beckers and Schmidt 2001; Igbaria 1990; Martocchio 1994; Popedavis and Vispoel 1993; Torkzadeh and Angulo 1992). Earlier studies had also found that increasing computer experience may reduce computer anxiety (Chang 2005; Igbaria 1993), and that the growth of computer knowledge decreases the level of computer anxiety (Kay 2008).

The participants in this study were 50 adult students and 40 university students whose computer experience was ten years on average and whose
earlier computer training was limited or non-existent. Hence, this population can be seen as experienced users. Although prior research had shown that computer experience may reduce computer anxiety, it was instructive to test whether CDL training has an impact on the anxiety levels of experienced users. Therefore, the first hypothesis was formulated as follows:

H1. CDL training will decrease an individual’s computer anxiety level.

The second hypothesis tested the relationship between reduced computer anxiety and computer self-efficacy, that is, one’s confidence in one’s computer capabilities. Prior research had proposed that computer self-efficacy has a stronger impact on computer anxiety than does experience (Wilfong 2006). In addition, numerous researchers agree that anxiety and self-efficacy are negatively related (Bandura 1977; Compeau and Higgins 1995a; Fagan et al. 2003; Henderson et al. 1995) and that the causality between the constructs is computer self-efficacy→anxiety. The current study, in turn, uses reduced computer anxiety as the starting point and examines how changes in computer anxiety, that is, reduced computer anxiety, are related to changes in computer self-efficacy. Hence, the second hypothesis was set as follows:

H2. Reduced computer anxiety will affect computer self-efficacy.

The third hypothesis focused on the relationship between computer anxiety and the TAM model’s perceived ease of use (PEOU). It had been suggested that there is a strong negative interdependence between anxiety and PEOU (Venkatesh 2000) and that computer anxiety is an antecedent of PEOU (Chee Wei et al. 2006; van Raaij and Schepers 2008; Venkatesh 2000). Thus, there appeared to be common agreement that computer anxiety and PEOU are related. As in the previous hypothesis, the used construct is reduced computer anxiety, that is, the changes in computer anxiety compared with the changes in perceived ease of use. Based on the previous literature in support of anxiety influencing PEOU, the third hypothesis was set as follows:

H3. Reduced computer anxiety will affect perceived ease of use.

The fourth hypothesis tested the relationship between reduced computer anxiety and the intention to use, or to continue to use, office applications taught on the CDL course. While many studies had found computer anxiety to be an essential predictor of the use of technology (Czaja et al. 2006; Tung and Chang 2007) other studies had found, on the contrary, that anxiety’s impact on usage is insignificant (Compeau and Higgins 1999). However, as the main stream of studies has shown computer anxiety to be a predictor of technology use, the fourth hypothesis was formulated as follows:

H4. Reduced computer anxiety will affect intention to use.
The research model of the impact of training on computer anxiety, along with the analysis results, is presented in Figure 9. It outlines how training decreases the level of computer anxiety and shows how the changes in computer anxiety levels relate to the changes in the key constructs of technology acceptance.

Figure 9. Research model of the impact of training on computer anxiety

The hypotheses were tested using t-tests and correlation analysis. Firstly, the analyses showed that training (the CDL courses in this study) decreases an individual’s anxiety level (H1 supported). Thus, the analyses confirmed the earlier findings in the literature that IT training decreases computer anxiety (e.g., Beckers and Schmidt 2001; Igbaria 1990; Martocchio 1994; Popedavis and Vispoel 1993; Torkzadeh and Angulo 1992). The decrease in computer anxiety level is especially important, because it impacts on many key constructs of technology acceptance. These will be presented next.

Secondly, reduced anxiety and self-efficacy are related (H2 supported). This longitudinal study supports earlier studies that show that computer anxiety and computer self-efficacy are negatively related (see Bandura 1977; Compeau and Higgins 1995a; Fagan et al. 2003; Henderson et al. 1995). Strengthened self-efficacy beliefs are important, as they impact positively on the intention to use and PEOU (see Figure 9). These relationships were not hypothesized in this study, but they were calculated and presented in the model. The results are in line with previous studies (e.g. Compeau and Higgins 1995a; Fagan et al. 2003; Venkatesh 2000). In addition, it had been suggested that self-efficacy has a stronger effect on computer anxiety than dose experience and use (Wilfong 2006). The decrease in computer anxiety is especially important, because it is related to one’s confidence in one’s capabilities (= self-efficacy).

Thirdly, the changes in anxiety level did not correlate with the changes in PEOU; that is, the relationship between computer anxiety and PEOU was not significant, contrary to what was expected (H3 not supported). One explanation
for this might be that users do not feel that a lower anxiety level results in PEOU, but rather in the use of new features; that is, the lower the anxiety level, the more inclined the users are to learn more advanced features. Another explanation might be that users compare the ease of use of new applications with that of other applications they already know how to use. Anyway, this finding contradicts that of earlier studies that indicated a strong relationship between ease of use and anxiety (Chee Wei et al. 2006; van Raaij and Schepers 2008; Venkatesh 2000).

Fourthly, the analyses supported the earlier mainstream finding that anxiety predicts the intention to use a technology (Igbaria 1993) or the actual use of a technology (Czaja et al. 2006; Tung and Chang 2007), that is, H4 was supported.

The model also included TAM’s basic assumptions that user beliefs, PU and PEOU are major determinants of intention (Davis 1986; Davis 1989; Davis et al. 1989), although they were not hypothesized (see Figure 9). The results of this research supported the basic TAM studies mentioned above. In addition, the relationship between PEOU and PU was presented in the same model. PEOU impacts intention directly and affects PU as suggested in the previous literature (Davis et al. 1989). Although the effect of PEOU on intention is quite high, it decreases over time (Davis et al. 1989).

The results show that an individual’s anxiety level can be impacted by training. A decreased anxiety level, in turn, relates to self-efficacy and intention to use. Although in this study, the relationships between anxiety and the TAM beliefs were not significant, it will be included in the final ITLP because it is related to self-efficacy and intention to use. (see Figure 10):

![Diagram](image)

**Figure 10. First part of the ITLP framework discussed in Paper 1**

The relationship between training, computer anxiety, and intention to use provides the model for the first part of the final ITLP framework.

Paper 1 contributes to this dissertation by emphasizing training’s role in decreasing the anxiety levels of experienced users. The original Paper 1 is available in Part II of the dissertation.
4.2 Summary of Paper 2


Paper 2 contributes to the second and third constructs in research question 1 “How does IT training influence IT anxiety, IT beliefs, and attitudes?”. The focus of Paper 2 is to understand how user beliefs and attitudes change during a software training course, in this case the FPC course, and what the mechanism behind these changes is. To reach this target, two alternative theories were tested: one suggested by the two-stage model of cognition presented by Bhattacherjee and Prekumar (2004), and the other based on theories of reasoned action and planned behavior (Ajzen 1988; Ajzen 1991; Fishbein and Ajzen 1975). An overview of Paper 2 is provided in the table below.

<table>
<thead>
<tr>
<th>Title</th>
<th>Research questions</th>
<th>Method</th>
<th>Theories/Constructs</th>
<th>Results</th>
<th>Outlet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changes in User Beliefs and Attitudes during the Learning Process of Office Applications</td>
<td>Q1s: (b and c): How does IT training influence IT beliefs, and attitudes? The goal is to examine how students’ beliefs and attitudes change during the learning process when they participate in a software training course. 1) How can the changes in beliefs and attitudes be explained? 2) What is the mechanism behind the changes?</td>
<td>Questionnaire (N = 48) Fall 2007 t-tests SEM</td>
<td>TAM, Perceived usefulness (PU) Intention to use (INT) TRA/Attitude (ATT) TSMCC/Disconfirmation (DNS) Satisfaction (SAT)</td>
<td>1) Expectations may operate directly on behavioral beliefs rather than influencing attitudes through feelings of (dis)satisfaction. 2) The disconfirmatory mechanism may be a tacit feature of the deliberative process as pictured by TRA. 3) Separate constructs for feelings of (dis)satisfaction may not be needed for understanding the deliberative process.</td>
<td>ECIS 2012</td>
</tr>
</tbody>
</table>

Table 3. Brief summary of Paper 2

The most important basic assumption in this paper is that attitudes towards any object are determined by beliefs about that object (Ajzen and Fishbein 1980, p. 62). Second, based on Oliver’s (1980) model, it was proposed that pre-usage beliefs and attitudes have a direct effect on usage-stage beliefs and attitudes. However, attitudes tend to change over time (Szajna and Scamell 1993; Venkatesh 2000) and, in the long run, very positive attitudes or expectations will decrease, and very negative expectations will increase (Szajna and Scamell 1993). Nevertheless, positive attitudes will stay at a higher level than negative or neutral attitudes (Szajna and Scamell 1993). In addition, beliefs and attitudes influence later behavior indirectly via the disconfirmation and satisfaction constructs (Oliver 1980). The effects of disconfirmation and satisfaction on beliefs and attitudes may continue to recur over time as users acquire more experience and, in so doing, revise their prior cognitions in an iterative manner.
(Bhattacherjee and Premkumar 2004). However, these changes are assumed to take place more often during the early phases of usage and to diminish over time as users’ expectations become more realistic (see Bhattacherjee and Premkumar 2004; Szajna and Scamell 1993). Thus, it has been believed that, in our end-user training context, the biggest changes in beliefs and attitudes will occur between the pre-usage stage and the first usage stage and diminish towards the end of the training period. Furthermore, according to the TRA theory, “a person’s attitude is formulated by beliefs and attitudes that are the major determinant of intentions, and thus of behaviour” (Ajzen and Fishbein 1980, p. 62).

The hypotheses were tested in two phases: between the pre-usage stage (t0) and the usage stage 1 (t1), and between usage stages 1 and 2 (t1 and t2). In the first phase we tested how beliefs and attitudes changed from the pre-usage stage (t0) to usage stage 1 (t1), and how these changes impacted the EDT constructs, (dis)confirmation and satisfaction (Oliver 1980) and the behavioural intention (Ajzen and Fishbein 1980; Davis et al. 1989). In addition, the interdependencies between these TRA and EDT constructs were tested using the two-stage theoretical model of cognition change by Bhattacherjee and Prekumar (2004) (see Figure 11).

![Figure 11. Research model: The Two-Stage Theoretical Model of Cognition Change (Bhattacherjee and Premkumar 2004)](image)

The results of this study provided only partial support for the expectation-disconfirmation mechanism. The most important finding was that satisfaction lies outside the cognitive process that leads to the formation of behavioural intention. There are causal links between disconfirmation, belief, attitude, and intention (see Figure 12). Thus, this research suggests that expectations may operate directly on behavioural beliefs, rather than impacting attitudes through feelings of (dis)satisfaction. In addition, it appears that the (dis)confirmatory mechanism may be a tacit feature of the deliberative process as suggested by TRA. These findings are consistent with Ajzen’s findings (Ajzen 1991; Ajzen 2005; Ajzen and Fishbein 1980; Ajzen and Madden 1986).
Figure 12. Causal links in beliefs between different time points

Paper 2 answers research question 1 “How does IT training influence IT beliefs and attitudes?” as follows: User beliefs and attitudes change during the learning process. The statistical means of beliefs (usefulness) and attitudes were compared pairwise at three time points using a series of t-tests. The tests showed that both means decreased statistically significantly from the pre-usage stage to usage stage 1. The means continued to decrease from usage stage 1 to usage stage 2, but the changes were not statistically significant. Thus, these changes support the theoretical expectations about IT use: cognition changes diminish over time as the reality becomes more apparent and corrects expectations of the application use.

The proposed causal links of the research model (the two-stage theoretical model of cognition change) were tested using SEM analyses. Based on the results of the SEM analyses, it is suggested that expectations may function directly on behavioral beliefs, rather than impacting attitudes through the feelings of satisfaction as Figure 12 shows.

The relationship between training, (dis)confirmation, attitudes including beliefs and intention to use provides the model for the second part of the modified ITLP framework as follows:

Figure 13. Second part of the ITLP framework discussed in Paper 2

In this relationship, attitudes are defined in line with the TRA model, that is, they are one’s beliefs that behavior will lead to certain outcomes, and one’s evaluations of these outcomes. However, the impact of training on attitudes is
complex. The empirical data shows that both attitudes and perceptions of beliefs (PU) decrease statistically significantly from the first time point (measured in week 1) to the second time point (measured in week 4). From the second time point to the end of the course, the above-mentioned constructs continue to decrease, but the changes are statistically non-significant. The construct means stay very high, that is, positive, but they are less than at the beginning. This is in line with earlier studies stating that attitudes tend to change during the process of learning computer applications (e.g., Szajna and Scamell 1993; Venkatesh et al. 2000). Very positive attitudes or expectations decrease and negative expectations increase in the long run (Szajna and Scamell 1993). However, Szajna and Scamell (1993) argue that very positive attitudes stay at a higher level than negative or neutral attitudes. Like earlier studies (e.g., Igbaria 1990; Igbaria 1993), the current study shows the strong relationship between attitudes and training, and, thus, it is added to the model.

Another question arises from the link between attitudes and the intention to use. Our study showed the chain of logic to be disconfirmation > beliefs > attitude > intention. However, some studies argue that attitudes towards using technology have no significant impact on behavioral intention (Venkatesh et al. 2003) or they may operate through effort expectancy (EE) (Venkatesh 2000). Effort expectancy is defined as “the degree of ease associated with the use of the system” (Venkatesh et al. 2003). It was created in developing the UTAUT model and consists of three constructs of other existing models (see Venkatesh et al. 2003). However, mainstream studies and this current study argue that attitudes are the predictor of intention to use technology (e.g., Bhattacharjee and Premkumar 2004; Davis et al. 1989; Fishbein and Ajzen 1975; Lin and Bhattacharjee 2010). Thus, the arrow between attitudes and intention is added.

Paper 2 contributes to the dissertation by emphasizing the importance of (dis)confirmation and attitudes during the IT learning process.

4.3 Summary of Paper 3

Sokura, B.: “FLOW EXPERIENCES IN LEARNING TO USE A SPREADSHEET APPLICATION”

Paper 3 examines the students’ flow experiences during the learning process in a spreadsheet application course. This study contributes to research question 3 of this dissertation: “How does IT training-related flow experience influence learning transfer?” An overview of Paper 3 is provided in the table below.
Table 4. Brief summary of Paper 3

The main objective was to examine the effect of flow experience when learning to use a spreadsheet application. To reach the main objective the more detailed research questions were set as follows: 1) What are the features of flow experience in the spreadsheet application training context? 2) Does flow experience affect learning outcomes? 3) What are the relationships between flow experience, learning outcomes, and perceived usefulness? To answer the research questions, three hypotheses were set based on the prior literature.

As the main objective of IT training, especially in the office application context, is to achieve the ability to apply what has been learnt in one context to new contexts and situations, that is, learning transfer (Byrnes 1995; Thorndike and Woodworth 1901), the first hypothesis focused on the relationship between flow experience and learning outcomes. Only a few studies have examined this relationship. Choi, Kim et al. (2007) and Ho and Kuo (2010) found a positive relationship between these constructs. However, both studies were conducted in an e-learning context, rather than in the context of using office applications. In addition, the features of flow experience were different from the features studied in the present research, that is, those applicable to IT training. Moreover, the flow experience construct used here is defined in words instead of using lists of features only. Based on the above-mentioned studies the first hypothesis was set as follows:

H1. Flow experience affects learning outcomes.

Various studies have shown that perceived usefulness is the most important belief influencing intention to use technology (Chau and Hu 2002; Davis et al.
1989; Davis et al. 1992; Karahanna and Straub 1999; Venkatesh and Davis 2000) or intention to continue to use technology (Bhattacherjee 2001; Castaneda et al. 2007; Kan-Min et al. 2011; Koufaris 2002; Lee 2010; Limayem and Cheung 2011). Furthermore, motivational factors such as perceived usefulness have been suggested impacting on transfer of learning (Pugh and Bergin 2006). Hence, the second hypothesis was defined as follows:

H2. Perceived usefulness has a positive impact on learning outcomes.

Especially in the context of the Internet, many studies have indicated that perceived usefulness and one or more features of flow are related (see Agarwal and Karahanna 2000; Saadé and Bahli 2005; Shang et al. 2005). All these studies also suggest that flow experience or cognitive absorption has a positive impact on perceived usefulness. Hence, the third hypothesis was defined as follows:

H3. Flow experience has a positive impact on perceived usefulness in the learning context.

A research model illustrating the results of the relationship between flow experience, learning outcomes and perceived usefulness is presented in Figure 14.

![Figure 14. Research model: The relationships between flow experience, learning outcomes and, perceived usefulness](image)

The model developed to explain the relationships between learning outcomes, flow experience, and perceived usefulness was tested using SEM structural equation modeling. In addition to the SEM analysis, the paired t-tests were used to analyze the change over time in spreadsheet skills (ES) and general computing skills (CS).

The findings of this study reveal that students have flow experiences that, in turn, affect learning outcomes (H1 supported). Thus, the analyses confirmed the
earlier findings of the two studies (Choi et al. 2007; Ho and Kuo 2010) carried out in an e-learning context. However, the e-learning studies examined different features of flow experience. Paper 3, in turn, defined the features of flow experience in the IT training context as follows: “Flow is a state where one works with total involvement in reaching the goals, where skills and challenges are in balance, where one perceives the task as stimulating and is focused to the extent that time distortion occurs.”

Perceived usefulness has no impact on learning outcomes (H2 not supported). In this study, the phenomenon might mean that external motivational factors do not directly promote adaptive learning. On the other hand, if perceived usefulness is an antecedent of flow experience, it may impact learning outcomes via flow experience.

Furthermore, this study shows that there is a link between flow experience and perceived usefulness. In line with more recent IS literature (e.g., Agarwal and Karahanna 2000; Saadé and Bahli 2005; Shang et al. 2005; Venkatesh 1999) that argues that flow experience, cognitive absorption or enjoyment are antecedents of behavioral beliefs such as perceived usefulness, this study also suggests that flow experience is an antecedent of perceived usefulness. The earlier IS literature claimed the opposite (Davis et al. 1992; Trevino and Webster 1992b) in line with motivational theory (Ryan and Deci 2000). According to motivational theory, instrumental behavior typically changes self-purposely over time. The conflict is illustrated in Figure 15 below.

![Figure 15. Two competing theories in the IS literature on the relationship between flow experience (FE) and perceived usefulness (PU)](image)

Finally, this study shows that the increase in both spreadsheet skills and general computer skills was statistically significant, even though only spreadsheet skills were taught. Cognitive learning and learning transfer may explain this finding. When learning to use spreadsheet applications, cognitive processes structure knowledge all the time, thus enabling learning transfer, that is, the ability to adapt the knowledge learnt in one context (spreadsheets) to new contexts (general computing, word processing etc.).
Figure 16 illustrates how users’ computing skills (CS) and Excel skills (ES) increased during a spreadsheet course.

Figure 16. Acquisition of IT skills: The role of cognitive learning and learning transfer

As this study has demonstrated that flow experience is the major determinant of learning outcomes (Learning transfer), it is instructive to add this relationship to the ITLP framework. See Figure 17.

Figure 17. Third part of the ITLP framework in Paper 3

The relationship between training, flow experience, and learning outcomes creates the third part of the ITLP framework.

Although this study was not longitudinal, the impact of training was present as follows: First, the participants evaluated their Excel and computing skills before and after the course. Both skills increased statistically significantly, which may mean that the training was effective and that learning transfer occurred. Second, flow experience includes three features that are created by the trainer, that is, clear goals, a balance between skills and challenges, and immediate feedback.

Paper 3 contributes to the overall goal of the dissertation by highlighting the outcomes of learning – learning transfer – whose major determinant is flow experience. Flow experience has been defined above, but we should note that it consists of five features in this dissertation, that is, clear goals, a balance
between skills and challenges, concentration on the activity, time distortion, and enjoyment. Flow theory postulates three conditions for achieving a flow state (Csikszentmihalyi et al. 2005, pp. 601-2). Firstly, the activity must contain a clear set of goals. Secondly, the perceived challenges and skills must be in balance. Thirdly, flow depends on clear and immediate feedback. In the training context, these conditions can be put into practice by the learning arrangements, that is, an appropriate syllabus, assignments with clear goals, challenges that match the participants’ skill levels, and teaching methods that favor learning-by-doing and the provision of immediate feedback. When the above conditions are in place, an individual may enter the flow state.

Paper 4 will give stronger evidence for successful learning transfer by introducing psychological aspects. However, this paper has introduced and defined the flow construct in an IT training context.

The full version of Paper 3 is provided in Part II of the dissertation.

4.4 Summary of Paper 4

Öörni, A., Salovaara, A., Sokura, B.: “LEARNING TO USE IT ADAPTIVELY: FLOW EXPERIENCE INCREASES TRANSFER OF LEARNING”

In Paper 4, the relationship between perceived usefulness, flow experience and learning transfer is re-examined in order to find the determinants of a capacity for adaptive IT use. Whereas Paper 3 concentrated on identifying the features of flow experience and its impact on learning transfer, this study attempts to determine the learner’s capacity to use technology adaptively. To test this, self-determination theory (Ryan and Deci 2000) was added to the research model, as it helps to explain how motivation, operationalized in perceived usefulness, can promote learning transfer by facilitating flow experience. Learning transfer theory, in turn, explains how IT use adapts to new contexts. Finally, flow theory identifies features of the learning process that determine learning transfer and facilitate adaptive IT use.

This study also needs to solve a causality problem, that is, whether motivation (operationalized as PU) is an antecedent to flow experience, or vice versa. To solve this causality problem, the data was gathered and measured in two stages. In the first stage, only the independent variable (motivation = perceived usefulness PU) was measured and the dependent variables (flow experience and learning transfer) were measured in the second stage four weeks later. The study addresses research question 3 of this dissertation: “What are the antecedents of IT training-related flow experience?” An overview of the paper is presented in the table below.
To be more precise, the aim was to model determinants of capacity for adaptive use. Hence, the two research questions were set as follows: 1) Does motivation influence learning transfer for adaptive IT use? 2) Does flow experience influence learning transfer for adaptive IT use? 3) Is flow experience an antecedent to motivation, or is motivation an antecedent to flow experience? In this study, extrinsic motivation was operationalized as perceived usefulness.

The first hypothesis aimed at confirming the finding of Paper 3 about the positive relationship between flow experience and learning transfer. It was based on flow theory (Csikszentmihalyi 1990), on learning transfer theory (Thorndike and Woodworth 1901) and on the findings of Choi, Kim et al. (2007) and Ho and Kuo (2010) that flow experience can be an antecedent of learning transfer. Accordingly, the hypothesis was set as follows:

H1. Flow experience determines learning transfer.

Before setting the second hypothesis, Paper 4 briefly presents self-determination theory (Ryan and Deci 2000) and points out that, in practice, intrinsic and extrinsic motivation, fun and usefulness usually combine to influence IT use (Gerow et al. 2013). Furthermore, self-determination theory suggests that extrinsic motivation is more likely to be an antecedent than a product, of flow, as there is a general tendency for extrinsically motivated...
behaviours to become more self-determined through the processes of internalizing and integrating (Ryan and Deci 2000). Cognitive psychology also supports this position by suggesting that extrinsic motives can non-consciously monitor attention. Attention is the product of selection processes that proactively filter behaviorally relevant stimuli from clutter (Andersson 2011).

Paper 4 applies the results of self-determination theory and psychological literature relating to attention to suggest that extrinsic motivation is causative of flow, rather than vice versa. The automatic (non-conscious) mental processes that control attention are sensitive to rewards. When these processes “determine” that the rewards are sufficiently high to allocate one’s full attention to a task at hand, we observe flow. Individuals experience flow when a task fully absorbs their resources of attention. This translates in the IT context as follows: perceptions of motivational factors – such as PU – should be seen as antecedents of flow, contrary to the dominant thinking in current IS research.

H2. Extrinsic motivation determines flow experience.

While the first hypothesis focused on the effect of flow experience on learning transfer, and the second hypothesis on the causal direction between extrinsic motivation and flow experience, the third hypothesis examines the relationship between motivational factors and learning transfer. In addition, it was theorized in this study that motivation should influence learning transfer indirectly through flow experience. Pugh and Bergin (2006) showed that motivational factors can directly influence learning transfer. Motivational factors are usually operationalized as the behavioral beliefs PU and PEOU. In addition, a multitude of studies has found PU to be the most important determinant of technology acceptance (Chau and Hu 2002; Davis et al. 1989; Davis et al. 1992; Karahanna and Straub 1999; Venkatesh and Davis 2000) and use (Bhattacherjee 2001; Castaneda et al. 2007; Kan-Min et al. 2011; Koufaris 2002; Lee 2010; Limayem and Cheung 2011). Hence, this study suggests that motivational factors can directly influence learning transfer as follows:

H3. Extrinsic motivation determines learning transfer.

A research model illustrating the results of the relationship between flow experience, learning transfer, and motivation is presented in Figure 18.
A new model of the relationships between learning transfer, flow experience, and motivation was developed and tested using SEM structural equation modeling.

Firstly, flow experience has a statistically significant effect on learning transfer as hypothesized (H1 supported). This finding shows that learning transfer can significantly benefit from a learning process in which challenges are in balance with one’s available attention resources.

Secondly, motivation (PU) has a statistically significant effect on flow experience as hypothesized (H2 supported). Note that the independent variable, motivation (PU), was measured earlier than the dependent variables (flow experience and learning transfer) because measuring the cause (extrinsic motivation operationalized as perceived usefulness) and the effect (flow experience, learning transfer) with a time delay validates the causal relationship. In addition, the finding shows that extrinsic motivation can be causative of flow experience in IT learning. This is in line with current theorizing on flow experience and attention: extrinsic motivation can persuade the attention mechanism, which, in turn, boosts the flow experience. It should be understood that this indirect effect on learning transfer mediated by flow experience is, by definition, non-conscious, and therefore not empirically captured in our study. So although people have only limited conscious control over attention, and although flow experience cannot be forced, rewards can still facilitate flow experience.

Thirdly, perceived usefulness has no direct effect on learning transfer (H3 not supported). As perceived usefulness is an antecedent of flow, it can logically be assumed that extrinsic motivation impacts learning transfer indirectly through flow experience. In other words, the notion of perceived usefulness seems to impact how efficiently learners will learn to apply and adapt technology in new situations.
The main theoretical contribution of the study is the new demonstration of the connections between motivation, flow experience, and learning transfer: 1) A meaningful learning process is a direct determinant of one’s capacity for adaptive IT use, and 2) the learning process can fully mediate the effect of IT-related motivation on that capacity. Extrinsic motivation, such as PU, should be treated as a possible determinant rather than as a consequence of flow experience.

It should be noted that the results of Paper 4 differ from those of Paper 3 in two respects. In both studies, flow experience was found to affect learning outcomes/learning transfer, and perceived usefulness was found not to affect learning outcomes/learning transfer directly. The differences lie in the relationship between flow experience and perceived usefulness and in the features of the flow experience.

In the latter flow study (Paper 4), it was suggested that perceived usefulness is an antecedent of flow experience, contrary to the earlier study (Paper 3). This phenomenon was also examined in the previous literature. It is widely accepted in IT learning-related research that flow experience or an equivalent construct is an antecedent of perceived usefulness (e.g., Roca et al. 2006; Saadé and Bahli 2005; Shang et al. 2005). Some IS researchers, however, argue that extrinsic motivation factors, such as PU, are conducive to flow experience (Davis et al. 1992; Trevino and Webster 1992a). The present study applied psychological theories to explain IS theories.

Two components, clear goals and concentration, have been omitted from the flow experience construct due to their poor discriminant validity. The reason may be that the learning arrangements were not optimal. First, the group size varied from 12 students to 72 students. Second, the duration of the course was six weeks instead of seven weeks. Hence, the goals of the course were less clear and it was more difficult to concentrate in the larger groups.

However, this study adds an important detail to the ITLP framework: namely the causative direction between perceived usefulness and flow experience. Perceived usefulness is an antecedent to flow experience (see Figure 19):

![Perceived usefulness (PU) → Flow experience (FE)](image)

**Figure 19. Fourth part of the ITLP framework discussed in Paper 4**

This causality builds the fourth part of the ITLP framework, and also makes a more fundamental contribution to IT use theory, in that it theorizes a non-
conscious mechanism as impacting on IT use-related behaviors. In addition, the perceived usefulness (=motivation) -> flow-experience path is conducive to meaningful learning, as flow theory highlights exceptional concentrations of attention.

4.5 A synthesis of the four papers’ contribution to the ITLP framework

Finally, Figure 20 illustrates how the four papers contribute to the developed ITLP framework. At the same time a new construct (IT use) and one new connection based on the key results of this research have been added to the framework.

![Figure 20. A synthesis of the four studies and the ITLP framework](image)

First, Paper 1 focuses on the computer anxiety construct. Training decreases the level of computer anxiety. Decreased computer anxiety, in turn, is related to computer self-efficacy and intention to use.

Second, Paper 2 elaborates the importance of understanding how attitudes and beliefs change during the learning process, and what the driving force behind them is. It seems that expectations are the baseline in re-examining beliefs. Hence it is necessary for the trainer to focus on changing attitudes by arguing for the usefulness of a particular application, for example, in order to achieve better learning results.

Third, Papers 3 and 4 examine how flow experience affects learning transfer. Fourth, Study 4 focuses on examining the causative direction between perceived usefulness and flow experience. The results show that flow experience affects learning transfer and that perceived usefulness is an antecedent of flow experience. All-in-all, it is important to enter a flow state when learning to use
IT applications. In addition, the notion of the usefulness of technology is important, because it increases an individual’s capacity to learn to apply a technology more efficiently and adaptively.

The IT use construct has been added to the framework, as it is commonly postulated that volitional behavior is predicted by intentions (e.g., Davis et al. 1989; Fishbein and Ajzen 1975). Finally, although the causative direction from learning transfer to IT use (marked by the dashed line) has not been studied separately, it is suggested that learning transfer may impact IT use. Another possible relationship might be between learning transfer and intention to use (learning transfer $\rightarrow$ intention to use). These two relationships will be important focus areas of future research.
This dissertation has examined the learning process in the IT training context. The overall goal was to model how training influences different outcomes of learning: changes in IT beliefs and attitudes, IT-related anxiety, and the ability to apply learned IT skills to novel situations (learning transfer). The ITLP framework created in Chapter 2 and finalized in Chapter 4 focused on modeling the learning process in the IT training context. The research questions were answered in individual research papers. Papers 1 and 2 focused on research question 1: “How does IT training influence IT anxiety, IT beliefs, and attitudes?” Paper 3, in turn, answered research question 2: “How does IT training-related flow experience influence learning transfer?” Paper 4 was devoted to the fourth research question: “What are the antecedents of IT training-related flow experience?”

The purpose of this chapter is to summarize the findings of the different parts and propose topics for future research. First, I will show how the findings of the four papers contribute to the overall goal (Section 5.1). Second, the theoretical and practical contributions will be discussed (Section 5.2). Third, the limitations of the research will be deliberated and some avenues for further studies will be proposed in Section 5.3. Finally, some conclusions will be drawn in Section 5.4.

5.1 Discussion of the main findings

As mentioned above, the research questions of the dissertation were addressed in four research papers. According to their findings, there are many user-related factors that affect the process of learning to use office applications and influence the outcomes of learning. Paper 1 reported that training impacts mainly by decreasing individuals’ computer anxiety levels and by increasing the perceived ease of use. However, reduced computer anxiety did not increase the perceived ease of use.

Paper 2 showed how user beliefs and attitudes change during the learning process and identified the driving forces behind these changes. It suggested that
the changes may be explained directly by behavioral beliefs, rather than by attitudes prompted by feelings of (dis)satisfaction. Paper 3 examined the relationships between the perceived benefits (usefulness) of IT use, flow experience and learning transfer in the IT learning context. The findings suggest that flow experience is the major determinant of learning transfer in the IT learning context. Finally, Paper 4 focused on examining the relationship between perceived usefulness and flow experience, and suggested that perceived usefulness predicts the flow experience of individuals.

5.2 Contribution

This dissertation makes both theoretical and practical contributions, and these are presented next.

5.2.1 Theoretical contribution

The findings of this dissertation contribute to the IS adoption, IT learning and training, and flow research streams. During the last decade (2004-2012), I examined the IT learning process in longitudinal studies in the context of numerous office application courses. First, I studied computer anxiety in the IT training context and found that the notion of ease of use is independent of computer anxiety. Users may not necessarily think that computer anxiety is caused by the use of a new technology or new applications. Instead, they may compare the ease of use of a new application to that of other applications they already know how to use. Hence, the relationship between ease of use and computer anxiety still requires further research. It would be interesting to examine what applications are compared with what, when measuring the ease of use of office applications.

Secondly, it was demonstrated that user attitudes and beliefs change during the learning process. It was found that expectations come into play when re-measuring beliefs. Attitudes, in turn, transform these changes into intentions to use technology. Furthermore, satisfaction does not seem to impact behavior at all, in the format conceptualized in IS research. Hence, it is not necessary to measure it in this IT training context. Instead of measuring satisfaction, the focus should be on measuring user beliefs and attitudes concerning the use of a particular application. In addition, it could be important to find ways of influencing beliefs and attitudes so that they become more positive over time.

Thirdly, this dissertation demonstrated that flow or flow experience is the major predictor of learning transfer in the IT learning context. Learning transfer is especially important, as different software features can be used in new situations and contexts (cognitive adaptation) or, after that, for innovating with information technology.
Fourthly, this dissertation provides a novel demonstration of the connections between extrinsic motivation (PU), flow experience, and learning transfer. First, a meaningful learning process is the direct determinant of one’s capacity for adaptive IT use. Secondly, the learning process can fully mediate the effect of IT-related extrinsic motivation on that capacity. Extrinsic motivation, such as PU, should be treated as a possible determinant, rather than a consequence, of flow experience. In addition to the path extrinsic motivation (PU) > flow experience > learning transfer, it is important to notice that the principles of cognitive and experiential learning are constantly present in this meaningful learning process. Cognitive learning modifies the underlying structures of understanding, and experiential learning helps when combining new skills with earlier experiences. Thus, the antecedent of adaptive IT use is a meaningful learning process that includes, in addition to the above described causality path, the features of cognitive and experiential learning. As the result, users may advance from automatic, habitual thinking to active thinking when using IT applications.

Finally, this dissertation suggests an alternative way to evaluate the outcomes of learning, by using a learning transfer construct with three dimensions describing the depth of learning transfer: cognitive replication, adaptation, and innovation. This dissertation measures the ability to adapt skills to new situations, rather than measuring separate, stable skills and knowledge. The dissertation also develops a theoretical framework for the learning process in the IT training context (ITLP). The framework is built around the key constructs of anxiety, attitudes, flow experience, intention to use, learning transfer and their causal relationships. The final ITLP framework is presented in Figure 21 below.

![Figure 21. The final ITLP framework](image)

The final ITLP framework clarifies some details. First, beliefs (= motivation, shown in the figure as Attitudes (ATI)) is an antecedent (1) of flow experience (FE). Second, learning transfer may predict (2) actual IT use, similar to the
relationship between intention to use and actual IT use as an enabler. This needs to be explored further in future research.

5.2.2 Practical contribution

This dissertation makes many practical contributions due to its longitudinal study approach and practical nature. In addition, the author has been involved all the time as both a participant and an observer.

First, this dissertation presents computer anxiety in a new light. It has been known that training decreases the levels of anxiety, but in the context of this study, the role of anxiety was shown to be different from what was expected. In the first longitudinal study, users did not feel that lower anxiety levels resulted in ease of use. Rather, the perceived ease of use may have been a function of users’ comparisons of the ease of use of more advanced applications (such as those taught on the course) with the ease of use of applications they were already familiar with. Maybe perceived ease of use cannot be improved so much by training IT, especially among experienced users. Instead, software with more user-friendly interfaces should be developed.

Secondly, this research suggests that expectations are used in re-measuring beliefs and attitudes. However, satisfaction seems to have no impact on predicting IT use. Hence, it is not necessary to measure it in the IT learning context simultaneously with beliefs and attitudes. As the theory of reasoned action (TRA) argues that it is specifically beliefs that change, and that attitudes are the sum of beliefs, it is recommended that only attitudes should be measured. However, when measuring attitudes, it is necessary to keep in mind the sequential relationship between beliefs and attitudes.

Thirdly, this dissertation gives recommendations for learning arrangements. The study promotes the creation of learning environments where skills and challenges are in balance, in order to keep learners on “the flow channel”. It is certainly possible to create tasks that generate an increasing flow cycle. Of course, the tasks should have clear goals and be stimulating. Learning environments where learners can actively participate and learn by doing or co-operating, and where they receive immediate feedback, should be created.

Finally, this research highlights the importance of the usefulness of a technology, as this impacts on how efficiently individuals will learn to adapt it. The better a technology can be adapted, the more it may be used. This, in turn, will influence performance.

5.3 Limitations and further research

No research is without limitations and this dissertation is not an exception. One limitation of this longitudinal survey research arises from the
methodologies used. Qualitative methods should also be applied in order to increase understanding of the learning process in the IT leaning context.

Another methodological concern is the measurement of the constructs. The research data consisted of the self-reported, experience-based measures of the course participants. A better way to measure the constructs would have been to use a recording system to find out the actual use of an information system. According to Straub et al. (1995), the self-reported system usage and computer-recorded system usage constructs did not relate to each other. It seems that computer-recorded measures are more objective, although they showed distinctly weaker links to other self-reported TAM measures. However, computer-recorded usage measurement is not without concern either. If it measures only the amount of time spent, or the frequency or sum of the tasks finished, it does not tell the whole truth. In addition to the above-mentioned measures, it is important to know how users utilize the software, that is, whether they use the system adaptively or innovatively. Nowadays, it is possible to record whatever is done in the system, for example, what features are used and how they are used to conduct different tasks. As the number of features and tasks in a system can be very high, the recording system may produce a huge amount of so-called big data that can be analyzed easily with specific tools for data and text mining, for example. Combining observational or just-in-time measurements such as the experience sampling method (ESM), or biometrical methods with the computer-recorded big data, would provide information that could help to utilize information systems more efficiently, predict training needs, and target the training better in both organizations and schools.

Moreover, it might have been useful to compare the self-reported learning transfer measures with the grades of the course participants in order to explore adaptive abilities in IT use. In this research, the duration of the courses was short, and the 45-minute or 2-hour tests given at the end of the courses concentrated on evaluating repetitive, technology-oriented basic skills rather than adaptive abilities. The measurement of adaptive skills would require a much longer testing time. Hence, in this case the course grade is not appropriate for measuring adaptive abilities in IT use.

Many theories have been applied in this dissertation. They were chosen because they are the most commonly used in IS disciplines. Other theories could also be used in the future to examine how to increase an individual’s competence and capabilities by coaching the adaptation of IT skills and knowledge in novel situations. For example Intellectual Capital theory (Stewart 1997), which holds that value is created especially by individuals’ skills and knowledge, that is, by human capital, might be interesting to apply. Furthermore, knowledge creation (Nonaka’s SECI model), including the ba concept could be useful for testing the creation of IT skills in different ba states:
Discussion and conclusions

originating, interacting, cyber, and exercising ba (see Nonaka and Konno 1998; Nonaka et al. 2008).

In addition, it might be valuable to test different teaching methods, such as co-operative learning, problem-based learning, and inquiry-based learning. Furthermore, it would be very interesting to study the role of games, educational games or gamification in the IT training context. It could be especially valuable to test different approaches in parallel. The generalizability of the results could also be tested by using other than office applications.

Some of the inconsistencies with the extant IS research recognized in this dissertation would also be useful to re-examine. First, the relationship between computer anxiety and perceived ease of use is still unclear and could be an interesting topic to study further. The role of computer anxiety in itself is problematic. While some studies have found the impact of anxiety on usage to be insignificant (Compeau and Higgins 1999; Venkatesh et al. 2003), many studies have found that computer anxiety is indeed an important predictor of the use of technology (Czaja et al. 2006; Tung and Chang 2007).

Secondly, the impact of attitudes is unclear. Some longitudinal studies, including this dissertation in the context of learning to use applications, have indicated that beliefs and attitudes become more negative during the learning process (Bhattacherjee and Premkumar 2004; Szajna and Scamell 1993). On the other hand, it has been shown that the more one’s experience with particular applications increases, the more positive one’s attitudes become (Venkatesh et al. 2003). Further, the direct or interactive influence of attitudes on intention is under debate. This dissertation and a multitude of other longitudinal studies argue that the attitude construct is significant across many time periods (Bhattacherjee and Premkumar 2004; Szajna and Scamell 1993) or is the strongest predictor of behavioral intention (e.g., Ajzen 1991; Ajzen and Fishbein 1980; Harrison et al. 1997; Mathieson 1991; Taylor and Todd 1995). However, other studies argue that the attitude construct is non-significant (Taylor and Todd 1995; Thompson and Higgins 1991; Venkatesh et al. 2003). Venkatesh et al. (2003) demonstrated that attitudinal constructs are significant only when they are related to performance, and when effort expectancies are not included in the model. Hence, it seems that an attitudinal construct is significant or non-significant depending on the structure of the model, that is, whether constructs related to performance or effort expectancies are on the same line as an attitudinal construct or behind it. These kinds of constructs seem to be sequential, rather than parallel. Yet another concern is that attitudinal constructs are defined in many different ways in extant studies.

Thirdly, the synthesis of motivation, flow experience, and learning transfer in the findings of this dissertation differs from that found in mainstream IS literature. Motivation and flow experience are essential constructs impacting on
learning and accepting IT. Motivation is usually operationalized as perceived IT characteristics in IS research (e.g., Venkatesh 1999). The basic assumption in IS literature has been to see motivation as a determinant of IT use. Furthermore, motivational factors can directly influence transfer of learning (Pugh and Bergin 2006). In mainstream IS research, flow experience is an antecedent of perceived usefulness (=motivation). The present dissertation argues that motivation (PU) is a cause of flow experience and theorizes that motivation (PU) should influence transfer of learning indirectly through flow experience. These inconsistencies in the current IT literature, in particular, call for future research to better identify the factors impacting learning transfer.

Finally, the respondents in the present research were students participating in separate courses. The general opinion is that young people, such as the students in this study, are very skilled in using computers. However, it seems that their skills in office applications, especially in spreadsheets, are limited. In the future, it would be interesting to study how these digital natives are different from older people in using office applications in general and especially spreadsheets.

5.4 Conclusions

This dissertation studied the learning process in the IT training context. The main theoretical contribution was the theoretical IT Learning Process (ITLP) framework that was developed and tested in the context of office application training. The framework was based on the literature on information systems, human behavior, flow, learning transfer, and motivation. The key findings of the dissertation were as follows: First, the notion of ease of use is independent of computer anxiety. Secondly, user beliefs and attitudes change during the IT learning process, due to beliefs about usefulness, rather than satisfaction. Thirdly, extrinsic motivation is more likely to cause a flow state than vice versa. Fourthly, students gain flow experience when learning to use a spreadsheet application. Flow, in turn, is the major determinant of learning transfer. Finally, a meaningful learning process enables deeper learning transfer, that is, users gain adaptive IT abilities.

To conclude, IT training is often regarded as too expensive and not necessary, especially for digital natives, due to their good basic IT skills. However, new IT technologies challenge all users daily, and nowadays lifelong learning is a must for each and every one of us. In the context of contemporary complex organizational information systems, IT training is even today a necessary antecedent of learning and learning transfer, even for digital natives. IT training can be highly cost-effective by significantly increasing the performance of users, be they digital natives or from an older generation. Even experienced IT users should, from time to time, pause and ponder how they are using IT applications.
Are they laboriously and manually doing things that could be done much more effortlessly by applying the features of the application? In other words, could all users move from habitual, automatic thinking to more active thinking when using IT applications?
6. REFERENCES FOR PART I


REFERENCES FOR PART i


REFERENCES FOR PART i


REFERENCES FOR PART I


## 7. Appendices

<table>
<thead>
<tr>
<th>Title of the Paper</th>
<th>Research Questions</th>
<th>Methods</th>
<th>Theories</th>
<th>Results</th>
<th>Outlet</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Paper 1: The Role of Training in Decreasing Anxiety among Experienced Computer Users</strong></td>
<td>RQ1a: How does IT training influence IT anxiety? 1) How does CDL-training influence user acceptance of information systems among relatively experienced users? 2) Does CDL training decrease computer anxiety? 3) What is the relative importance of self-efficacy?</td>
<td>Questionnaire (N = 96) 2004 – 2005 Correlation analysis, t-tests</td>
<td>TAM, anxiety and self-efficacy literature</td>
<td>1) CDL training decreases individual computer anxiety level. 2) Reduced computer anxiety increases computer self-efficacy. 3) Reduced computer anxiety increases intention. 4) Reduced computer anxiety does not increase perceived ease of use.</td>
<td>ECIS, 2009</td>
</tr>
<tr>
<td><strong>Paper 2: Changes in User Beliefs and Attitudes During the Learning Process of Office Applications</strong></td>
<td>RQ1b: How does IT training influence IT beliefs, and attitudes? 1) How do students’ beliefs and attitudes change during the learning process when they participate in a software training course? 2) How can these changes be explained? 3) What is the mechanism behind the changes?</td>
<td>Questionnaire (N = 96) Fall 2006 t-tests, SEM</td>
<td>TRA, EDT</td>
<td>1) Expectations may operate directly on behavioral beliefs rather than influencing attitudes through feelings of (dis)satisfaction. 2) The disconfirmatory mechanism may be a tacit feature of the deliberative process as pictured by TRA. 3) Separate constructs for feelings of (dis)satisfaction may not be needed for understanding the deliberative process.</td>
<td>ECIS, 2012</td>
</tr>
<tr>
<td><strong>Paper 3: Flow Experiences in Learning to Use a Spreadsheet Application</strong></td>
<td>RQ2. How does IT training-related flow experience influence learning transfer? 1) Do students have flow experiences when learning to use a spreadsheet application? 2) What are the features of the flow experience in this context? 3) Does flow experience affect learning outcomes? 4) What is the relationship between flow experience, learning outcomes, and perceived usefulness?</td>
<td>Questionnaire (N = 116) Fall 2010 t-tests, SEM</td>
<td>Flow Learning transfer TAM</td>
<td>1) The students have flow experiences. 2) The features of Flow experience are listed, five altogether. 3) Flow experience affects learning outcomes. 4) Perceived usefulness does not affect learning outcomes. Flow experience is an antecedent of perceived usefulness.</td>
<td>HICSS, 2012</td>
</tr>
<tr>
<td><strong>Paper 4: Learning to use IT adaptively: Flow experience Increases Transfer of Learning</strong></td>
<td>RQ3: What are the antecedents of IT training-related flow experience? 1) Re-examination of the relationships between behavioural beliefs, flow-experience, and learning transfer</td>
<td>Questionnaire (N=113) fall 2012 SEM</td>
<td>Flow learning transfer, self-determination, UTAUT</td>
<td>1) Flow experience has a statistically significant effect on learning transfer 2) Perceived usefulness has a statistically significant effect on flow experience 3) Perceived usefulness has no direct effect on learning transfer.</td>
<td>Unpublished</td>
</tr>
</tbody>
</table>

### 7.1 Appendix A: Positioning of the papers
7.2 Appendix 1: Questionnaire items used in Paper 1

**HELINGIN KAUPPAKORKEAKOULOU**

**KYSELY**

Tietojärjestelmätiede

Tietokoneen ajokorri –kurssi (pvm)

Bertlia Sokura

sokura@hkki.fi

pvm

---

### 1. Taustatiedot

<table>
<thead>
<tr>
<th>Mies □</th>
<th>Nainen □</th>
<th>Miksi hakeudit Tietokoneen ajokorri –kurssille? (Voit valita useamman vaihtoehton)</th>
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<tr>
<td></td>
<td></td>
<td>Oppiakseen tietokoneen peruskäytön □</td>
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<td></td>
<td>Parantaakseen tietokoneen käyttötaitojani □</td>
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<td></td>
<td></td>
<td>Ystävä / Kollega suosittelu □</td>
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<td></td>
<td></td>
<td>Esimies / Työnantaja suositteli □</td>
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<td></td>
<td>Saadakseen todistuksen □</td>
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<td></td>
<td></td>
<td>Myy syy, mikä? □</td>
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| Työkokemus (vuosia) | _ _ |

---

### Kuinka kauan olet käyttänyt mikrotietokonetta (vuosia)? _ _

<table>
<thead>
<tr>
<th>Kuinka usein käytät tietokonetta</th>
<th>Päivittäin</th>
<th>Viikoittain</th>
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</thead>
<tbody>
<tr>
<td>Tunto</td>
<td>_ _</td>
<td>_ _</td>
</tr>
</tbody>
</table>

### Onko sinulla tietokone käytettävissä

- **Kotona**: oma □, yhteinen □
- **Koulussa**: oma □, yhteinen □
- **Työpaikalla**: oma □, yhteinen □

### Onko sinulla Internet-yhteyksä käytettävissä

- **Kotona**: oma □, yhteinen □
- **Koulussa**: oma □, yhteinen □
- **Työpaikalla**: oma □, yhteinen □

---

### Kuinka olet enimmäkseen hankkinut tietotekniset taitosi? Valitse vain yksi vaihtoehto.

- Peruskoulun ylaasteella □
- Lukiossa □
- Erillisillä kurseilla □
- Työssä □
- Itseopisekunnan □
- Muuten, miten? □

---

### Aikaisempi tietotekniikkakoulutus peruskoulun/lukion jälkeen (myös muu kuin mikrotietokoneet)

- Ei ollenkaan □
- 1 – 50 tunta □
- 51 – 100 tunta □
- Yli 100 tunta □
2. Teknologian hyväksyminen

Ota kantaa seuraaviin väittämiin seitsemän portaisella asteikolla siten, että 1 = täysin samaa, 7 = täysin eri mieltä.

Minun on helppo tulla taitavaksi mikrotietokoneen perustöyökaluohjelmien käyttäjäksi.

Aion käyttää mikrotietokoneen perustöyökaluohjelmia erilaisissa työtehtävissäni milloin vain mahdollista.

Pystyisin tekemään työn tietokoneella, jos olen nähnyt jonkun toisen käyttävän sitä ensin.

Tietokoneen käyttäjän A-kortti -tutkinnon antamat valmiudet helpottavat työskentelyäni.

Mikrotietokoneen perustöyökaluohjelmien käyttö on helppoa.

Tietokoneen käyttäjän A-kortti -tutkinnon antamat valmiudet lisäävät tuottavuutiani.

Yetävieni mielostä minun pitäisi käyttää mikrotietokoneen perustöyökaluohjelmia.

Tietokoneen käyttäjän A-kortti -tutkinnon antamat taidot auttavat minua selvitymään tehtävistäni nopeammin.

Mieletäni on tärkeää, että opetuksessa käytetty ohjelmat ovat yhteensopivia tietokoneeseen, jota käytän kotona ja / tai työssä.

Minua pelottaa ajatus, että voisim menetää paljon tietoa painamalla väärrää tietokoneen näppäintä.

Mieletäni Tietokoneen käyttäjän A-kortti -tutkinnon antamia valmiuksia tarvitaan työssäni / opiskelussani.

Pystyisin tekemään työn tietokoneella, jos joku ensin näyttäisi minulle, kuinka tehdä ko. tehtävää.

Mieletäni Tietokoneen käyttäjän A-kortti -tutkinnon antamat valmiudet ovat keskeisiä työssäni / opiskelussani.

Minun on helppo tehdä mikrotietokoneen perustöyökaluohjemiä niitä asioita, joita haluan tehda.

---

1 mikrotietokoneen perustöyökaluohjelmat tarkoittavat samaa kuin Tietokoneen käyttäjän A-kortti -tutkinnon suorityvat perustöyökaluohjelmat eli tekstinkäsittely, taiuikkokäsittely, esitysgrafikka, hetskamat, internet ja sähköposti selä laiteen käyttö (Windows).
Ota kantaa seuraavien välttämien seiteeman portaisella asteikolla siten, että 1 = täysin samaa, 7 = täysin eri mieltä.

Pelkaan käyttää mikrotietokonetta ja sen ohjelmia. 1 2 3 4 5 6 7

Pystyisin tekemään työn tietokoneella, jos saan apua sitä tarvitessani. 1 2 3 4 5 6 7

Yleisesti koon mikrotietokoneen perustyökaluohjelmien käytön helpoksi. 1 2 3 4 5 6 7

Kollegojeni mielestä minun pitäisi käyttää mikrotietokoneen perustyökaluohjelmia. 1 2 3 4 5 6 7

Pystyisin tekemään työn tietokoneella, jos olen käyttänyt samanlaisia ohjelmia aikaisemmin samaan tehtävään. 1 2 3 4 5 6 7

Mielestäni Tietokoneen käyttäjän A-kortti-tutkinnon antamat valmiudet ovat oleellisia työssäni / opiskelussani. 1 2 3 4 5 6 7

Pystyisin tekemään työn tietokoneella, jos minulla olisi paljon aikaa tehdä ko. tehtävää. 1 2 3 4 5 6 7

Ihmiset, jotka vaikuttavat käytökseeni, ovat sitä mieltä, että minun tulisi käyttää mikrotietokoneen perustyökaluohjelmia. 1 2 3 4 5 6 7

Mielestäni Tietokoneen käyttäjän A-kortti-tutkinnon antamat valmiudet parantavat suoritumistani työtehtävistä. 1 2 3 4 5 6 7

Vihaan käyttää tietokonetta, koska pelkään tekeväni virheitä, joita en voi korjata. 1 2 3 4 5 6 7

Aion käyttää mikrotietokoneen perustyökaluohjelmia laajasti kaikissa työtehtävissäni. 1 2 3 4 5 6 7

Pystyisin tekemään työn tietokoneella, jos joku muu auttaa minut alkuun. 1 2 3 4 5 6 7

Mielestäni Tietokoneen käyttäjän A-kortti-tutkinnon antamat valmiudet ovat tärkeitä työssäni / opiskelussani. 1 2 3 4 5 6 7

Minulle tärkeiden ihmisten mielestä minun pitäisi käyttää mikrotietokoneen perustyökaluohjelmia. 1 2 3 4 5 6 7

Mielestäni on tärkeää, että opetuksessa käytetyt ohjelmat ovat yhteensopivia ohjelmistoon, jota käytän kotona ja / tai työssä. 1 2 3 4 5 6 7

Esimieheni mielestä minun tulisi käyttää mikrotietokoneen perustyökaluohjelmia. 1 2 3 4 5 6 7

Lämmin kiitos tutkimusyhteistyöstä!
7.3 Appendix 2: Questionnaire items used in Paper 2

Cover page of the questionnaire:

PTO SL2006 - Tietokoneen perustyövälineohjelmat
Tämän foorumin tarkoituksena on kartoittaa Perustyövälineohjelmat-kursille osallistuvien asenteita ja kokemuksia valineiden hyödyllisyydestä kurssin alussa, keskivälissä ja lopussa. Klikkaa ao. linkkiä alla avataksesi kyselyn.

<table>
<thead>
<tr>
<th>Agenda</th>
</tr>
</thead>
</table>
| Alkukysely
| Keskivaiheen kysely
| Loppuksely

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FacilitatePro
Questionnaire at the beginning of the course
**Questionnaire in the middle of the course**

---

**OSIO 1**

<table>
<thead>
<tr>
<th>Vastauksen</th>
<th>Yestaus</th>
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<tbody>
<tr>
<td>1. Verrattuna alkuperäisin odotuksini perustyövälineohjelmien kyky parantaa suorituskykyäni oli</td>
<td>Valitse tästä</td>
</tr>
<tr>
<td>2. Verrattuna alkuperäisin odotuksini perustyövälineohjelmien kyky lisätä tuottavuutanni oli</td>
<td>Valitse tästä</td>
</tr>
<tr>
<td>3. Verrattuna alkuperäisin odotuksini perustyövälineohjelmien kyky lisätä tehokkuutanni oli</td>
<td>Valitse tästä</td>
</tr>
<tr>
<td>4. Verrattuna alkuperäisin odotuksini perustyövälineohjelmien kyky olla hyödyksi opinnoissani/työssäni oli</td>
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</tr>
</tbody>
</table>

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**OSIO 2**

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>5. Koskien tietokoneen perustyövälineohjelmien käyttöäni, olen</td>
<td>Valitse tästä</td>
</tr>
<tr>
<td>6. Koskien tietokoneen perustyövälineohjelmien käyttöäni, olen</td>
<td>Valitse tästä</td>
</tr>
<tr>
<td>7. Koskien tietokoneen perustyövälineohjelmien käyttöäni, olen</td>
<td>Valitse tästä</td>
</tr>
<tr>
<td>8. Koskien tietokoneen perustyövälineohjelmien käyttöäni, olen</td>
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</table>

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**OSIO 3**

<table>
<thead>
<tr>
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<th>Yestaus</th>
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<tbody>
<tr>
<td>9. Tietokoneen perustyövälineohjelmien käyttäminen parantaa suorituskykyäni</td>
<td>Valitse tästä</td>
</tr>
<tr>
<td>10. Tietokoneen perustyövälineohjelmien käyttäminen lisää tuottavuutanni</td>
<td>Valitse tästä</td>
</tr>
<tr>
<td>11. Tietokoneen perustyövälineohjelmien käyttäminen lisää tehokkuutanni</td>
<td>Valitse tästä</td>
</tr>
<tr>
<td>12. Tietokoneen perustyövälineohjelmien käyttämisestä on hyötyä opinnoissani/työssäni</td>
<td>Valitse tästä</td>
</tr>
</tbody>
</table>
### OSIO 4

| 13 | Kaikki näkökohdat huomioiden perustyövälineohjelmien käyttäminen on | Valitse tästä |
| 14 | Kaikki näkökohdat huomioiden perustyövälineohjelmien käyttäminen on | Valitse tästä |
| 15 | Kaikki näkökohdat huomioiden perustyövälineohjelmien käyttäminen on | Valitse tästä |
| 16 | Suhtaudun tietokoneen perustyövälineohjelmiin | Valitse tästä |

### OSIO 5

| 17 | Alon jatkaa perustyövälineohjelmien käyttöä oppiaksesi lisää uusista teknologiosta | Valitse tästä |
| 18 | Alon jatkaa perustyövälineohjelmien käyttöä oppiaksesi uusia ohjelmistotaitoja | Valitse tästä |
| 19 | Alon jatkaa perustyövälineohjelmien käyttöä monipuolisemmin tämän kurssin jälkeenkin | Valitse tästä |
| 20 | Alon käyttää perustyövälineohjelmia tehokkaammin (nopeammin) jatkossa | Valitse tästä |
| 21 | Uuskon pystyväni opastamaan asian untuvasti myös ystäviäni / kollegoituani perustyövälineohjelmien käytössä | Valitse tästä |
| 22 | Kirjoita lopuksi ao. kenttään Kurssikuvaus-lomakkeeseen kirjoitettu anonymi numerotunnus. Käytän saman tunnusta myös aiku-, keski- ja loppukyselyissä! Tieto kerätään tutkimuselämisissä tarkoituksia varten, eikä sen perusteella voida päätellä vastaajan henkilöllisyyttä. | Valitse tästä |

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**Questionnaire at the end of the course**

<table>
<thead>
<tr>
<th>Loppukysely</th>
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</tr>
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<tbody>
<tr>
<td>Tämän kyselyn tarkoituksena on kartoittaa Tietokoneen perustöväläineohjelmien kyky parantaa suorituskykyäsi.</td>
<td>Valitse tästä</td>
</tr>
<tr>
<td>*astaa oheisiin kysymyksiin, jotka koskevat perustöväläineohjelmien hyödyllisyttä sekä asenteitasi niitä kohtaan. Syötä viimeiseen enttään kursilomakkessesi oleva punainen numero. Paina lopuksi Save and Submit -nappia.</td>
<td></td>
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</tbody>
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<table>
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<tr>
<th>OSIO 1</th>
<th>Vastaus</th>
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<tbody>
<tr>
<td>1 Verrattuna alkuperäisinsin odotuksini perustöväläineohjelmien kyky parantaa suorituskykyäsi oli</td>
<td>Valitse tästä</td>
</tr>
<tr>
<td>2 Verrattuna alkuperäisinsin odotuksini perustöväläineohjelmien kyky lisättä tuottavuuttani oli</td>
<td>Valitse tästä</td>
</tr>
<tr>
<td>3 Verrattuna alkuperäisinsin odotuksini perustöväläineohjelmien kyky lisättä tehokkuuttani oli</td>
<td>Valitse tästä</td>
</tr>
<tr>
<td>4 Verrattuna alkuperäisinsin odotuksini perustöväläineohjelmien kyky olla hyödyks opinnoissani/työssäni oli</td>
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<td>5 Koskien tietokoneen perustöväläineohjelmien käyttöä, olen</td>
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<tr>
<td>6 Koskien tietokoneen perustöväläineohjelmien käyttöä, olen</td>
<td>Valitse tästä</td>
</tr>
<tr>
<td>7 Koskien tietokoneen perustöväläineohjelmien käyttöä, olen</td>
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<th>Vastaus</th>
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<tbody>
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<td>9 Tietokoneen perustöväläineohjelmien käyttäminen parantaa suorituskykyäsi</td>
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</tr>
<tr>
<td>10 Tietokoneen perustöväläineohjelmien käyttäminen lisää tuottavuuttani</td>
<td>Valitse tästä</td>
</tr>
<tr>
<td>11 Tietokoneen perustöväläineohjelmien käyttäminen lisää tehokkuuttani</td>
<td>Valitse tästä</td>
</tr>
<tr>
<td>12 Tietokoneen perustöväläineohjelmien käyttämisestä on hyötyä opinnoissani/työssäni</td>
<td>Valitse tästä</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OSIO 4</th>
<th>Vastaus</th>
</tr>
</thead>
<tbody>
<tr>
<td>13 Kaikki näkökohdat huomioiden perustöväläineohjelmien käyttäminen on</td>
<td>Valitse tästä</td>
</tr>
<tr>
<td>14 Kaikki näkökohdat huomioiden perustöväläineohjelmien käyttäminen on</td>
<td>Valitse tästä</td>
</tr>
<tr>
<td>15 Kaikki näkökohdat huomioiden perustöväläineohjelmien käyttäminen on</td>
<td>Valitse tästä</td>
</tr>
<tr>
<td>16 Suhtaudun tietokoneen perustöväläineohjelmiin</td>
<td>Valitse tästä</td>
</tr>
</tbody>
</table>
7.4 Appendix 3: Questionnaire items used in Paper 3

Excel-kokemuksia


Vastaamiseen kuluu aikaa noin 10 minuuttia.

1. Arvioi seuraavia taitojasi ennen Excel-kurssille osallistumista kouluarvosanoin 4-10

Yleinen Tietokoneen käyttötaito
Excel-ohjelman käyttötaito

2. Arvioi myös seuraavia asioita kouluarvosanoin 4-10

Excel-kurssin oppimistavoitteet olivat selkeästi esitetyt
Excel-kurssin työskentelytavat olivat selkeästi esitetyt

3. Arvioi tuntimäärä, jonka käytit Excelin opiskeluun


Olin uppoutunut perusteellisesti Excel-tehtäviin
Olin syventynyt intensiivisesti Excel-tehtäviin
Huomioni oli keskittyneen toimintaan
Muu tietokoneen käyttö (esim. Facebook) ei häirinnyt työskentelyäni
Kirjoittimien ääni ja yleinen liikehdintä luennon aikana eivät häirinneet työskentelyäni
Excein opiskelu on mielenkiintoista

En ollut uppoutunut perusteellisesti Excel-tehtäviin
En syventynyt Excel-tehtäviin lainkaan
Huomioni ei ollut keskittynyt toimintaan
Muu tietokoneen käyttö häiritsi työskentelyäni
Kirjoittimien ääni ja yleinen liikehdintä luennon aikana häiritsivät työskentelyäni
Excein opiskelu ei ole mielenkiintoista
5. Myös seuraavat väittämät liittyvät tuntemuksiisi opiskellessasi Excel-ohjelman käyttöä. Valitse nyt luku väliltä -3 - +3, siten että -3 = täysin eri mieltä, +3 = täysin samaa mieltä

Olen levollinen käyttäessäni Excel-ohjelmaa.  
Osaan käyttää itsenäisesti Excel-ohjelmaa.  
Minusta tulee taitava Excel-käyttäjä.  
Luutan siis, että osaan käyttää Excel-ohjelmaa.  
Excel-kurssilla hankitut taidot lisäävät suorituskykyyni.  
Excel-kurssilla hankitut taidot lisäävät tuottavuutani.  
Excel-kurssilla hankitut taidot parantavat tehokkuutani.  
Excel-kurssilla hankitusosta taidoista on hyötyä opiskelussani.  
Excel-opintojen aikana olen ollut innokas kokeilemaan myös uusia ohjelman ominaisuuksia.  
Aika tuntuu kuluvan nopeasti, kun opettelen Excel-ohjelman käyttöä.  
Olen taipuvainen kadottamaan ajantajun opetellessani käyttämään Excel-ohjelmaa.  
Excel-ohjelman monipuolisten ominaisuuksien opettelu saa minut tuntemaan, että aika kuluu nopeasti.  
Osaan käyttää hyvin Excel-ohjelmaa.  
Tunnen Excelin ominaisuukset hyvin.  
Osaan käyttää Excel-ohjelmaa vaivattomasti.  
Excelin käytön opettelu on sopivan vaikeaa.  
Excelin käytön opettelu haastaa minut tekemään parhaani.  
Excelin opiskelu tarjoaa minulle lukuisia haasteita voitettavaksi.  
Pystyn soveltamaan kurssilla oppimaani opiskeluun tai työssä.  
Ymmärrän nyt paljon paremmin oikean tavan käyttää Exceliä kuin ennen kurssia.  
Aikaisempaan verrattuna tiedän paljon enemmän ”oikeista” tavoin työskennellä Excel-ohjelmalla.  
Pystyn mukauttamaan kurssilla oppimani opiskeluun tai työön lisääkseni tehokkuutani ja tuottavuutani.  
Haluan pitää Excel-tietämysenä ajan tasalla myös jatkossa.  
Aion päivittää osaamiseni myös, kun Exclin tulee uusia ominaisuuksia.  
Osaan soveltaa Excel-kurssilla oppimiani taitoja uusien työtapojen löytämiseksi.  
Pystyn jatkossa käyttämään innovatiivisesti oppimiani Excel-toimintoja.  
Olen innokas kokeilemaan jatkossa itsenäisesti Excelin uusia ominaisuuksia.
6. Kuvaile persoonallisuuttasi valitsemalla sopiva vaihtoehto seuraavista. -3 = täysin eri mieltä, +3 = täysin samaa mieltä

-3 -2 -1 0 +1 +2 +3

VIihdyn teorioiden ja abstraktien asioiden parissa.

Pidän ongelmien ja tehtävien ratkaisemisesta.

Filosofiset keskustelut eivät kiinnosta minua.

Menetän joskus mielenkiintoni, kun ihmiset puhuvat hyvin abstraktisti ja teoreettisesti.

En ole kiinnostunut maailmankaikkeuden olemuksen tai ihmisenä olemisen pohdiskelusta.

Olen älyllisesti erittäin utelias.

Olen laajalti kiinnostunut älyllisistä asioista.

Luen mielelläni filosofiaa käsitteleviä kirjoja.

Tunnen itseni usein jännittyneeksi ja hermostuneeksi.

Olen harvoin pelokas tai levoton.

Pelästyn helposti.

En huolehdi turhista.

Olen usein huolestunut asioista, jotka saattavat mennä vikaan.

Joskus mieleeni tulee pelottavia asioita.

Olen vain harvoin huolestunut tulevaisuudesta.

Minulla on vähemmän pelkoja kuin muilla ihmisillä.

7. Arvioi vielä tämänhetkisiä taitojasi kouluarvosanoin 4-10

4 5 6 7 8 9 10

Yleinen tietokoneen käyttötaito

Excel-ohjelman käyttötaito


☐ Kurssi on pakollinen
☐ Halusin oppia käyttämään Excel-ohjelmaa
☐ Excel-taitoja tarvitaan muiden aineiden opiskelussa
☐ Excel-taitoja tarvitaan työelämässä

9. Sana on vapaa. Kerro lyhyesti, mitä haluat nostaa esiin joko negatiivisista tai positiivisista tuntemuksistasi (ta molemmista) kurssin aikana. Onko sinulla parannusehdotuksia kurssin toteutukseen?

________________________________________________________________

________________________________________________________________

________________________________________________________________
10. Sukupuoli
   ○ Mies
   ○ Nainen

11. Ikäryhmä
   ○ 15 tai alle
   ○ 16-26
   ○ 27-36
   ○ 37-46
   ○ 47-56
   ○ 57 tai yli

12. Opiskelijanumero (jos et halua antaa opiskelijanumeroasi, voit laittaa merkkijonon, jonka vain sinä tiedät ja muistat jatkossa)

____________________________________________________________________________________

13. Jos haluat osallistua muistitikkujen arvontaan, laita sähköpostiosoitteesi tähän:

____________________________________________________________________________________
### 7.5 Appendix 4: Questionnaire items used in Paper 4

**Excel-käyttökyselfy kurssin alussa**
Excel on tärkeä työväline monilla kauppakorkeakoulun kureuseilla. Tällä kyselyllä selvitämme osaamisen lähtötasoa tämän kurssin alkaessa. Tuloksia on tarkoitus käyttää myös tutkimustarkoituksiin.

**Antamasi vastaukset eivät vaikuta kurssiarvosanaan.**

Kaikki aineisto käsittellään luottamuksellisesti. Tutkimuksen tekijät ovat Antti Salovaara, Bertta Sokura ja Anssi Öörni (etunimi.sukunimi@aalto.fi).

**Vastausohjeet:**
- Vastaa mahdollisimman totuudellisesti.
- Älä palaa taaksepäin korjaamaan aiempia vastauksiasi
- Älä tutustu myöhempänä oleviin kysymyksiin etukäteen

**Taustatiedot**

<table>
<thead>
<tr>
<th>Opiskelijanumero</th>
<th>________________ (Tarvitsemme tämän yhdistääksemme kurssin alussa ja lopussa olevat vastaukset samaan ihmiseen. Emme siis selvitä tällä tiedolla, kuka kukin vastaaja on ollut.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vuosikurssi</td>
<td>___________</td>
</tr>
<tr>
<td>Syntymävuosi</td>
<td>___________</td>
</tr>
<tr>
<td>Sukupuoli</td>
<td>[ ] nainen [ ] mies</td>
</tr>
</tbody>
</table>

Tähänastinen kokemuksesi tietokoneiden käytöstä:

<table>
<thead>
<tr>
<th>Käyttötapa</th>
<th>Moneltako vuodelta kokemusta</th>
<th>Käytön aktiivisuus viimeisten 12 kk aikana</th>
</tr>
</thead>
<tbody>
<tr>
<td>WWW-sivuilla olevan sisällön hakeminen ja lukeminen</td>
<td>ei koke-musta 0–1 v 1–5 v yli 5 v</td>
<td>päivit-täin viikoit-tain kuukau-sittain harvem-min ei ollen-kaan</td>
</tr>
<tr>
<td>Viestiminen Facebookilla tai muulla sosiaalisella mediailla</td>
<td>[ ] [ ] [ ] [ ]</td>
<td>[ ] [ ] [ ] [ ]</td>
</tr>
<tr>
<td>Viestiminen sähköpostilla</td>
<td>[ ] [ ] [ ] [ ]</td>
<td>[ ] [ ] [ ] [ ]</td>
</tr>
<tr>
<td>Viestiminen Skypellä tai messengerillä</td>
<td>[ ] [ ] [ ] [ ]</td>
<td>[ ] [ ] [ ] [ ]</td>
</tr>
<tr>
<td>Microsoft Excel ja muut taulukkolaskenta-ohjelmat</td>
<td>[ ] [ ] [ ] [ ]</td>
<td>[ ] [ ] [ ] [ ]</td>
</tr>
<tr>
<td>Muut hyötyohjelmat (tekstinäkittely, esitysten tekon)</td>
<td>[ ] [ ] [ ] [ ]</td>
<td>[ ] [ ] [ ] [ ]</td>
</tr>
<tr>
<td>Pelaaminen (konsolipelit ja pelit jotka vaativat erillisen asennuksen tietokoneelle)</td>
<td>[ ] [ ] [ ] [ ]</td>
<td>[ ] [ ] [ ] [ ]</td>
</tr>
<tr>
<td>Ohjelmointi</td>
<td>[ ] [ ] [ ] [ ]</td>
<td>[ ] [ ] [ ] [ ]</td>
</tr>
</tbody>
</table>

Rehellisesti puhuen, kuinka kiinnostunut olet oppimaan Excelin käyttöä (vastaus ei vaikuta arvosanaan):

[ ] en ole ollenkaan kiinnostunut [ ] olen vain vähän kiinnostunut [ ] olen jonkin verran kiinnostunut [ ] olen erittäin kiinnostunut
Appendices

1. Aika tuntuu kuluvan nopeasti, kun opettelet Excel-ohjelman käyttöä.
   - Täysin eri mieltä
   - Ei samaa eikä eri mieltä
   - Täysin samaa mieltä
   - 1 2 3 4 5 6 7

2. Osaan käyttää hyvin Excel-ohjelmaa.
   - Täysin eri mieltä
   - Ei samaa eikä eri mieltä
   - Täysin samaa mieltä
   - 1 2 3 4 5 6 7

3. Excelin käytön opettelu on sopivan vaikeaa.
   - Täysin eri mieltä
   - Ei samaa eikä eri mieltä
   - Täysin samaa mieltä
   - 1 2 3 4 5 6 7

4. Pystyn soveltamaan kurssilla oppimaani opiskelussa tai työssä.
   - Täysin eri mieltä
   - Ei samaa eikä eri mieltä
   - Täysin samaa mieltä
   - 1 2 3 4 5 6 7

5. Pystyn mukauttamaan kurssilla oppimani opiskeluun tai työhön lisätäkseni tehokkuuttani ja tuottavuuttani.
   - Täysin eri mieltä
   - Ei samaa eikä eri mieltä
   - Täysin samaa mieltä
   - 1 2 3 4 5 6 7

   - Täysin eri mieltä
   - Ei samaa eikä eri mieltä
   - Täysin samaa mieltä
   - 1 2 3 4 5 6 7

Excel-tuntemus
Vastaa tietämyksesi pohjalta seuraaviin Excelin toimintaa koskeviin kysymyksiin. **Jos et tiedä, älä yritä arvata, vaan vastaa “en tiedä”**. Oikeilla ja väärillä vastauksilla ei ole vaikutusta kurssin läpäisemiseen.

Kussakin kysymyksessä on **vain yksi oikea vastausvaltoehdo**. Laita siksi rasti vain yhteen kohtaan kussakin kysymyksessä.

Mitä pitää muistaa kopioitaessa taulukon sisältöä uuteen paikkaan Excelin työskentelytilassa?

- [ ] Taulukon sisältö pitää ensin muistaa tallentaa.
- [ ] Exceliil lepitää kertoa, kumpaa taulukkoa sen on käsiteltävä ensisijaisena sisältöänä.
- [ ] Numeroiden sijaan Excel kopioi kaavojen, ellei Exceliä pyydä erikseen tekemään toisin.
- [ ] Taulukoiden kopioinnista syntyy paljon väliaikaisia tiedostoja.
- [ ] En tiedä.

Mikä on ero tavallisella ja $-viittauksella Excelissä?

- [ ] Kun $-viittauksen sisältävä kaavaa kopioi, soluviittauksen osoite pysyy paikallaan eikä siirry.
- [ ] $-viittaus käsittelee tekstimuodossa olevaa informaatiota numeroiden sijasta.
- [ ] $-symbolilla voit antaa viittaukselle oman nimen jota voit käyttää kääntöksi kaavojen laatiessasi.
- [ ] $-symboli piilottaa tuloksen näkyvistä, mikä tekee taulukosta siistimmän näköisen.
- [ ] En tiedä.

---

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Laskutoimitukset taulukoissa
(esim. summien, keskiarvojen ja erotusten laskeminen allekkain olevista luvuista)

<table>
<thead>
<tr>
<th>Luettelo</th>
<th>Täysin eri mieltä</th>
<th>Ei samaa eikä eri mieltä</th>
<th>Täysin samaa mieltä</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Excelin käyttö auttaa minua suorittamaan taulukkolaskutoimituksia aiempaa nopeammin.</td>
<td>1 2</td>
<td>3 4 5</td>
<td>6 7</td>
</tr>
<tr>
<td>2 Excelin käyttö parantaa suorituskykyäni taulukkolaskutoimituksissa.</td>
<td>1 2</td>
<td>3 4 5</td>
<td>6 7</td>
</tr>
<tr>
<td>3 Excelin käyttö kasvattaa tuottavuutani taulukkolaskutoimituksissa.</td>
<td>1 2</td>
<td>3 4 5</td>
<td>6 7</td>
</tr>
<tr>
<td>4 Excelin käyttö parantaa tavoitteiden saavuttamista taulukkolaskutoimituksissa.</td>
<td>1 2</td>
<td>3 4 5</td>
<td>6 7</td>
</tr>
<tr>
<td>5 Excelin käyttö tekee taulukkolaskutoimitusten tekemisen helpomaksi.</td>
<td>1 2</td>
<td>3 4 5</td>
<td>6 7</td>
</tr>
<tr>
<td>6 Mielestäni Excel on hyödyllinen taulukkolaskutoimituksissa.</td>
<td>1 2</td>
<td>3 4 5</td>
<td>6 7</td>
</tr>
</tbody>
</table>
Informaation havainnollistaminen kaavioina
(esim. prosenttiosuksien esittäminen piirakkakuvioina tai muutosten esittäminen vierekkäisillä palkeilla)

<table>
<thead>
<tr>
<th>(kaikki alla olevat kohdat koskevat yllä kysyttyä Excelin käyttöä)</th>
<th>Täysin eri mieltä</th>
<th>Ei samaa eikä eri mieltä</th>
<th>Täysin samaa mieltä</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Excelin käyttö auttaa minua havainnollistamaan informaatiota aiempaa nopeammin.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Excelin käyttö parantaa suorituskykyäni informaation havainnollistamisessa.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Excelin käyttö kasvattaa tuottavuuttani informaation havainnollistamisessa.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Excelin käyttö parantaa tavoitteideni saavuttamista informaation havainnollistamisessa.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Excelin käyttö tekee informaation havainnollistamisen helpomaksi.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Mielestäni Excel on hyödyllinen informaation havainnollistamisessa.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Listojen ylläpito
(esim. osallistumislistat, tavaralistat, ostoslistat)

<table>
<thead>
<tr>
<th>(kaikki alla olevat kohdat koskevat yllä kysytettyä Excelin käyttöä)</th>
<th>Täysin eri mieltä</th>
<th>Ei samaa eikä eri mieltä</th>
<th>Täysin samaa mieltä</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Excelin käyttö auttaa minua ylläpitämään listoja aiempaa nopeammin.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>2 Excelin käyttö parantaa suorituskykyäni listojen ylläpidossa.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3 Excelin käyttö kasvattaa tuottavuuttani listojen ylläpidossa.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4 Excelin käyttö parantaa tavoitteiden saavuttamista listojen ylläpidossa.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>5 Excelin käyttö tekee listojen ylläpidon helpommaksi.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>6 Mielestäni Excel on hyödynnälistojen ylläpidossa.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

Kysely päättyi tähän. Kiitoksia osallistumisesta tutkimukseen!

Lahjakortti:
Arvomme kurssin lopussa tämän kurssiryhmän jäsenten joukosta kuusi voittajaa, joista kukin saa 20 euron lahjakortin Stockmannille.
Excel-käyttökysely kurssin lopussa

Kurssin alussa kysymme sinulta muutamia Exceliä koskevia kysymyksiä. Nyt toivomme että vastaat vielä muutamia loppukysymyksiin. Vastaamiseen pätevät samat periaatteet kuin aiemminkin:

- **Antamasi vastaukset eivät vaikuta kurssiarvosanaan.**
- Tuloksia on tarkoitus käyttää myös tutkimustarkoituksiin.
- Kaikki aineisto käsitellään luottamuksellisesti. Tutkimuksen tekijät ovat Antti Salovaara, Bertta Sokura ja Anssi Öörni (etunimi.sukunimi@aalto.fi).

Vastausohjeet:
- Vastaa mahdollisimman totuudellisesti.
- Älä palaa taaksepäin korjaamaan aiempia vastauksiasi
- Älä tutustu myöhempänä oleviin kysymyksiin etukäteen

Taustatiedot

Opiskelijanumero: ________________ (Tarvitsemme tämän yhdistääksemme kurssin alussa ja lopussa olevat vastaukset samaan ihmiseen. Emme siis selvitä tällä tiedolla, kuka kukin vastaaja on ollut.)

Kuinka usein olit paikalla oppitunnilla koko kurssin aikana?

- 0–20 %
- 20–40%
- 40–60%
- 60–80%
- 80–100%

Paljonko käytit Exceliä kurssin aikana?

- Päivittäin
- Viikoittain
- Muutaman kerran
- En ollenkaan

Käsitykset itsestä ja tietotekniikasta kurssin lopussa

Vasta kuinka hyvin seuraavat väittämät kuvaavat itseäsi tietotekniikan käyttäjänä (ympyröi):

Kysymyksissä “uudella tietotekniikalla” tarkoitetaan esim. *uudenlaisia laitteita tai sovelluksia*.

<table>
<thead>
<tr>
<th></th>
<th>Täysin eri mieltä</th>
<th>Ei samaa eikä eri mieltä</th>
<th>Täysin samaa mieltä</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Jos kuulusin uudesta tietotekniikasta, yrittäisin löytää keinoo päästä kokeilemaan sitä.</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>Tuttujeni joukossa olen yleensä ensimmäinen, joka kokeilee uutta tietotekniikkaa</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Yleensä ottaen epäröin uuden tietotekniikan kokeilemista.</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>Pidän uuden tietotekniikan kokeilemisesta.</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>
Yliopiston kursseilla ja työelämässä kohdataan usein tietokoneohjelmia, joiden tarkoitus on tehdä työstä helpompaa. Kun vastaat seuraaviin kysymyksiin, kuvittele että sinulle on annettu käytettävaksi **uusi Excelin laajennusosa** johonkin tehtävään. Se, mikä tämä laajennusosa voisi olla, ei ole tässä väliä; merkitsevää on vain se, että sen tarkoitus on helpottaa työtä ja että **et ole käyttänyt laajennusosaa aiemmin**.

Seuraavissa kysymyksissä sinua pyydetään kertomaan, uskoisitko pystyväsi käyttämään tätä sinulle tuntematonta ohjelmaa eri tilanteissa. Jokaisen tilanteen osalta kerro, uskoisitko pystyväsi suorittamaan tehtävän.

Nyt **kurssin lopussa** onnistuisi suorittamaan tehtävän Excelin laajennuosan käyttäen… (ympyröi)

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
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</table>
Käsitykset itsestä ja Excelistä

Kerro, miten hyvin seuraavat väittämät sopivat sinuun.

Vastaa sen käsityksen pohjalta mikä sinulla on nyt kurssin lopussa.

<table>
<thead>
<tr>
<th>Täysin eri mieltä</th>
<th>Ei samaa eikä eri mieltä</th>
<th>Täysin samaa mieltä</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Excelin käyttö auttaa minua suorittamaan tehtäviä ja askareita aiempaa nopeammin.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>2 Excelin käyttö parantaa suorituskykyäni.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>3 Excelin käyttö kasvattaa tuottavuuttani.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>4 Excelin käyttö parantaa tavoitteiden saavuttamista.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>5 Excelin käyttö tekee tehtävien tekemisen helpomaksi.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>6 Mielestäni Excel on hyödyllinen tehtävissäni.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
</tbody>
</table>

Millä tarkkuudella ajattelit Excelin käyttöä vastatessasi ylläoleviin kysymyksiin?

☐ Ajattelin jotain tiettyä käyttötarkoituusta    ☐ Ajattelin useita eri käyttötarkoituksia    ☐ Ajattelin käyttöä yleisellä tasolla    ☐ Jokin muu    ☐ En osaa sanoa

Mitkä Excelin ominaisuudet ovat ajattelemassasi käytössä tärkeimiä?

__________________________________________________________

Minkä tehtävän tekemiseen ajattelit näitä ominaisuuksia?

__________________________________________________________

Tähänastiset kokemukset Excelistä tällä kurssilla

Vastaa seuraaviin kysymyksiin tähänastisten tämän kurssin kokemustesi pohjalta.

Excel-kurssin oppimistavoitteet oli esitetty selkeästi: ______________________ (kouluarvosana 4–10)

<table>
<thead>
<tr>
<th>Perusteellisesti</th>
<th>En ollenkaan perusteellisesti</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Olin uppoutunut tämän kurssin Excel-tehtäviin….</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>Mielenkiintoista</td>
<td>Ei ollenkaan mielenkiintoista</td>
</tr>
<tr>
<td>2 Excelin opiskeluni tällä kurssilla on ollut…</td>
<td>1 2 3 4 5 6 7</td>
</tr>
</tbody>
</table>

Mieti miltä Excelin käyttö on tuntunut, ja vastaa sen pohjalta seuraaviin väitteisiin (ympyröi):
<table>
<thead>
<tr>
<th></th>
<th>Täysin eri mieltä ▼</th>
<th>Ei samaa eikä eri mieltä ▼</th>
<th>Täysin samaa mieltä ▼</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aika tuntui kuluvan nopeasti, kun opettelin Excel-ohjelman käyttöä.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Osaan käyttää hyvin Excel-ohjelmaa.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Excelin käytön opetteluli oli sopivan vaikeaa.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Pystyn soveltamaan kurssilla oppimani opiskelussa tai työssä</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Pystyn mukauttamaan kurssilla oppimani opiskelun tai työhön lisätäksemisen tehokkuutta ja tuottavuutta.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Osaan soveltaa Excel-kurssilla oppimiani taitoja uusien työtapojen löytämiseksi.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
</tbody>
</table>

**Excel-tuntemus**

Vastaa tietämystesi pohjalta seuraaviin Excelin toimintaa koskeviin kysymyksiin. ***Jos et tiedä, älä yritä arvata, vaan vastaa “en tiedä”***. Oikeilla ja väärillä vastauksilla ei ole vaikutusta kurssin läpäisemiseen.

Kussakin kysymyksessä on **vain yksi oikea vastausvaihtoehto**. Laita siksi rasti vain yhteen kohtaan kussakin kysymyksessä.

Mitä pitää muistaa kopioitaessa taulukon sisältöä uuteen paikkaan Excelin työskentelytilassa?

- Taulukon sisältö pitää ensin muistaa tallentaa.
- Numeroiden sijaan Excel kopioi kaavat, ellei Exceliä pyydä erikseen tekevä toiminnot.
- Exceliin pitää kertoa, kumpaa taulukkoa sen on käsiteltävä ensisijaisena sisältöön.
- Taulukoiden kopioinnista syntyvän paljon väliaikaisia tiedostoja.
- En tiedä.

Mikä on ero tavallisella ja $-viittauksella Excelissä?

- $-viittaus käsittelee tekstimuodossa olevaa informaatiota numeroiden sijasta.
- $-symbolilla voit antaa viittaukselle oman nimen jota voit käyttää käätevästi kaavojen laatiessasi.
- Kun $-viittauksen sisältävää kaavaa kopioo, soluviittauksen osoite pysyy paikallaan eikä siirry.
- $-symboli pilottaa tauloksen näkyvistä, mikä tekee taulukosta siistimmän näköisen.
- En tiedä.

---

**Appendices**

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Mitä ovat Excelin funktiot?
☐ Funktiot kuvaavat erityyppisiä raporttisivuja, joita Excel voi luoda datan pohjalta automaattisesti.
☐ Funktiointilla piirretään kaaviota datan pohjalta.
☐ Funktioiden käytetään taulukon soluiden kirjoitettavissa kaavoissa esim. laskutoimitusten tekemiseen.
☐ Jokaisella taulukolla on Excelissä käytötarkoituksensa, ja näitä tarkoituksia kutsutaan funktioiksi.
☐ En tiedä.

Mikä seuraavista pitää paikkansa graafisten kaavioiden piirtämisessä:
☐ Kun taulukon sisältöä muuttaa, siitä piirretty kaavio päivitetyy automaattisesti.
☐ Kaavioihin voi myös asetella arvot hiirellä osoittamalla, jolloin ne siirtyvät taulukkoon omiin kohtiinsa.
☐ Kaaviota kaksoisklikkaamalla pääsee suoraan muokkaamaan lukua, joista kaavio on piirretty.
☐ Excel osaa piirtää myös zoomattavia kaaviota, joissa suuria aineistoja voi katsella eri tarkkuuksilla.
☐ En tiedä.

Excelin käyttötavat
Seuraavaksi sinulta kysytään Excelin käytöstä muutamaa eri käyttötoimintoon.

Vastaushje:
1. Aloita vastaaminen aina ylhäältä.
2. Ympyröi sinua parhaiten vastaavan vaihtoehdon numero
3. Seuraa nuolta seuraavaan kysymykseen
4. Kun kysymyksestä ei lähde uutta nuolta, siirry lomakkeessa eteenpäin.
Laskutoimitukset taulukoissa
(esim. summien, keskiarvojen ja erotusten laskeminen allekkain olevista luvuista)

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<th>Ei samaa eikä eri mieltä</th>
<th>Täysin samaa mieltä</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Excelin käyttö auttaa minua suorittamaan taulukkolaskutoimituksia aiempaa nopeammin.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Excelin käyttö parantaa suorituskykyäni taulukkolaskutoimituksissa.</td>
<td>1 2 3 4 5 6 7</td>
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<tr>
<td>3</td>
<td>Excelin käyttö kasvattaa tuottavuuttani taulukkolaskutoimituksissa.</td>
<td>1 2 3 4 5 6 7</td>
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<tr>
<td>4</td>
<td>Excelin käyttö parantaa tavoitteiden saavuttamista taulukkolaskutoimituksissa.</td>
<td>1 2 3 4 5 6 7</td>
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</tr>
<tr>
<td>5</td>
<td>Excelin käyttö tekee taulukkolaskutoimituksen tekemisen helpomaksi.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Mielestäni Excel on hyödyllinen taulukkolaskutoimituksissa.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
</tbody>
</table>
Informaation havainnollistaminen kaavioina
(esim. prosenttiosuuksien esittäminen piirakkakuvioina tai muutosten esittäminen vierekkäisillä palkeilla)

**Kuinka aktiivisesti käytit tätä käyttötapaa Excelillä kurssin alamisen jälkeen?**
(sekä kurssin tehtäviä tehdessä **että muissakin tilanteissa**)

- Päivittäin viime viikkoina
- Viikoittain viime viikkoina
- Muutaman kerran viime viikkoina
- Olen tiennyt tämän käyttöönoton, mutta en ole käyttänyt sitä viime viikkoina
- **Käyttöönoto on minulle täysin uusi: se ei ollut koskaan aiemmin tullut mieleen.**

**Miten usein olet sellaisissa tilanteissa viime viikkoina (kurssilla tai muuten), joissa tästä käyttöönotosta olisi voinut olla hyötyä?**

- En kertaakaan
- Kerran tai muutaman kerran
- Useita kertoja
- **En osaa sanoa – En tiedä oliko tilanteessa joissa tästä olisi voinut olla hyötyä**

Siirry alla olevaan taulukkoon

<table>
<thead>
<tr>
<th>(kaikki alla olevat kohdat koskevat yllä kysyttyä Excelin käyttöönotoa)</th>
<th>Täysin eri mieltä</th>
<th>Ei samaa eikä eri mieltä</th>
<th>Täysin samaa mieltä</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Excelin käyttö auttaa minua havainnollistamaan informaatiota aiempaa nopeammin.</td>
<td>1 2 3 4 5</td>
<td>6 7</td>
<td></td>
</tr>
<tr>
<td>2 Excelin käyttö paranee suorituskykyäni informaation havainnollistamisessa.</td>
<td>1 2 3 4 5</td>
<td>6 7</td>
<td></td>
</tr>
<tr>
<td>3 Excelin käyttö kasvattaa tuottavuuttani informaation havainnollistamisessa.</td>
<td>1 2 3 4 5</td>
<td>6 7</td>
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</tr>
<tr>
<td>4 Excelin käyttö paranee tavoitteideni saavuttamista informaation havainnollistamisessa.</td>
<td>1 2 3 4 5</td>
<td>6 7</td>
<td></td>
</tr>
<tr>
<td>5 Excelin käyttö tekee informaation havainnollistamisen helpomaksi.</td>
<td>1 2 3 4 5</td>
<td>6 7</td>
<td></td>
</tr>
<tr>
<td>6 Mielestäni Excel on hyödyllinen informaation havainnollistamisessa.</td>
<td>1 2 3 4 5</td>
<td>6 7</td>
<td></td>
</tr>
</tbody>
</table>
Listojen ylläpito
(esim. osallistumislistat, tavaralistat, ostoslistat)

Kuinka aktiivisesti käytit tätä käyttötapaa Excelillä kurssin alamisen jälkeen? (sekä kurssin tehtäviä tehdessä että muissakin tilanteissa)

- Päivittäin viime viikoina ➔ Viikoittain viime viikoina ➔ Muttamman kerran viime viikoina ➔ Olen tiennyt tämän käyttöönoton, mutta en ole käyttänyt sitä viime viikoina ➔
- Käyttöönoto on minulle täysin uusi: se ei ollut koskaan aiemmin tullut mieleen.

Miten usein olet sellaisissa tilanteissa viime viikoina (kurssilla tai muuten), joissa tästä käyttöönotosta olisi voinut olla hyötyä?

- En kertaakaan
- Kerran tai muutaman kerran
- Useita kertoja
- En osaa sanoa – En tiedä olukohtaisissa tilanteissa joissa tästä olisi voinut olla hyötyä

Siirry alla olevaan taulukkoon

<table>
<thead>
<tr>
<th>(kaikki alla olevat kohdat koskevat yllä kysyttyä Excelin käyttöä)</th>
<th>Täysin eri mieltä</th>
<th>Ei samaa eikä eri mieltä</th>
<th>Täysin samaa mieltä</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Excelin käyttö auttaa minua ylläpitämään listoja aiempaa nopeammin.</td>
<td>1 2</td>
<td>3 4 5</td>
<td>6 7</td>
</tr>
<tr>
<td>2 Excelin käyttö parantaa suorituskykyäni listojen ylläpidossa.</td>
<td>1 2</td>
<td>3 4 5</td>
<td>6 7</td>
</tr>
<tr>
<td>3 Excelin käyttö kasvattaa tuottavuuttimi listojen ylläpidossa.</td>
<td>1 2</td>
<td>3 4 5</td>
<td>6 7</td>
</tr>
<tr>
<td>4 Excelin käyttö parantaa tavoitteideni saavuttamista listojen ylläpidossa.</td>
<td>1 2</td>
<td>3 4 5</td>
<td>6 7</td>
</tr>
<tr>
<td>5 Excelin käyttö tekee listojen ylläpidon helpomaksi.</td>
<td>1 2</td>
<td>3 4 5</td>
<td>6 7</td>
</tr>
<tr>
<td>6 Mielestäni Excel on hyödyllinen listojen ylläpidossa.</td>
<td>1 2</td>
<td>3 4 5</td>
<td>6 7</td>
</tr>
</tbody>
</table>
**Luovat käyttötavat**

Seuraavassa sinulta kysytään hieman erilaisista käyttötavoista.

*Leikepöydällä (copy & paste) olevan materiaalin “puhdistaminen”*

_Yksi mutta ei ainoa esimerkki: www-sivun sisällön kopiointi Exceliin ja turhan sisällön poistaminen, jotta olennaisen asian voi tulostaa tai lisätä Word-dokumenttiin siististi._

---

**Kuinka aktiivisesti käyttät tätä käyttötapaa Excelilä ennen tätä kurssia?**

- Päivittäin kurssia edeltäneiden 12 kk aikana.
- Viikoittain kurssia edeltäneiden 12 kk aikana.
- Kuukausittain kurssia edeltäneiden 12 kk aikana.
- Harvemmin kuin kuukausittain kurssia edeltäneiden 12 kk aikana.
- Tiesin tänän käyttötavan, mutta en käyttänyt sitä kurssia edeltäneiden 12 kk aikana.
- Käyttötapa ei ollut koskaan tullut mieleen.

---

**Kuinka aktiivisesti olet käyttänyt tätä käyttötapaa Excelilä tähän kurssin aikana?**

(sekä kurssin tehtäviä tehdessä _että muissakin tilanteissa_)

- Päivittäin viime viikkoina ➔
- Viikoittain viime viikkoina ➔
- Muutaman kerran viime viikkoina ➔
- Tiesin tänän käyttötavan, mutta en käyttänyt sitä viime viikkoina ➔
- Käyttötapa on minulle täysin uusi: kuulin siitä vasta nyt.

---

**Miten usein olit selaisissa tilanteissa viime viikkoina (kurssilla tai muuten), joissa tästä käyttötavasta olisi voinut olla hyötyä?**

- En kertaakaan
- Kerran tai muutaman kerran
- Useita kertoja
- En osaa sanoa – En tiedä olanko tilanteessa jossa tästä olisi voinut olla hyötyä

---

**Muistele aivan ensimmäistä tilannetta, jolloin keksit tai opit tämän käyttötavan. Kuinka opit sen?**

- Luin tai kuulin tästä tai se opetettiin minulle.
- Olisin paikallaa, mutta joku muu kuin minä keksi tämän.
- Keksin tämän yhdessä muiden kanssa.
- Opin tämän itse, mutta muita ihmisä olivat läsnä.
- Opin tämän yksin.
- Ei mikään yllä olevista
- En muista

---

Siirry seuraaviin kysymyksiin
Aikataulun suunnitteleminen

Yksi mutta ei ainoa esimerkki: lukujärjestysten suunnitteleminen: muutosten tekeminen ja lopputuloksen tulostus on helppoa, ja kalenteriin voi lisätä www-linkit kurssien kotisivuille

---

Aikataulun suunnitteleminen

Yksi mutta ei ainoa esimerkki: lukujärjestysten suunnitteleminen: muutosten tekeminen ja lopputuloksen tulostus on helppoa, ja kalenteriin voi lisätä www-linkit kurssien kotisivuille
Oletko käyttänyt Exceliä myös seuraaviin tarkoituksiin? (rastita kummaltakin riviltä yksi vaihtoehto)

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<th>Opin muilta tämän käyttötavan kurssin aikana</th>
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Tekstin tai listan rivien määrän selvittäminen (kopioida leikepöydän kautta sisällön Exceliin ja katsomaalla, mihin rivinumeroon asti sisältö ulottuu)

<table>
<thead>
<tr>
<th>Kysely päättyi tähän. Voit antaa palautetta tähän:</th>
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Kiitos osallistumisesta tutkimukseen!

Toivottavasti saat esimerkkeistä ideoita omaan Excelin käyttöösi!

Lahjakortti:
Kun kaikki kyselylyomakkeet on kerätty, suoritamme kuuden 20 euron Stockmann-lahjakortin arvonnan niiden joukosta, jotka ovat vastanneet kyselyyn kurssin alussa ja lopussa. Otamme yhteyttä voittajiin henkilökohtaisesti.
PART II: ORIGINAL RESEARCH PAPERS
THE ROLE OF TRAINING IN DECREASING ANXIETY AMONG EXPERIENCED COMPUTER USERS

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Abstract

Surprisingly, in addition to inexperienced computer users, also those who have used different software applications at least to moderate extent can have feelings of anxiety with their use of computers. This paper examines the role of training in decreasing anxiety among experienced computer users. More specifically, the role of training is studied in relation to computer anxiety, behavioral beliefs and self-efficacy, which are the key mental constructs training may impact. 96 adult and university students, who attended a CDL course on voluntary basis, participated in this longitudinal study. The results suggest that training is an effective tool to decrease anxiety and promote self-efficacy even among experienced users. In addition this study calls in the question of the relation of computer anxiety and ease of use.

Keywords: training, anxiety, Computer Driving License, ease of use, self-efficacy
1 INTRODUCTION

Personal computers have been on the market and on the desktops of employees already for a quarter of a century. Today PCs are also an essential domestic appliance with broadband channel connections. Although the ubiquitous role of information and communication technology (ICT) in people’s everyday lives has grown significantly, average users’ skills to exploit basic computer applications efficiently are still low, and many people feel nothing less than anxiety when having to use computers (Kohrman 2003; Tekinarslan 2008). Computer anxiety can be defined in terms of a psychological response, such as, computer phobia, or in terms of a cognitive reaction, that is, apprehension of using computers (Jancour, Sinclair et al. 1994). As our focus is on more experienced computer users, we will use the latter definition in this study.

Computer anxiety is widely thought to impact early perceptions about the ease of use of a new system (Venkatesh and Davis 2000; Chee Wei, Sutanto et al. 2006). Hence, computer anxiety influences indirectly also the intention to use the system. As computer anxiety exerts such a negative influence on intention to adopt information technology attenuating its effects should remain a high priority. It is commonly argued that training decreases anxiety, yet, empirical evidence on the effect of training is ambiguous. To better decrease levels of computer anxiety among average users, we should possess a clearer picture on the effects of our main tool, training, on anxiety, and that is, precisely, the aim of this study.

In this paper, we report the findings of a longitudinal study on the effect of training on computer anxiety and behavioural beliefs about use of the target system. The study explores remedying the impact anxiety exerts on the perceptions of ease of use and usefulness related constructs. We are especially interested in how training, in our case a CDL-course, influences these perceptions in the presence of anxiety. CDL, or Computer Driving Licence, is a standardized examination developed for providing basic computing skills. It is a hands-on test, including the most commonly used software, such as, word processing, spreadsheet, graphics, databases, and graphical operating systems.

Our main research questions are as follows: 1) How does CDL-training influence user acceptance of information systems among relatively experienced users? 2) Does CDL training decrease computer anxiety? We will also test the relative importance of self-efficacy, as it has been suggested to exert a stronger effect on computer anxiety than that of experience (Wilfong 2006)

The structure of this paper is as follows: In section 2, we introduce the key constructs of anxiety, training, self-efficacy, perceived ease of use, perceived usefulness and intention to use, and introduce our research model. In Section 3, we briefly describe the empirical data collection method, and then present the results of the analyses in Section 4. Summary and conclusions, as well as directions for future research, are discussed in Section 5.

2 ANXIETY AND TRAINING

The rapid development of new computer applications and continuing software upgrading require lifelong learning. Many users remain uncomfortable using new applications, and often revert to using traditional methods to accomplish tasks that could be performed quicker or more efficiently with some software or software features. Because of feelings of uncertainty or anxiety, users remain unaware of many useful computer applications on the market and software features of the applications in use.

In the following, we will review earlier literature on computer anxiety and constructs that have been found to have effect on it, and formulate our research hypotheses based on the earlier research.
2.1 Anxiety (ANX)

We understand computer anxiety in terms of a cognitive reaction that manifests itself as apprehension of using computers (Jancour, Sinclair et al. 1994). In practice, this means that people experience uncertainty, and they are a little uncomfortable working with computers. Anxiety, then, can be viewed resulting from the beliefs an individual holds, rather than as an antecedent to these beliefs (Saade and Kira 2007).

Overall, results of many studies indicate that computer anxiety is an important predictor of the use of technology (Czaja, Charness et al. 2006; Tung and Chang 2007). Although the results of the earlier studies regarding interdependencies between anxiety and behavioral beliefs (discussed in more detail in section 2.4) are inconsistent, anxiety clearly seems to have negative effects on performance of the users.

2.2 Training

It is commonly agreed that training decreases anxiety (Igbaria 1990; Torkzadeh and Angulo 1992; Popedavis and Vispoel 1993; Torkzadeh and Koufteros 1993; Martocchio 1994; Shelley 1998; Beckers and Schmidt 2001). Effects training has on anxiety have been studied both in mandatory and voluntary settings, focusing mainly on particular new technologies, and users with limited experience. Earlier studies have found that increasing computer experience may help reduce computer anxiety (Igbaria 1993; Chang 2005), and that anxiety level decreases also while computer knowledge increases (Kay 2008). On the other hand, it has also been argued that computer self-efficacy beliefs have a stronger impact on computer anxiety than computer experience or use do (Wilfong 2006). Thus, we posit that training will decrease computer anxiety also among experienced users, whose earlier computer training is limited or missing, and we formulate our first hypothesis as follows:

Hypothesis 1 (H1): CDL training will decrease individual computer anxiety level.

2.3 Self-efficacy (SE)

Computer self-efficacy beliefs are expected to have a greater impact on computer anxiety than computer experience and use (Wilfong 2006). Self-efficacy has been defined as “people’s judgments of their capabilities to organize and execute courses of action required to attain designated types of performances” (Bandura 1986, p. 391). This means that self-efficacy is concerned not with the skills one has, but with judgments of what one can do with whatever skills one possesses (Bandura 1986). Thus, self-efficacy is simply the person’s confidence in performing a particular behaviour. In the context of computer use, self-efficacy has been defined as a judgement of one’s ability to use a technology (e.g. computer) to accomplish a particular task (Compeau and Higgins 1995a). A number of researchers agree that computer anxiety and computer self-efficacy are negatively related (Bandura 1977; Henderson, Deane et al. 1995; Igbaria and Ivari 1995; Compeau and Higgins 1995a; Fagan, Neill et al. 2003; Chang 2005). Hence, we formulate our second hypothesis as follows:

Hypothesis 2 (H2): Reduced computer anxiety will increase computer self-efficacy.

2.4 Perceived ease of use (PEOU) and perceived usefulness (PU)

According to Davis’ technology acceptance model (TAM) (Davis 1989; Davis, Bagozzi et al. 1989) user acceptance of a new technology can be explained by two salient beliefs: perceived ease of use (PEOU) and perceived usefulness (PU). Perceived ease of use has been defined as the degree to which a person believes that using a particular system would be free of effort (Davis 1989). There is a strong negative interdependence between anxiety and PEOU (Venkatesh 2000). However, PEOU’s impact on intention is expected to decrease when experience increases (Davis, Bagozzi et al. 1989).
Computer anxiety has been offered as one of the anchors that determine early perceptions about the ease of use of a new system and it is modeled as an indirect determinant of intention (Venkatesh 2000). In particular, computer anxiety has been found to be an antecedent of perceived ease of use (Venkatesh 2000; Chee Wei, Sutanto et al. 2006). Computer anxiety has been found to have a strong negative effect on perceived usefulness (Igbaria 1993), and also resistance to change is claimed to be a significant determinant of PEOU (Nov and Ye 2008). On the other hand, it has been argued that perceived ease of use and perceived usefulness of microcomputers have a direct inverse effect on computer anxiety (Ferguson 1997).

The nature of the anxiety-PEOU relationship is further complicated by the dispute over whether the relationship is direct or not. System experience has been found to be significantly related to perceived ease of use and the effect of experience fully mediated by computer anxiety (Hackbarth et al. 2003). On the other hand, some studies report that even though anxiety has no mediating role on the impact of computer experience on perceived ease of use, it has some moderating influence on the relationship (Saade and Kira 2007).

While the nature of the anxiety-PEOU relationship remains under dispute, there appears to be a general agreement that anxiety and the salient beliefs of computer use are related. We deem that the weight of the body of literature is in support of anxiety influencing behavioral beliefs. Accordingly, we formulate our third hypothesis as follows:

Hypothesis 3 (H3): Reduced computer anxiety will increase perceived ease of use (PEOU).

2.5 Intention to use (ITU)

Computer anxiety has also been found to have a strong negative effect on behavioral intentions (Igbaria 1993), and only indirect effects on usage, mainly through perceived usefulness (Igbaria and Iivari 1995). In the context of Web-based learning, anxiety has been found to have a significant negative effect on individuals’ continuance intentions of technology usage, (Chiu and Wang 2008).

While some studies have found anxiety’s impact to usage to be insignificant (Compeau and Higgins 1999), many studies have indicated that computer anxiety is indeed an important predictor of the use of technology (Czaja, Charness et al. 2006; Tung and Chang 2007). We thus formulate our fourth hypothesis as follows:

Hypothesis 4 (H4): Reduced computer anxiety will increase intention.

2.6 Proposed model

Based on the above hypotheses, we present our research model in figure 1:
3 EMPIRICAL STUDY

The empirical data for our study was collected at the Helsinki School of Economics during 2004 – 2007, from altogether 243 students attending eight CDL courses. The duration of each course was seven weeks and the course was voluntary. The data was collected with two sets of questionnaires upon the completion of the first and the last laboratory session. Having a longitudinal set of data made it possible to investigate the possible changes in the level of anxiety and other key constructs.

Our sample consists of fairly experienced users of computer technology. The software applications in question are those included in the widely used Microsoft Office package of software, that is, word processing (MS Word), spreadsheet (MS Excel), graphics (MS PowerPoint), and database applications (MS Access), and the Windows operating system.

All the constructs in our model were validated by previous research (see Appendix 1). The question items were measured using a seven-point Likert scale, with 1 anchored at totally agree and 7 anchored at totally disagree. The detailed measures used can be found in Appendix 1.

4 RESULTS

In this longitudinal study, we explore anxiety’s impact on the perceptions of ease of use and usefulness of computer applications, our particular interest being in how training, in our case a CDL-course, changes these perceptions.

4.1 Descriptive statistics

We analyzed 96 respondents in our first and second data collection. The participants were 50 adult students and 46 university students, of which 25 were males and 71 females. The average age of the respondents was 32 years, and their work experience varied between 0 and 40 years, the average being approximately 9 years. The respondents had on average 10 years of earlier experience with computers (range: 0 - 24 years). The respondents used computers on average for about 3 hours a day. Computer skills prior to the CDL course were acquired mainly (66 %) at work or through self study. Forty percent of the respondents reported having no prior formal computer education (for more details, see Table 1.).

<table>
<thead>
<tr>
<th></th>
<th>Total (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult / University students</td>
<td>50/46</td>
</tr>
<tr>
<td>Men / Women</td>
<td>25 (26 %) / 71 (74 %)</td>
</tr>
<tr>
<td>Age in years (average/ median/ min-max)</td>
<td>32.2 / 29 / 19-60</td>
</tr>
<tr>
<td>Work experience in years (average/median/ min-max)</td>
<td>8.7 / 5 / 0-40</td>
</tr>
<tr>
<td>Computer experience in years (average/median/ min-max)</td>
<td>10 / 10 / 0 - 24</td>
</tr>
<tr>
<td>Computer daily use (average/median/ min-max)</td>
<td>3.3 / 2 / 0-10</td>
</tr>
<tr>
<td>Computer weekly use</td>
<td>7 / 7 / 1-20</td>
</tr>
<tr>
<td>Earlier computer skills (at work or self study/no prior computer education)</td>
<td>66 % /40 %</td>
</tr>
</tbody>
</table>

*Table 1. Descriptive statistics of the respondents.*
4.2 Data analysis

We estimated the instrument’s validity in terms of internal consistency, and convergent and discriminant validity (Straub 1989). Internal consistency was tested using Cronbach’s alpha. In both rounds of data collection, all constructs except intention to complete training, displayed an alpha value higher than 0.7 indicating reliability on the common acceptable level (Nunnally 1978) (see Appendix 2).

The instrument’s discriminant and convergent validity was evaluated using a principal component factor analysis of Orthogonal varimax with Kaiser normalization rotation. All measurement items showed high loadings on their respective factors, thus proposing the instrument exhibited satisfactory convergent and discriminant validity (see Appendix 2.)

The summary constructs (mean) of each original construct before and after training are below in Table 2:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Before training</th>
<th>After training</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANX</td>
<td>96</td>
<td>96</td>
</tr>
<tr>
<td>ITU</td>
<td>96</td>
<td>96</td>
</tr>
<tr>
<td>PEOU</td>
<td>96</td>
<td>96</td>
</tr>
<tr>
<td>PU</td>
<td>96</td>
<td>96</td>
</tr>
<tr>
<td>SE</td>
<td>96</td>
<td>96</td>
</tr>
<tr>
<td>Valid N (listwise)</td>
<td>96</td>
<td>96</td>
</tr>
</tbody>
</table>

Table 2. Descriptive statistics before and after training

Before training, computer anxiety (ANX) was not very high (5.6), and after training it was not high at all (6.0). PEOU of basic pc tools changed from being 2.8 before training to being 2.3 after training. The changes of these two construct (ANX and PEOU) were also statistically significant, measured by partial t-test. The other measured constructs did not change significantly. Directions of changes are presented in Table 3 below.

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANXc</td>
<td>96</td>
<td>-4.67</td>
<td>1.67</td>
<td>-0.37</td>
<td>1.13</td>
</tr>
<tr>
<td>ITUc</td>
<td>96</td>
<td>-2.50</td>
<td>4.50</td>
<td>0.10</td>
<td>1.12</td>
</tr>
<tr>
<td>PEOUc</td>
<td>96</td>
<td>-2.50</td>
<td>4.50</td>
<td>0.50</td>
<td>1.05</td>
</tr>
<tr>
<td>PUC</td>
<td>96</td>
<td>-4.33</td>
<td>4.33</td>
<td>-0.11</td>
<td>1.16</td>
</tr>
<tr>
<td>SEC</td>
<td>96</td>
<td>-5.92</td>
<td>2.83</td>
<td>-0.04</td>
<td>1.24</td>
</tr>
<tr>
<td>Valid N (listwise)</td>
<td>96</td>
<td>96</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3. Direction of change

The results show that computer anxiety decreased with training, as expected. However, a lot of variance can be observed. Perceived ease of use increased the most, while perceived usefulness decreased slightly.
Table 4. Correlations of change constructs

<table>
<thead>
<tr>
<th></th>
<th>ITUc</th>
<th>PEOUc</th>
<th>PUc</th>
<th>SEc</th>
<th>ANXc</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Pearson Correlation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>1.000</td>
<td>.415**</td>
<td>.596**</td>
<td>.308**</td>
<td>-.295**</td>
</tr>
<tr>
<td>N</td>
<td>96</td>
<td>96</td>
<td>96</td>
<td>96</td>
<td>96</td>
</tr>
<tr>
<td>PEOUc</td>
<td>Pearson Correlation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>.415**</td>
<td>1.000</td>
<td>.215*</td>
<td>.290**</td>
<td>-.174</td>
</tr>
<tr>
<td>N</td>
<td>96</td>
<td>96</td>
<td>96</td>
<td>96</td>
<td>96</td>
</tr>
<tr>
<td>PUc</td>
<td>Pearson Correlation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>.596**</td>
<td>.215*</td>
<td>1.000</td>
<td>.167</td>
<td>-.128</td>
</tr>
<tr>
<td>N</td>
<td>96</td>
<td>96</td>
<td>96</td>
<td>96</td>
<td>96</td>
</tr>
<tr>
<td>SEc</td>
<td>Pearson Correlation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>.308**</td>
<td>.290**</td>
<td>.167</td>
<td>1.000</td>
<td>-.222**</td>
</tr>
<tr>
<td>N</td>
<td>96</td>
<td>96</td>
<td>96</td>
<td>96</td>
<td>96</td>
</tr>
<tr>
<td>ANXc</td>
<td>Pearson Correlation</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>-.295**</td>
<td>-.174</td>
<td>-.128</td>
<td>-.222**</td>
<td>1.000</td>
</tr>
<tr>
<td>N</td>
<td>96</td>
<td>96</td>
<td>96</td>
<td>96</td>
<td>96</td>
</tr>
</tbody>
</table>

Our first hypothesis (H1: CDL training will decrease individual computer anxiety level) was supported. Training significantly influenced anxiety by decreasing it. Anxiety level before training was 5.6 and after training 6.0, and t-test showed the change to be significant. These results confirm the findings of earlier studies (Igbaria 1990; Torkzadeh and Angulo 1992; Popedavis and Vispoel 1993; Torkzadeh and Koufteros 1993; Martocchio 1994; Shelley 1998; Beckers and Schmidt 2001). Also our second hypothesis (H2: Reduced computer anxiety will increase computer self-efficacy.) was supported. The change in the level of self-efficacy before and after training was very low and not statistically significant, but when we look at the correlations of these changes, it can be seen that changes of anxiety and self-efficacy correlate significantly at the 0.05 level (-.222) (see Table 4). The negative correlation between computer anxiety and computer self-efficacy confirm the results of earlier studies (Bandura 1977; Henderson, Deane et al. 1995; Igbaria and Iivari 1995; Compeau and Higgins 1995a; Fagan, Neill et al. 2003; Chang 2005), but our study demonstrates the relationship also in context of longitudinal training.

Our third hypothesis (H3: Reduced computer anxiety will increase perceived ease of use) was, however, not supported. Even though the measurements of anxiety and ease of use showed significant changes after training, the change for ease of use being the strongest, the correlation between the changes of anxiety and ease of use was not significant. A possible explanation to this might be that the users did not experience that the lower anxiety level results in ease of use but instead in use of new features, i.e. the lower the anxiety level, the more prone the users are to learn more advanced functions. This finding is in contrast with earlier studies that have argued a strong relationship between ease of use and anxiety (Venkatesh 2000; Chee Wei, Sutanto et al. 2006; van Raaij and Schepers 2008).

Our fourth hypothesis (H4: Reduced computer anxiety will increase intention) was, again, supported. The negative correlation (-.295) between changes on computer anxiety and intention was significant at the 0.01 level. This means that reduced computer anxiety could increase intention to use, and that anxiety, in general, can have a negative impact on intention to use. There are contradicting findings for this in earlier research (Igbaria 1993; Compeau and Higgins 1999; Kluwin and Noretsky 2005; Chiu and Wang 2008), clearly calling for future research on the issue.
We hence conclude that training decreases computer anxiety and increases perceived ease of use. Training was found to influence user acceptance of information technology, decreasing anxiety and increasing perceived ease of use. There is a negative relationship between computer anxiety and self-efficacy also after training. Contrary to earlier research, there was no relationship between the changes of levels of computer anxiety and ease of use. In addition, anxiety seems to impact intention to use technology.

Our results can be summarized as follows (see Figure 2): Firstly, training, or a CDL course in our study, decreases individual anxiety level (ANX). Secondly, reduced anxiety has a positive impact on self-efficacy (SE). Thirdly, anxiety does not correlate with perceived ease of use (PEOU), which might mean that users do not experience that the lower anxiety level results in ease of use. Fourthly, reduced anxiety increases intention (INT). We have included in our model also the relationships between self-efficacy and intention, self-efficacy and perceived ease of use, perceived ease of use and perceived usefulness (PU), perceived ease of use and intention, and perceived usefulness and intention, but these were not hypothesized, nor tested, in this study, but left for future research.

Figure 2. The research model and hypotheses testing results

5 SUMMARY AND CONCLUSIONS

In this study, we examined how CDL-training influences user acceptance of PC tools among relatively experienced users. It also answered the question if CDL training decreases computer anxiety. In addition the role of self-efficacy was addressed. Our empirical study was based on two longitudinal surveys on 96 students who attended CDL course at the Helsinki School of Economics. Using key constructs on user acceptance of information systems adopted from earlier research, the measurements were made before and after training. Our main interest was on the role of CDL training in decreasing computer anxiety among relatively experienced computer users.

Our findings suggest that training significantly decreases computer anxiety, and at the same time, increases perceived ease of use among relatively experienced computer users. This means that training has a clear positive influence on user acceptance of these computer applications, Microsoft Office tools in our case. In addition, training seems to strengthen the negative relationship between computer anxiety and self-efficacy. The most surprising outcome was that the relationship between computer anxiety and perceived ease of use was not clear. After training changes in both constructs were statistically significant, perceived ease of use increased and anxiety decreased, but the changes did not correlate. Some scholars argue that anxiety is an anchor of perceived ease of use (Venkatesh 2000; Chee Wei, Sutanto et al. 2006) or vice versa (Ferguson 1997). Furthermore, anxiety has been suggested to be a result of the beliefs an individual has, rather than an antecedent to them (Saade and Kira 2007). While we found that changes at the levels of anxiety and ease of use do not correlate, the
findings of our study indicate that the relationship between these constructs needs deeper investigation. Our results also demonstrated a strong relationship between computer anxiety and intention to use technology.

While our study provided interesting findings about the relationship between anxiety and ease of use the study has a few limitations. Our study examined and reported anxiety’s impact only on perceived ease of use, self-efficacy, and intention. More research is needed to test anxiety’s impact on other user acceptance related beliefs such as perceived usefulness, subjective norm, job-relevance and compatibility.

References


APPENDIX 1: Measures Used in the Study

**Computer Anxiety (ANX)** (Drawn from the Computer Anxiety Rating Scale (Heinssen et al.,(1987):

1. It scares me to think that I could cause the computer destroy a large amount of information by hitting the wrong key.
2. I feel apprehensive about using computers.
3. I hesitate to use a computer for fear of making mistakes that I cannot correct.

**Computer Self-Efficacy (SE)** (Compeau and Higgins 1995a; Compeau and Higgins 1995b; Compeau and Higgins 1999):

I could complete my job using the technology if….

1. I had seen someone else using it before trying it myself.
2. someone showed me how to do it first
3. I could call someone for help if I got stuck
4. I had used similar packages like this one before to do the job.
5. I had a lot time to complete the job for which the software was provided.
6. someone else helped me get started

**Perceived ease of use (PEOU)** (Davis 1989; Davis, Bagozzi et al. 1989):

1. It would be easy for me to become skilful at using the system
2. Learning to operate the system is easy for me.
3. I believe that it is easy to get the system to do what I want to do
4. Overall, I believe that the system is easy to use.

**Perceived usefulness (PU)** (Davis 1989; Davis, Bagozzi et al. 1989):

1. Using basic PC tools makes it easier to do my job.
2. Using basic PC tools increases my productivity.
3. Using basic PC tools enables me to accomplish tasks more quickly.

**Intention to use (ITU)** (Hu and Chau (1999):

1. Whenever possible, I intend to use this basic software in my job/study
2. I intend to use this software versatility in my job/study

All items measured using a seven-point Likert scale (1=totally agree, 7=totally disagree).
### APPENDIX 2: SIMPLE STATISTICS

<table>
<thead>
<tr>
<th>Variable</th>
<th>Before training</th>
<th></th>
<th></th>
<th>After training</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
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<td>Std</td>
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CHANGES IN USER BELIEFS AND ATTITUDES DURING THE LEARNING PROCESS OF OFFICE APPLICATIONS

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Abstract

This longitudinal study examines the mechanisms through which behavioral beliefs and attitude toward behavior change in time. We test two alternative explanations: the two-stage model of cognition change based on the expectation-disconfirmation theory (EDT), and the implicit change mechanism of the deliberative theories: theory of reasoned action (TRA) and theory of planned behavior (TPB). As the research setting we employed the learning process of information systems, specifically office applications taught to university students. Our observations suggest that the expectation-disconfirmation model captures a special case rather than the general case of temporal change in dispositions. We posit that that the deliberative theories have more general inbuilt mechanisms of attitude and belief change. We feel that in an effort to create parsimonious models of the deliberative process, separate constructs for the feelings of (dis)satisfaction may not be needed, as suggested by EDT.

Keywords: User beliefs, Attitudes, Theory of Reasoned Action (TRA), Expectation-Disconfirmation Theory (EDT), Satisfaction, Structural Equation Modelling, Longitudinal study
1 Introduction

Jasperson et al. (2005) argue in their study that the functional potential of installed IT-enabled work systems is underutilized. This tends to be true also for office automation applications; most end-users apply only select functions of the applications and rarely consider starting to use the more advanced features. This behavior may have significant effect on workers’ productivity as the neglected functions could often substitute manual work. In the long run the cumulative time savings from using the additional functions of the office program would more than compensate the cost of learning to use them. The phenomenon is not restricted to workplaces; similar behavior can be observed in office program use in general. Hence, it is important to motivate the users of office automation tools at large to learn and utilize all necessary features of these applications to improve their performance.

High level of motivation should be achieved early in the use of new applications before the routine settles in and keeps the users from searching for unused program features (Juntumaa, 2011). But how to motivate, for example, university students? Monetary incentives such as salary and rewards are not applicable for university students to motivate them to apply feature extensions. Training is one option that universities can offer to increase the motivation of students to utilize software. The challenge of training is to identify how exactly the existing disposition of users should be modified to produce the desired behavior.

It is still contested how behavioral dispositions actually change over time. What is known, though, is that the attitude toward behavior (Igbaria, 1993, Lin and Bhattacharjee, 2010, Ping and Heshan, 2009, Harris, 1999) is a key determinant of intention to use any information technology (IT). At a more detailed level attitudes can be decomposed into their constituent beliefs (Davis et al., 1989). We do not know whether it would be more accurate to describe changes in beliefs and attitude in absolute terms or relative to a reference point, such as expectations that are either confirmed or disconfirmed (Bhattacharjee and Premkumar, 2004, Szajna and Scamell, 1993). In case of the latter, creating behavioral change would be further complicated by the need of expectations management.

In this paper our goal is to examine how students’ beliefs and attitudes change during the learning process when they participate in a software training course. In more detail, we are interested in how these changes can be explained, and what the mechanism behind the changes is. We test two alternative explanatory models for the behavior change during the learning process: one suggested by a two-stage theoretical model of cognition change presented by Bhattacharjee and Premkumar (2004), and the other based on the theories of reasoned action and planned behavior (Ajzen, 1988, Ajzen, 1991, Fishbein and Ajzen, 1975). The two-stage model takes into account temporal changes in beliefs and attitudes toward information technology usage and posits that (dis)confirmation of expectations and the resulting (dis)satisfaction influence post-usage beliefs and attitudes.

Our empirical data were collected during university level training classes. We conducted computer-assisted surveys of dispositions related to software usage among undergraduate students participating in a Fundamentals of Personal Computing course. We had three time points of data collection during the 7-week course: at the beginning, in the middle and at the end. This enabled us to investigate the temporal changes in the key dispositions.

We employed structural equation modelling to test our hypotheses. Our observations lead us to suggest that expectations may operate directly on behavioral beliefs rather than on attitudes through the feelings of (dis)satisfaction. It appears that the (dis)confirmatory mechanism may be an inbuilt feature of the deliberative process as pictured by TRA and TPB. We feel that in an effort to create parsimonious models to guide our understanding of the deliberative process, separate constructs for the feelings of (dis)satisfaction may not be needed.

This paper is organized as follows. In Section 2 we review the literature on attitudinal change. This is followed by the research design of our study. In section 4 we present the results and we end our paper in discussion and conclusions in Section 5.
2 Dispositional change

Several theories describe or explain changes in dispositions. The basic premise is that dispositions are influenced by new information or experience. The focus of our study is to understand how behavioral dispositions change during a software training course and what the mechanism behind these changes is. To reach this target, we test two alternative theories: one suggested by the two-stage model of cognition change presented by Bhattacherjee and Premkumar (2004), and the other based on the theories of reasoned action and planned behavior (Ajzen, 1988, 1991, Fishbein and Ajzen, 1975). Both theories conceptualize behavioral disposition as an attitude, an overall evaluation of favorableness of the act. We will next discuss the competing models of dispositional change and then reason our research model.

2.1 Attitude Change in Deliberative Theories

There is a consensus of opinion that people’s intention to perform or not to perform a behavior is the immediate determinant of the action (Ajzen and Fishbein, 1980, p. 41). Behavioral intention, in turn, is determined by two major factors: a personal or attitudinal component and a social or normative component (Ajzen and Fishbein, 1980, p. 54). Attitude towards behavior is the general feeling of favorableness or unfavorableness of the act. It can be conceptualized as a function of its constituent behavioral beliefs, each belief embodying a perception about an outcome of an action. Similarly, subjective norm can be conceptualized as the overall evaluation of normative beliefs, the perceived reactions of other people towards one taking the act (Ajzen and Fishbein, 1980, p. 73).

People hold beliefs about themselves and the world in which they live. These beliefs embody the information that is processed to cope with the environment (Ajzen and Fishbein, 1980, p. 62). This should not be taken to imply that people systematically scrutinize the determinants of their behavior. Rather, information processing is largely automatic or implicit, and only in rare cases people do become fully aware of these processes (Ajzen and Fishbein, 1980, p. 245). Even if information processing cannot be directly observed we can observe its results in changing beliefs, attitudes, and intentions. The deliberative theories do not offer any particular mechanism for such changes, but contend that change in behavior results from new information entering the decision making system. It should be noted, though, that behavioral attitude and beliefs are all in effect expectations about the outcomes of the act.

2.2 Attitude Change in Expectation Theories

In contrast to the deliberative theories described, behavior is, according to the expectation theories, more dependent on situational factors. These factors are explicitly included in the expectation theories in the form of expectations and their (dis)confirmation. In daily life, people have expectations about the outcomes of their actions. These expectations can be more or less (un)realistic. Additional information, often in the form of direct experience, validates the expectations, and leads to feelings of (dis)satisfaction. Satisfaction is the evaluation of the favorableness of the act relative to the related expectation.

One of the seminal expectation theories is the expectation-disconfirmation theory (EDT) that Oliver (1980) developed in a non-commercial context. EDT has been subsequently widely used to understand consumer satisfaction, repurchase intentions, loyalty, and irrational behaviors mainly in the marketing context (see e.g., Oliver, 1993). The basic idea of the EDT model is that an individual has expectations before a purchase decision that impact his or her attitudes, which in turn have an effect on the purchase intention. After that there is a period when the disconfirmation will happen. Oliver (1980) tested the relationships between expectation, disconfirmation, the traditional criteria of attitude, satisfaction, and purchase intention in his study.
The relationship between expectation and disconfirmation is complex (see Bhattacharjee and Premkumar, 2004, Yi, 1990), and the disconfirmation can be negative or positive. Furthermore, users’ unrealistic expectations “wear off” over time but stay at a higher level than moderate or low expectations, which tend to increase during the adoption process (Szajna and Scamell, 1993). The general opinion is that these two constructs are negatively related, as high expectations are more likely to be negatively disconfirmed and low expectations more likely to be positively disconfirmed (see Bhattacharjee and Premkumar, 2004, Yi, 1990). The initial expectation and disconfirmation together determine the satisfaction or dissatisfaction with the product. Based on the co-impact of expectation and disconfirmation, users decide to continue or discontinue product usage.

EDT has been applied in various different contexts, for example in IT usage continuance (Bhattacherjee, 2001, Bhattacharjee and Premkumar, 2004, Thong et al., 2006), online repurchase (Yen and Lu, 2008), online negotiation (Doong and Lai, 2008), and online services (Cenfetelli et al., 2008) contexts. In addition, some behavioral models such as TRA (Ajzen, 1988, 1991, Fishbein and Ajzen, 1975) have been extended with EDT-constructs (Hsu et al., 2006).

Bhattacherjee and Prekumar’s (2004) model examines how beliefs and attitudes change from the pre-usage stage to the usage stage in the context of information systems. The model’s basic idea is that the users’ pre-usage beliefs and attitude influence usage-stage beliefs and attitude both directly and indirectly via disconfirmation and satisfaction mechanism. The model tries to both explain and predict: Gregor (2006) mentions it as an exemplar of theories for explaining and predicting, because it shows the causative drivers and emergent mechanisms impacting temporal changes in user beliefs and attitude toward IT usage. We use this model as our initial research model (see Figure 1).

### 2.3 Basic assumptions and research model

In this study, the most important basic assumption is that attitude, which comprises the behavioral beliefs, is the major determinant of intentions and behavior (Ajzen and Fishbein, 1980, p. 62). Second, based on Oliver’s (1980) model, we propose that pre-usage beliefs and attitude have a direct effect on usage-stage beliefs and attitude. However, attitudes tend to change over time (Szajna and Scamell, 1993, Venkatesh et al., 2000). In the long run very positive attitudes or expectations will decrease and negative expectations will increase, yet, positive attitudes stay at a higher level than negative or moderate attitudes (Szajna and Scamell, 1993). In addition, beliefs and attitudes influence later behavior indirectly via the disconfirmation and satisfaction constructs (Oliver 1980).

The effects of disconfirmation and satisfaction on beliefs and attitude may continue to recur over time as users get more experience and, in doing so, revise their prior cognitions in an iterative manner (Bhattacherjee and Premkumar, 2004). These changes take place more likely during the early phases of usage and wear out over time as users’ expectations become more realistic (see Bhattacharjee and Premkumar, 2004, Szajna and Scamell, 1993). Thus, we believe that in our end-user training context the largest changes in beliefs and attitudes will occur between the pre-usage stage and the initial usage stage, and get smaller towards the end of the training period.

We test the model hypotheses in two phases; between the pre-usage stage (t₀) and the initial usage stage (t₁), and between the initial usage (t₁) and the latter usage stages (t₂). In the first phase we test how beliefs and attitudes change from pre-usage stage to initial usage stage, and how these changes impact the EDT constructs of (dis)confirmation and satisfaction (Oliver, 1980) and the behavioral intention (Ajzen and Fishbein, 1980, Davis et al., 1989). In the second phase, we test the interdependencies between these TRA and EDT constructs using the two-stage theoretical model of cognition change presented by Bhattacharjee and Prekumar (2004) (see Figure 1).
3 Research Design

In this section, we describe the design of the research. We will start with the research setting, follow with a presentation of the instrument development, and finally discuss the data collection method.

3.1 FPC-course

As the research setting we employed the learning process of information systems, specifically office applications taught to university students. At the Helsinki School of Economics Fundamentals of Personal Computing (FPC) course has been tailored to the needs of business university students. The course is compulsory for all bachelor’s students as part of their Professional Skills Portfolio, and it introduces ICT tools that are necessary in studies and later in work: spreadsheets (MS Excel), word processing (MS Word), presentation graphics (MS PowerPoint), information search (Journals database in the university library), and reference management (RefWorks). The course focuses on the advanced features of these tools and their utilization in studies and work. Even though it is possible to pass the course through a proficiency test, the majority (75%) of the students attend the class meetings. The course lasts one period (7 weeks).

3.2 Instrument development

The constructs of our model were validated by previous research. We used five constructs in our study: perceived usefulness (PU), attitude (ATT), disconfirmation (DIS), satisfaction (SAT), and intention (INT). The first two constructs were measured at three time points of data collection, whereas the latter three constructs were measured at two latter time points. We applied the same multi-item constructs that were used in Bhattacharjee and Premkumar (2004). The measurement scales for PU, ATT, and INT items were taken from existing pre-validated scales as well (e.g. Davis et al., 1989, Taylor and Todd, 1995): PU and INT were measured using 7-point Likert scales, and ATT was measured using a 7-point semantic differential scale anchored from negative to positive adjective pairs. DIS was measured using Oliver’s (1980) perceived disconfirmation scale (7-point Likert), and SAT using the semantic differential scale validated in the computer usage context by Bhattacharjee (2001). All constructs used with scaled items are listed in the Appendix.

The questionnaire was first reviewed by a small group of IS faculty at HSE, and the item wordings (translated into Finnish from original phrases) were modified as a result of their suggestions. After that the questionnaire was tested with a sample of 25 business school students. The test caused some further modifications to the scale item wordings.
3.3 Data collection

The survey was administered at HSE to students enrolled to five parallel sections of the FPC course. Participation in the study was voluntary. The data was collected during the classes with three sets of electronic questionnaires at three time-periods using FacilitatePro groupware. The first questionnaire was administered immediately after introducing the course and it measured the students’ pre-usage perceptions about usefulness of and attitude toward using the ICT tools. Three weeks later, we administered the second questionnaire containing, besides attitude and usefulness measures, also the constructs of disconfirmation, satisfaction and intention. The last data collection took place three weeks later, at the end of the course. The same constructs as those in the second survey were used.

We obtained 169 responses at time $t_0$, 141 responses at time $t_1$, and 159 at time $t_2$. Responses from these three surveys were matched using an anonymous user ID number to create a single record for each respondent. We used in our analysis only the records of 99 participants that contained data from all three time points (there were some data loss due to forgotten user ID’s). In addition, three records were dropped due to missing data, so that the final number of the analysed records was 96.

4 Results

4.1 Descriptive statistics and validity of the measurement model

The demographic profile of the respondents is presented in Table 1. Sixty-one percent of the respondents were female and 39 percent male. Most respondents were young adults. The respondents had on average 10 years of earlier experience with computers.

<table>
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Table 1. Descriptive statistics of the respondents

We estimated the instrument’s validity in terms of internal consistency, and convergent and discriminant validity (Straub, 1989). Internal consistency was tested using Cronbach’s alpha. In all three rounds of data collection, all constructs displayed an alpha value between 0.76 and 0.92 indicating acceptable reliability (Nunnally, 1978). The comprehensive list of the $\alpha$-values is available in the Appendix. The instrument’s discriminant and convergent validity were evaluated using factor analysis. We used principal component method to extract the factors and Orthogonal varimax with Kaiser normalization for the rotated solution. All measurement items showed high loadings on their respective factors, thus proposing that the instrument exhibited satisfactory convergent and discriminant validity. Also the comprehensive list of the factor loadings can be found in the Appendix.

4.2 Data analysis

The data analysis proceeded in two phases. We started by examining how the attitudes and beliefs change over time. Therefore we compared the construct means at each time point ($t_0$, $t_1$, and $t_2$). After that we tested the hypotheses presented in the research model (Figure 1) by using structural equation modelling with Amos 9.0.
### 4.2.1 Comparison of construct means

<table>
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<th>Time point t₀</th>
<th></th>
<th>Variable</th>
<th>Time point t₁</th>
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<td>Mean</td>
<td>S.D.</td>
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<td>96</td>
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</table>

**Table 2** Means and standard deviations of the construct items in each time point

Item responses to each construct at each time point were put together and compared to the mean aggregated scores pairwise by a series of t-tests (see Table 3). Perceptions of usefulness (PU0≠PU1) dropped from 5.83 at time t₀ to 5.51 at time t₁ (t = 2.88, p < 0.004), and attitude means (ATT0≠ATT1) respectively dropped from 6.14 to 5.92 (t = 2.15, p < 0.03). Hence, users’ beliefs and attitudes seem to change over time. Also from t₁ to t₂ the perceived usefulness means (from 5.51 to 5.47) and the attitude means (from 5.92 to 5.76) decreased, but both changes were statistically non-significant (t= 0.38 and 1.45). These changes support the theoretical expectations about IT usage: cognition changes wear out over time as the subject matters get more realistic and correct the expectations of application use. These results concur with Bhattachरjee and Premkumar (2004).

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>First time point</th>
<th>Second time point</th>
<th>Diff (1-2)</th>
<th>t-statistic</th>
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<td>5.83</td>
<td>5.51</td>
<td>0.32</td>
<td>2.88</td>
<td>0.004</td>
</tr>
<tr>
<td>PU1=PU2</td>
<td>96</td>
<td>5.51</td>
<td>5.47</td>
<td>0.04</td>
<td>0.99</td>
<td>0.38</td>
</tr>
<tr>
<td>ATT0≠ATT1</td>
<td>96</td>
<td>6.14</td>
<td>5.92</td>
<td>0.22</td>
<td>2.15</td>
<td>0.034</td>
</tr>
<tr>
<td>ATT1=ATT2</td>
<td>96</td>
<td>5.92</td>
<td>5.76</td>
<td>0.16</td>
<td>1.45</td>
<td>0.151</td>
</tr>
</tbody>
</table>

**Table 3.** Comparison of means in usefulness and attitudes (from t₀ to t₁ and from t₁ to t₂)

### 4.2.2 Structural model

Structural equation modelling (SEM) was applied to test the causal hypotheses presented in the research model. We examined the model’s goodness of fit, overall explanatory power, and hypothesized causal links using Amos 9.0. We used the maximum likelihood method to estimate the models. The overall goodness of fit for the models were evaluated using six different fit criteria: the Chi-square statistic divided by the degrees of freedom, comparative fit index (CFI), adjusted goodness
of fit (AGFI), normalized fit index (NFI), and root mean square error of approximation (RMSEA). The results of the fit tests are presented in Table 4.

<table>
<thead>
<tr>
<th>Fit index</th>
<th>Figure 2: SEM analysis of initial usage stage (from t0 to t1)</th>
<th>Figure 3: TRA model in time point t1</th>
<th>Figure 4: TRA model in time point t2</th>
<th>Figure 5: The causal links in beliefs between t1 and t2</th>
</tr>
</thead>
<tbody>
<tr>
<td>χ²/degrees of freedom</td>
<td>289.78/240</td>
<td>36.47/31</td>
<td>29/25</td>
<td>357.04/291</td>
</tr>
<tr>
<td>GFI</td>
<td>0.819</td>
<td>0.938</td>
<td>0.950</td>
<td>0.806</td>
</tr>
<tr>
<td>AGFI</td>
<td>0.754</td>
<td>0.868</td>
<td>0.868</td>
<td>0.748</td>
</tr>
<tr>
<td>CFI</td>
<td>0.960</td>
<td>0.990</td>
<td>0.994</td>
<td>0.965</td>
</tr>
<tr>
<td>NFI</td>
<td>0.814</td>
<td>0.938</td>
<td>0.963</td>
<td>0.893</td>
</tr>
<tr>
<td>RMSEA</td>
<td>0.047</td>
<td>0.043</td>
<td>0.041</td>
<td>0.049</td>
</tr>
</tbody>
</table>

Table 4. Fit tests of the models.

We started the analysis by employing the two-stage theoretical model of cognition change (Bhattacherjee and Premkumar, 2004), see Figure 2.

Although the model fit with the data was sufficient (i.e. RMSEA 0.047), the majority of the causal links between the constructs were statistically non-significant. The missing link between satisfaction (Satisfaction1) and attitude (Attitude1) was of particular interest. This observation suggests that EDT is a special case rather than a general mechanism of attitude change. While a single observation does not suffice to refute a theory, it suffices to demonstrate a limitation of the theory: satisfaction does not seem to be a necessary construct to explain changes in attitudes. We interpret our observation to indicate that there are at least two kinds of attitude change mechanisms in operation related to IT use. In some cases attitude change is rooted in feelings of satisfaction caused by (dis)confirmation of expectations. In other instances attitude change may result simply from re-evaluation of the favorableness of the action without feelings of (dis)satisfaction influencing the process.

To understand better what is happening between the different time points several further path analyses were conducted. First we tested with the TRA (Fishbein and Ajzen, 1975) whether the causal relation of belief – attitude – intention held at the two time points. The structural models are displayed in Figures 3 and 4.

Figure 2. SEM analysis of initial usage stage (from t0 to t1)

Figure 3. TRA model in time point t1
Figure 4.  **TRA model in time point t₂**

In both models, the specific behavioral attitude fully mediates the influence of behavioral beliefs to behavioral intentions. Both models fit well with the data and all path coefficients were statistically significant and had the expected signs. The detailed information of the model fit can be found in Table 4. The amount of variance explained by the models is on par with other social research.

Since the TRA-based models suggested that the belief – attitude – intention chain of explanation is not to be blamed for the unexpected observations related to the EDT-based model (see Figure 2), we next tested a simplified version of the EDT-based model. We left out all those non-significant paths that were not critical to the theory. We retained paths from past belief (Belief1) to later disconfirmation (Disconfirmation2) and satisfaction (Satisfaction2), and from past attitude (Attitude1) to later attitude (Attitude2). Similarly, we retained the link between the later attitude and intention (Intention2) because it is so central for both EDT and TRA. We discarded the link between later belief (Belief2) and intention because we could not find theoretical justification for it: Attitude, which is usually operationalized as a weighted sum of salient beliefs, is the direct determinant of intention. The resulting model is shown in Figure 5.

Figure 5.  **The causal links in beliefs between t₁ and t₂**

For the model presented in Figure 5 all fit measures suggest that the model fits the data (see Table 4). The basic structure of the model aligns well with the theories of reasoned action (Ajzen and Fishbein, 1980) and planned behavior (Ajzen, 2005). The model retains the chain of logic present in the deliberative theories: specific behavioral attitude fully mediates the influence of behavioral beliefs to behavioral intention. This is in line with TRA and TPB. It runs, though, against TAM (Davis et al., 1989) and some previous expectation-confirmation models published in IS journals (Bhattacherjee and Premkumar, 2004). The weight of evidence in social sciences overwhelmingly supports our interpretation. The structural relations in the model point to initial expectations being somewhat unrealistic as they can’t be linked to the initial beliefs. Expectations influence both satisfaction and beliefs at t₂. Disconfirmation seems to exert a direct effect on beliefs at t₂. Satisfaction, however, appears to be a dead-end as it does not exert any observable influence on later beliefs, attitude, or intention.

The basic logic of the model remains unchanged when the expectation-confirmation constructs are tested between time points t₁ and t₂. The chain of logic from beliefs to attitude to intention remains intact, and disconfirmation still influences belief formation. This time, however, expectations seem to be more sensible as beliefs at t₁ influence disconfirmation. The most important finding, however, is that satisfaction still lies outside the cognitive process that leads to the formation of behavioral intention.
Our observations lead us to suggest that expectations may operate directly on behavioral beliefs rather than influencing attitudes through feelings of (dis)satisfaction. It appears that the (dis)confirmatory mechanism may be a tacit feature of the deliberative process as pictured by TRA and TPB. We feel that in an effort to create parsimonious models to guide our understanding of the deliberative process, separate constructs for the feelings of (dis)satisfaction may not be needed.

5 Discussion and Conclusions

The aim of this study was to examine the mechanisms through which beliefs and attitudes change during the learning process. We tested two alternative explanatory models: one suggested by the two-stage model of cognition change presented by Bhattacharjee and Premkumar (2004), and the other based on the theories of reasoned action and planned behavior (Ajzen, 1988, 1991, Fishbein and Ajzen, 1975).

The results of this study provided only partial support for the expectation-disconfirmation mechanism. They indicate that the separate constructs for the feelings of (dis)satisfaction are not, in general, needed to explain and predict attitudinal change in IT usage behavior. Our findings are consistent with Ajzen’s findings (Ajzen, 1991, Ajzen, 2005, Ajzen and Madden, 1986, Ajzen and Fishbein, 1980): people may not, in general, distinguish feelings of (un)satisfaction from the general feelings of (un)favorbleness of action, also known as attitude.

One weakness of this study arises from the fact that it did not take into account the normative beliefs and behavioral control. In addition, we did not categorize our target group along their expectations high, moderate, and low, which might have given more explanatory power for our findings.

The most obvious direction for future research is to look for contextual factors that determine whether perceptions of (dis)confirmation and (un)satisfaction are separable from behavioral beliefs and attitude toward behavior, respectively. Identifications of these contingencies would not only contribute to IT behavior research, it would also directly benefit practitioners in the form of keenier understanding of how IT use related disposition should be modified to produce the desired changes in behavior.

References


### Appendix A: Measurements items

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Cronbach's Alpha</th>
<th>Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PU0 – Perceived Usefulness (t0):</strong> Cronbach’s alpha = 0.84</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. PU01: Using FPC will improve my performance (Strongly disagree…Strongly Agree)</td>
<td>Cronbach’s alpha = 0.84</td>
<td>0.86</td>
</tr>
<tr>
<td>2. PU02: Using FPC will increase my productivity (Strongly disagree…Strongly Agree)</td>
<td>Cronbach’s alpha = 0.84</td>
<td>0.80</td>
</tr>
<tr>
<td>3. PU03: Using FPC will enhance my effectiveness (Strongly disagree…Strongly Agree)</td>
<td>Cronbach’s alpha = 0.84</td>
<td>0.84</td>
</tr>
<tr>
<td>4. PU04: Using FPC will be useful for my studies (Strongly disagree…Strongly Agree)</td>
<td>Cronbach’s alpha = 0.84</td>
<td>0.73</td>
</tr>
<tr>
<td><strong>ATT0 - Attitude (t0):</strong> Cronbach’s alpha = 0.84</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All things considered, using FPC will be a__</td>
<td>Cronbach’s alpha = 0.84</td>
<td></td>
</tr>
<tr>
<td>1. ATT01: Bad idea…Good idea</td>
<td>Cronbach’s alpha = 0.84</td>
<td>0.86</td>
</tr>
<tr>
<td>2. ATT02: Foolish move…Wise move</td>
<td>Cronbach’s alpha = 0.84</td>
<td>0.88</td>
</tr>
<tr>
<td>3. ATT03: Negative Step…Positive Step</td>
<td>Cronbach’s alpha = 0.84</td>
<td>0.79</td>
</tr>
<tr>
<td>4. ATT04: Ineffective idea…Effective idea</td>
<td>Cronbach’s alpha = 0.84</td>
<td>0.66</td>
</tr>
</tbody>
</table>
### PU1 – Perceived Usefulness (t1): Cronbach’s alpha = 0.87

<table>
<thead>
<tr>
<th>Item</th>
<th>Cronbach’s alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. PU11: Using FPC will improve my performance</td>
<td>0.81</td>
</tr>
<tr>
<td>2. PU12: Using FPC will increase my productivity</td>
<td>0.75</td>
</tr>
<tr>
<td>3. PU13: Using FPC will enhance my effectiveness</td>
<td>0.83</td>
</tr>
<tr>
<td>4. PU14: Using FPC will be useful for my studies</td>
<td>0.75</td>
</tr>
</tbody>
</table>

### ATT1 - Attitude (t1): Cronbach’s alpha = 0.91

All things considered, using FPC will be a...  
<table>
<thead>
<tr>
<th>Item</th>
<th>Cronbach’s alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ATT11: Bad idea...Good idea</td>
<td>0.85</td>
</tr>
<tr>
<td>2. ATT12: Foolish move...Wise move</td>
<td>0.86</td>
</tr>
<tr>
<td>3. ATT13: Negative Step...Positive Step</td>
<td>0.89</td>
</tr>
<tr>
<td>4. ATT14: Ineffective idea...Effective idea</td>
<td>0.78</td>
</tr>
</tbody>
</table>

### DIS1 - Disconfirmation (t1): Cronbach’s alpha = 0.86

Compared to my initial expectations the ability of FPC  
<table>
<thead>
<tr>
<th>Item</th>
<th>Cronbach’s alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. DIS11: To improve my performance was (much worse than expected...</td>
<td>0.81</td>
</tr>
<tr>
<td>2. DIS12: To increase my productivity was (much worse than expected...</td>
<td>0.75</td>
</tr>
<tr>
<td>3. DIS13: To enhance my effectiveness was (much worse than expected...</td>
<td>0.70</td>
</tr>
<tr>
<td>4. DIS14: To be useful for my studies/work activities was (much worse...</td>
<td>0.79</td>
</tr>
</tbody>
</table>

### SAT1 - Satisfaction (t1): Cronbach’s alpha = 0.92

<table>
<thead>
<tr>
<th>Item</th>
<th>Cronbach’s alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. SAT11: Extremely displeased...Extremely pleased</td>
<td>0.70</td>
</tr>
<tr>
<td>2. SAT12: Extremely frustrated...Extremely contented</td>
<td>0.87</td>
</tr>
<tr>
<td>3. SAT13: Extremely terrible...Extremely delighted</td>
<td>0.85</td>
</tr>
<tr>
<td>4. SAT14: Extremely dissatisfied...satisfied</td>
<td>0.84</td>
</tr>
</tbody>
</table>

### INT1 – Intention (t1): Cronbach’s alpha = 0.76

<table>
<thead>
<tr>
<th>Item</th>
<th>Cronbach’s alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. INT11: I intend to continue using FPC to learn about new technologies</td>
<td>0.83</td>
</tr>
<tr>
<td>2. INT12: I intend to continue using FPC to learn new software skills</td>
<td>0.79</td>
</tr>
<tr>
<td>3. INT13: I intend to continue using FPC after this class</td>
<td>0.58</td>
</tr>
</tbody>
</table>

### PU2 – Perceived Usefulness (t2): Cronbach’s alpha = 0.88

<table>
<thead>
<tr>
<th>Item</th>
<th>Cronbach’s alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. PU21: Using FPC improves my performance</td>
<td>0.82</td>
</tr>
<tr>
<td>2. PU22: Using FPC increases my productivity</td>
<td>0.71</td>
</tr>
<tr>
<td>3. PU23: Using FPC enhances my effectiveness</td>
<td>0.82</td>
</tr>
<tr>
<td>4. PU24: I find using FPC to be useful for my studies</td>
<td>0.78</td>
</tr>
</tbody>
</table>

### ATT2 - Attitude (t2): Cronbach’s alpha = 0.85

All things considered, using FPC will be a...  
<table>
<thead>
<tr>
<th>Item</th>
<th>Cronbach’s alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ATT21: Bad idea...Good idea</td>
<td>0.85</td>
</tr>
<tr>
<td>2. ATT22: Foolish move...Wise move</td>
<td>0.76</td>
</tr>
<tr>
<td>3. ATT23: Negative Step...Positive Step</td>
<td>0.80</td>
</tr>
<tr>
<td>4. ATT24: I have an (extremely negative...Extremely positive) attitude toward FPC use</td>
<td>0.58</td>
</tr>
</tbody>
</table>

### DIS2 - Disconfirmation (t2): Cronbach’s alpha = 0.91

Compared to my initial expectations the ability of FPC  
<table>
<thead>
<tr>
<th>Item</th>
<th>Cronbach’s alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. DIS21: To improve my performance was (much worse than expected...</td>
<td>0.85</td>
</tr>
<tr>
<td>2. DIS22: To increase my productivity was (much worse than expected...</td>
<td>0.81</td>
</tr>
<tr>
<td>3. DIS23: To enhance my effectiveness was (much worse than expected...</td>
<td>0.81</td>
</tr>
<tr>
<td>4. DIS24: To be useful for my studies/work activities was (much worse...</td>
<td>0.85</td>
</tr>
</tbody>
</table>

### SAT2 - Satisfaction (t2): Cronbach’s alpha = 0.92

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<thead>
<tr>
<th>Item</th>
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</tr>
</thead>
<tbody>
<tr>
<td>1. SAT21: Extremely displeased...Extremely pleased</td>
<td>0.89</td>
</tr>
<tr>
<td>2. SAT22: Extremely frustrated...Extremely contented</td>
<td>0.82</td>
</tr>
<tr>
<td>3. SAT23: Extremely terrible...Extremely delighted</td>
<td>0.75</td>
</tr>
<tr>
<td>4. SAT24: Extremely dissatisfied...satisfied</td>
<td>0.87</td>
</tr>
</tbody>
</table>

### INT2 – Intention (t2): Cronbach’s alpha = 0.82

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<thead>
<tr>
<th>Item</th>
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</tr>
</thead>
<tbody>
<tr>
<td>1. INT21: I intend to continue using FPC to learn about new technologies</td>
<td>0.91</td>
</tr>
<tr>
<td>2. INT22: I intend to continue using FPC to learn new software skills</td>
<td>0.83</td>
</tr>
<tr>
<td>3. INT23: I intend to continue using FPC after this class</td>
<td>0.59</td>
</tr>
</tbody>
</table>
Paper 3

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Flow Experiences in Learning to Use a Spreadsheet Application

Bertta Sokura
Aalto University School of Economics
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Abstract
This paper explores the features of flow experience when learning a spreadsheet application. In addition, the goal is to examine whether and how the flow experience impacts on learning outcomes and what is the relationship between flow experience, learning outcomes, and perceived usefulness. The participants of this study were 116 university students attending a spreadsheet course on a voluntary basis. The data analysis was conducted using structural equation modelling. The results show that the elements of flow experience in this context are similar to those of Csikszentmihalyi, such as, balance between skills and challenges, the clarity of goals, concentration, time distortion, and enjoyment. Furthermore, the flow positively impacts learning outcomes. Surprisingly, learning outcomes is not directly affected by perceived usefulness.

Keywords: Flow experience, Learning outcomes, Perceived usefulness, Spreadsheet application, Structural equation modelling

1. Introduction

In the past three decades, technology adoption has been one of the most popular research areas in information systems (IS) science. The focus has shifted from organizational settings to wide audience end-users. A considerable amount of recent research has focused on the continuance of the use instead of the intention to use new technologies. In addition, most studies have examined full adoption instead of partial adoption. Less attention has been paid to the nature of the adoption, i.e. how users use technologies; can they replicate, adapt or innovate when using information technology; are they satisfied with using only the limited, general features of the entire application, thus adopting the technology only partially?

A multitude of prior studies on technology adoption argues that intention to use new technologies or intention to continue to use technology is seen as a direct antecedent of actual behavior. The theoretical background of these adoption studies has evolved around the Technology Acceptance Model (TAM) developed by Davis [1, 2]. TAM posits that technology adoption intention is predicted by perceived usefulness (PU) and perceived ease of use (PEOU) of the particular technology. After its initial introduction, TAM has been developed further by adding external variables [3], or combining with other theories, e.g., the Unified Theory of Acceptance and Use of Technology (UTAUT) [4], and the Diffusion of Innovations Theory [5].

A fundamental concept in this study is flow, which was first presented in 1975 by Csikszentmihalyi [6]. He has defined flow in many articles and writings later. One definition describes flow to be dynamic: flow is a subjective and optimal experience; something that a person makes happen [7]. The most extensive definition of flow by Csikszentmihalyi consists of eight major features such as balance between skills and challenges, clear goals, immediate feedback, concentration on the activity, time distortion, rewarding activity, the merge of action and awareness, and the decreasing of self-consciousness [8]. This study uses six features of them. We define flow as follows: flow is a state, where a person works with total involvement. She knows the goals of her activity, skills and challenges are in balance, and she sees her task interesting and is focused on her activity feeling time distortion.

In this study, we adopt the construct of perceived usefulness from TAM. However, instead of intention we use learning outcomes as the dependent variable. The core in learning outcomes is learning transfer. Byrnes [9] defines learning transfer as the ability to extend what has been learned in one context to new contexts. By using learning outcomes as the dependent variable it is possible to measure the quality of adoption – the quality of learning.

Past research that adopt TAM, extended TAM or combined TAM and flow theory has examined Internet
use behavior [10], online shopping [11, 12], the effects of online learning [13, 14] and users’ involvement in online game playing [15, 16], among others. Although it has been shown that flow experience increases learning, only few studies e.g. Ghani and Deshpande [17] and Pilke [18] have been made in the context of learning to use traditional software such as a spreadsheet application.

Our aim in this paper is to explore the effect of flow experience in learning to use a spreadsheet application. To reach this purpose, users’ perceptions of flow experiences, perceived usefulness and learning outcomes are measured. Firstly, we will examine what are the antecedents of the flow experience in this context. Secondly, our goal is to examine whether and how the flow experience affects learning outcomes. Finally, we will study the relationship between flow experience, learning outcomes, and perceived usefulness.

The data for this study was collected from 116 university students attending a spreadsheet course on a voluntary basis in the fall of 2010. Structural equation modelling was used for analysing the data. The results of this study indicate that the students have flow experience when learning to use a spreadsheet application and that affects learning outcomes. Surprisingly, the perceived usefulness has no direct impact on learning outcomes.

The structure of the study is as follows. In the second section, the literature on flow theory and its relationships with learning outcomes and perceived usefulness is discussed. In the third section, we describe the research setting. The results of this study are presented in the fourth section. In the last section, we discuss our findings, draw conclusions and suggest thoughts for further research.

2. Theoretical background

In this section, we discuss the key concept of the paper, i.e. flow experience (FE), and its relationship with learning outcomes (LO) and perceived usefulness (PU). In addition, based on earlier research the hypotheses and the research model are presented.

2.1. Flow experience

Csikszentmihalyi presented a theoretical model of flow experience in 1975. According to this model, flow describes a state of complete immersion or engagement in an activity. Later Csikszentmihalyi created a unified model for the flow theory integrating motivation, personality, and subjective experience. This optimal experience has been described comprehensively in many of his articles and other writings. The basic idea in the flow theory is that the feeling varies from boredom to anxiety and flow depending on the balance between skills and challenges. The flow experience is possible when both skills and challenges are in balance. One tries to stay at the flow zone by exercising the more challenging tasks (see Figure 1).

![Figure 1. Growth of Complexity Through Flow](19, p. 67)

A typical, new activity starts with low skills and challenges (A). When the skills increase the activity gets boring (B). At this point, one wants to grow the challenges to return to flow (C). This cycle is repeated through points D and E at higher levels of complexity. These cycles can continue almost forever. Thus, the flow is dynamic by nature.

Csikszentmihalyi’s research and personal observations have identified altogether eight major features in the state of flow [7]:
1. A balance between challenge and skill.
2. Clear goals.
3. Immediate feedback.
4. Distractions are excluded from consciousness.
5. The sense of time becomes distorted.
6. The activity becomes rewarding in itself.
7. Action and awareness merge.
8. Self-consciousness disappears.

The majority of flow related studies use only some of these features simultaneously.

Several techniques have been used to measure flow experience. The earliest flow studies were made using the Experience Sampling Method (ESM) [20, 21]. The ESM method consists of sending the same questionnaire to the participants repeatedly at random times during their activity. The ESM questionnaires contain both categorical and scaled items validated by Csikszentmihalyi and Larson [22]. The categorical items are aimed at reconstructing activity and its social
context. The scaled items aim to measure the intensity of perceived subjective feelings [23]. The other method to measure flow experience used in most studies is single measuring.

2.2. Interdependencies between flow, learning outcomes, and perceived usefulness

The core in learning outcomes is learning transfer. Byrnes [9] defines learning transfer as the ability to extend what has been learned in one context to new contexts. Only a few studies have examined the relationships between flow experience and learning outcomes. Choi et al. [24] and Ho et al. [13] found a positive relationship between these constructs. Both studies found that flow experience has direct and indirect impact via attitudes on learning outcomes. Yet, the features used for flow experience were different. In the ERP study of Choi et al. [24] the factors of flow were quite instrumental such as learner interface, interaction, instructor’s attitude towards students, and the contents of the course. The study of Ho et al. [13] adopted the classification from Trevino and Webster [25] that includes four elements: feel of being in control, focusing attention on activity, feeling curiosity, and having intrinsic interest. Despite the different elements of FE, however, consistent with prior studies about the relationship between flow experience (FE) and learning outcomes (LO), the first hypothesis is defined as follows:

H1. Flow experience affects learning outcomes.

Perceived usefulness (PU) was originally defined as “the degree to which a person believes that using a particular system would enhance his or her job performance” [1, 2]. According to the Technology acceptance model (TAM) [1, 2], PU and perceived ease of use (PEU) are the beliefs that impact positively the intention to use new technologies. A multitude of studies have shown PU to be the most important belief influencing intention to use information technology [1, 2, 26-29]. In addition, many studies have indicated PU to be an antecedent of continuance intention [11, 14, 30-33]. The impact of usefulness on learning outcomes might be analogous to the above mentioned studies based on intention and continuance intention. This leads to the second hypothesis:

H2. Perceived usefulness has a positive impact on learning outcomes.

A multitude of studies has indicated the relationship between perceived usefulness and one or more features of flow. In the World Wide Web context, Agarwal and Karahanna [10] argued that cognitive absorption, which is a multi-dimensional construct having the conceptual similarity with Csikszentmihalyi’s flow state, has a positive impact on perceived usefulness. Saade and Bahli [12] found cognitive absorption to be a predictor of perceived usefulness in their Internet-based learning study. Also Shang et al. [34] found a positive relationship between these constructs in their study of on-line shopping. In addition, the e-learning services study of Roca et al. [35] supported a relationship between these constructs. Although all these studies have been made in the web-context, we believe that this is true also in the learning context. So we define the third hypotheses as follows:

H3. Flow experience has a positive impact on perceived usefulness in the learning context.

2.3. Proposed research model

Based on prior research discussed above and relations hypothesized between the three key constructs, we formulate the following research model in Figure 2. The model is based on flow theory (FE) [8], TAM (PU) [1, 2], and learning outcomes (LO) [9].

![Figure 2. Proposed research model]

3. Research method

We studied the phenomenon of flow in the context of learning through a survey for the students attending a spreadsheet course at the Aalto University School of Economics (Aalto ECON). In this section we present the course, the Fundamentals of Personal Computing (FPC), and discuss the instrument development and data collection processes.

The empirical data for this study was collected during fall 2010 from students enrolled to six parallel spreadsheet courses. The spreadsheet course is a part of the Fundamentals of Personal Computing (FPC)
course that has been tailored to the needs of business university students at the Aalto ECON. The course is compulsory for all Bachelor level students as part of their Professional Skills Portfolio. FPC introduces ICT tools that are necessary in studies and later at work: spreadsheets (MS Excel), word processing (MS Word), presentation graphics (MS PowerPoint), information search (Journals database in the university library), and reference management (RefWorks). The course focuses on the advanced features of these tools and their utilization in studies and work life.

Even though it is possible to pass the course through a proficiency test, the majority (75%) of students take part in the voluntary contact teaching lessons. Most participants were freshmen. The size of each group was 40 students on average. Every student had a computer available and the teaching method was learning by doing. The teaching language was Finnish.

The teaching of the spreadsheet part includes also the fundamental features of the program. The program used was MS Excel 2007. The Excel-session was taught so that it first consisted of 12 contact hours, and then 12 hours of individual working. The total duration of this voluntary course was seven weeks and the Excel part lasted three weeks.

### 3.1. Instrument development

For our data collection, a web survey using Webropol 2.0 was designed. Measurement scales for our variables were taken from earlier studies, with modified wordings to adjust them to our topic.

In this study, flow experience (FE) consists of six features adapted from Csikszentmihalyi [8]. Learning outcomes (LO), in turn, were adapted from Gray and Meister [36]. LO consists of three dimensions: cognitive replication (LR), adaptation (LA), and innovation (LI). Perceived usefulness (PU) was adapted from TAM [1, 2]. However, in our study the target is not the tool, but learning to use it.

The research model consisted of three constructs that included altogether 11 dimensions. The dimensions of learning outcomes were replication (LR), adaptation (LA), and innovation (LI). The features (dimensions) of flow experience were balance between skills and challenges (BA), goal (GO), concentration (CO), time distortion (TI), and enjoyment (EN). Perceived usefulness (PU) included three items (dimensions), i.e. performance (PU01), productivity (PU02), and efficiency (PU03).

The construct of goal (GO), i.e. the clarity of the goals, was measured with school grades (4-10) that were rescaled to 1-7. The constructs of CO and EN were measured using a seven-point semantic differential scale anchored from positive to negative adjective pairs. The other constructs were measured using a seven-point Likert scale validated in the earlier studies. All constructs used with scaled items are available in Appendix 1.

According to Csikszentmihalyi [8], the state of flow experience consists of eight features. In choosing the features, we attempted to take into account our investigation context – learning to use a spreadsheet application in a face-to-face classroom setting. We adopted five features listed by Csikszentmihalyi. The most important feature to reach flow experience may be the balance between skills and challenges. Many researchers have pointed out the importance of this balance [23, 37-39]. Hence, we have the combined variable balance (BA). The scales were adapted from Wu and Liang [40].

Clear goals and immediate feedback help in reaching flow state. However, these features have been used only in few studies [18, 37]. In this study we used the variable goal (GO), which was measured by school grades (4-10). Feedback was not requested. The students get quick feedback due to the teaching method, learning by doing. They all learn together by doing calculations. When a student gets a different result from the trainer’s demonstration, she notices it immediately and asks “what is wrong with my formula or with my chart?”.

Concentration, time distortion, and enjoyment also seem to be quite often used variables in flow studies. The flow state always requires concentration that therefore has been used in several flow studies [23, 37, 41]. In this study the concentration construct (CO) is adopted from Ghani and Deshpande [17]. Time distortion construct (TI) in turn was adapted from Wu and Liang [40] and enjoyment (EN) from Ghani and Deshpande [17].

In addition, we collected information about the general computing skills (CS) and spreadsheet skills (ES) of the participants. All these constructs were measured using school grades (4-10). The self-evaluations on SC and SS were collected before and after the Excel-part of the course.

The questionnaire was first reviewed by a small group of IS faculty at the Aalto ECON and the item wordings (translated into Finnish from original phrases) were modified according to received suggestions. Then the questionnaire was tested by a small group of doctoral candidates. The test again resulted in some further modifications to the scale item wordings.
3.2. Data collection
The data was collected electronically immediately after the Excel part using the Webropol 2.0 survey tool. 120 responses were received; four responses were discarded due to missing data. Finally, 116 responses were accepted for the analysis.

4. Results
In this section we present the empirical findings of the survey. First, we present the descriptive statistics. Second, we describe the data regarding changes in skills before and after training. The main focus of the analysis is to discover the interdependencies between flow experience, perceived usefulness and learning outcomes, and describe the structure of the research model in detail. For that purpose the instrument’s validity is estimated and a structural model is used to conduct a path analysis and to test the hypotheses in the proposed research model.

4.1. Demographics and skills
The demographic data of the respondents is presented in Table 1. Fifty-two percent (52%) of the respondents were male and forty-eight percent (48%) female. The majority (97%) of the respondents were young adults.

Table 1. Descriptive statistics

<table>
<thead>
<tr>
<th>Construct</th>
<th>Classification</th>
<th>Number</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male</td>
<td>60</td>
<td>52</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>56</td>
<td>48</td>
</tr>
<tr>
<td>Age</td>
<td>&lt;16</td>
<td>113</td>
<td>97</td>
</tr>
<tr>
<td></td>
<td>16-26</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>27-36</td>
<td>46</td>
<td></td>
</tr>
<tr>
<td></td>
<td>37-46</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;57</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

The measurements of general computing skills (CS) and Excel skills (ES) before and after training were compared using the paired t-test (see Table 2). Perceptions of general computing skills increased from 7.71 to 8.04 \( (t=6.15, p<0.0001) \) and those of Excel skills from 5.38 to 7.07. \( (t=17.61, p<0.0001) \). Hence, the respondents’ perceptions about their both skills have developed positively over time. The course seems to be efficient from the learning point of view. In addition, based on the survey results, it was motivating to notice that the respondents’ perceptions about their general computing skills grew while learning Excel, despite the short duration of the course.

4.2. Measurement model
The instrument’s validity (see Appendix 1) was estimated in terms of internal consistency, and convergent and discriminant validity [42]. Internal consistency was tested using Cronbach’s alpha. All constructs displayed an alpha value between 0.73 and 0.96, indicating reliability on the common acceptable level [43].

The instrument’s discriminant and convergent validity were evaluated using principal component factor analysis of Orthogonal varimax with Kaiser normalization rotation. All measurement items used showed loadings higher than 0.50 on their respective factors, thus proposing the instrument exhibited acceptable convergent and discriminant validity.

However, to keep our model simple, we used multi-item measures only in the construct of PU. The dimensions of FE and LO each consisted of one item (feature). Among others Drolet and Morrison [44] argue that one-item constructs are not necessary harmful.

4.1. SEM-analysis
Structural equation modeling (SEM) was applied to test the causal hypotheses presented in the research model. We examined the model’s goodness of fit, overall explanatory power, and hypothesized causal links using Amos 19.0. The analysis method was maximum likelihood. The SEM approach integrates both observed and latent variables. In the proposed
model, perceived usefulness (PU) and learning outcomes (LO) are endogenous (dependent) variables. Flow experience, in turn, functions as an exogenous (independent) variable.

Firstly, we evaluated the overall goodness fit of the model by using six different fit criteria: the Chi-square statistic divided by the degrees of freedom, comparative fit index (CFI), adjusted goodness of fit (AGFI), normalized fit index (NFI), and root mean square error of approximation (RMSEA).

The results of our analysis and the recommended acceptance criteria for different goodness of fit indices are presented in Table 3. The fit measures show that the structural model represents an excellent fit for the collected data.

Table 3. Fit-test of the research model

<table>
<thead>
<tr>
<th>Fit index</th>
<th>Values</th>
<th>Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\chi^2$/degree of freedom</td>
<td>1.27 (52/41)</td>
<td>&lt;3.0</td>
</tr>
<tr>
<td>GFI</td>
<td>0.922</td>
<td>&gt;0.9</td>
</tr>
<tr>
<td>AGFI</td>
<td>0.875</td>
<td>&gt;0.8</td>
</tr>
<tr>
<td>CFI</td>
<td>0.981</td>
<td>&gt;0.9</td>
</tr>
<tr>
<td>NFI</td>
<td>0.918</td>
<td>&gt;0.9</td>
</tr>
<tr>
<td>RMSEA</td>
<td>0.048</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>

Secondly, the overall explanatory power of the model was measured by using the $R^2$ values for the two dependent variables. The flow experience construct explained 41 percent of the variance observed in students’ perceptions of usefulness. Moreover, flow experience explained 80 percent of the variance in students’ learning outcomes.

Finally, the two hypothesized causal paths of the research model, hypotheses H1 and H3, were supported. Flow experience had a direct positive relationship to learning outcomes with the standardized path coefficient being 0.90. Flow experience, in turn, had a positive relationship to usefulness with 0.64. The hypothesized path between perceived usefulness and learning outcomes was insignificant, and hypothesis H2 was therefore rejected.

Based on the SEM analysis that is presented in Figure 3, hypotheses H1 and H3 were supported, and hypothesis H2, surprisingly, was not supported. Thus, flow experience in this study consists of five supposed features. Also learning outcomes seem to have three dimensions (cognitive replication, adaptation, and innovation). Perceived usefulness does not impact directly on learning outcomes as expected. The impact of flow experience on learning outcomes is undisputable.

![Figure 3. The results of SEM-analysis](image-url)
5. Summary and Conclusions

In this study we explored the feelings and experiences of students participating in a spreadsheet course. The aim was to examine flow experience when learning the use of a spreadsheet application. In more detail, we wanted to find out the features of the flow experience in this learning context. Our main interest was to consider how flow experience impacts learning outcomes and what kind of role perceived usefulness may have in this context.

The findings of this study suggest that the students who participated in these spreadsheet courses had flow experiences, which in turn affected learning outcomes. The role of perceived usefulness was a surprise. It was expected that PU is an important, direct antecedent to learning outcomes based on adoption theories [1, 2]. However, flow experience had an impact on perceived usefulness. These findings suggest that PU might be added as a feature to flow experience. Or perceived usefulness might have a moderating effect enlarging the flow zone.

This study also showed that learning was quite efficient. The respondents evaluated their spreadsheet skills and general computer skills before and after the course - the results show that both skills increased significantly during the course.

These findings have both theoretical and practical contributions. Our study provides a new utilitarian construct, perceived usefulness, to the flow theory that has been seen more as hedonic in nature. Thus, perceived usefulness might enlarge the flow zone. Practical contributions are related to learning arrangements. It is important to create learning environments where skills and challenges are in balance to keep the learners on “the flow channel”. It might also be possible to use tasks that generate an increasing flow cycle. In addition, the task should have a clear goal, and naturally it should be interesting. Finally, as Csikszentmihalyi [7] argues, “flow is something we make happen”. We have to create learning environments, where learners can actively participate and learn by doing, and get immediate feedback.

While this study provided interesting findings about the relationships between flow experience, learning outcomes and perceived usefulness, it has limitations. The study examined and reported the participants’ feelings and experiences after the spreadsheet course. To get more just in time measurements, the Experience Sampling Method (ESM) or biometrical methods during the task execution could be used, for example. Maintaining the flow state is a continuous challenge in learning.

References


Appendix 1
Table 4. Measurement items
(The italicized items are not analyzed, the italicized items with * are dropped due to inconsistent alpha values)

<table>
<thead>
<tr>
<th>Item</th>
<th>Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CO – Concentration, Ghani and Deshpande (1994): Cronbach’s alpha = 0.83</strong></td>
<td></td>
</tr>
<tr>
<td>CO01: I was deeply engrossed in Excel activity … Not deeply engrossed</td>
<td>0.85</td>
</tr>
<tr>
<td>CO02: I was absorbed intensely in Excel activity … Not absorbed intensely</td>
<td>0.84</td>
</tr>
<tr>
<td>CO03: Attention was focused on Excel activity…Attention not focused</td>
<td>0.69</td>
</tr>
<tr>
<td><strong>EN – Enjoyment, Ghani and Deshpande (1994): Cronbach’s alpha = 0.88</strong></td>
<td></td>
</tr>
<tr>
<td>EN01: Learning to use Excel is interesting … Not interesting</td>
<td>0.70</td>
</tr>
<tr>
<td>EN02: Learning to use Excel is fun … Not fun</td>
<td>0.80</td>
</tr>
<tr>
<td>EN03: Learning to use Excel is exciting … Dull</td>
<td>0.77</td>
</tr>
<tr>
<td><strong>TI – Time distortion, Wu and Liang (2011): Cronbach’s alpha = 0.93</strong></td>
<td></td>
</tr>
<tr>
<td>TI01: Time seems to pass quickly when learning to use Excel (Strongly disagree…Strongly agree)</td>
<td>0.85</td>
</tr>
<tr>
<td>TI02: I tend to lose track of time when learning to use Excel (Strongly disagree…Strongly agree)</td>
<td>0.88</td>
</tr>
<tr>
<td>TI03: Learning to use the versatile functions of Excel makes me feel time distortion (Strongly disagree…Strongly agree)</td>
<td>0.84</td>
</tr>
<tr>
<td><strong>CH – Challenge, Wu and Liang (2011) (BA=balance between skills and challenges): Cronbach’s alpha = 0.73</strong></td>
<td></td>
</tr>
<tr>
<td>CH01: Learning to use Excel challenges me (Strongly disagree…Strongly agree)</td>
<td>*</td>
</tr>
<tr>
<td>CH02: Learning to use Excel challenges me to do my best (Strongly disagree…Strongly agree)</td>
<td>0.75</td>
</tr>
<tr>
<td>CH03: Learning to use Excel gives me a multitude of challenges to win (Strongly disagree…Strongly agree)</td>
<td>0.83</td>
</tr>
<tr>
<td><strong>LR – Cognitive replication, Ho and Kuo (2010), Gray and Meister (2004): Cronbach’s alpha = 0.89</strong></td>
<td></td>
</tr>
<tr>
<td>LR01: I am able to apply what I learned in the spreadsheet course at studying and work (HO and Kuo (2010))</td>
<td>*</td>
</tr>
<tr>
<td>LR02: I understand much better now the right way to use Excel than before the course (Strongly disagree…Strongly agree) (Gray and Meister (2004))</td>
<td>0.82</td>
</tr>
<tr>
<td>LR03: I know much more now about the right ways to work with Excel compared with earlier (Strongly disagree…Strongly agree) Gray and Meister (2004)</td>
<td>0.89</td>
</tr>
<tr>
<td><strong>LA – Cognitive Adaptation, Ho and Kuo (2010), Gray and Meister (2004): Cronbach’s alpha = 0.81</strong></td>
<td></td>
</tr>
<tr>
<td>LA01: I am able to adapt what I learned in the spreadsheet course in studies and at work to improve my working effectiveness and efficiency (Strongly disagree…Strongly agree) (Ho and Kuo)</td>
<td>*</td>
</tr>
<tr>
<td>LA02: I want to upgrade my Excel knowledge also in the future (Strongly disagree…Strongly agree) (Gray and Meister (2004))</td>
<td>0.79</td>
</tr>
<tr>
<td>LA03: I want to upgrade my Excel skills also when it gets new features (Strongly disagree…Strongly agree) (Gray and Meister (2004))</td>
<td>0.80</td>
</tr>
<tr>
<td><strong>LI – Cognitive innovation, Ho and Kuo (2010), Gray and Meister (2004): Cronbach’s alpha = 0.78</strong></td>
<td></td>
</tr>
<tr>
<td>LI01: I am able to find a new way of doing my job based on what I learned in the Excel course (Strongly disagree…Strongly agree) (Ho and Kuo (2010))</td>
<td>*</td>
</tr>
<tr>
<td>LI02: I can use innovatively the provided Excel functions (Strongly disagree…Strongly agree) (Gray and Meister (2004))</td>
<td>0.50</td>
</tr>
<tr>
<td>LI03: I am eager putting to the test new features of Excel (Strongly disagree…Strongly agree) (Gray and Meister (2004))</td>
<td>0.46</td>
</tr>
<tr>
<td><strong>PU – Perceived usefulness, Davis (1989): Cronbach’s alpha = 0.96</strong></td>
<td></td>
</tr>
<tr>
<td>PU01: The skills provided by Excel course increase my performance (Strongly disagree…Strongly agree)</td>
<td>0.87</td>
</tr>
<tr>
<td>PU02: The skills provided by Excel course increase my productivity (Strongly disagree…Strongly agree)</td>
<td>0.90</td>
</tr>
<tr>
<td>PU03: The skills provided by Excel course improve my efficiency (Strongly disagree…Strongly agree)</td>
<td>0.90</td>
</tr>
</tbody>
</table>

The items used in the SEM analysis are as follows: Concentration CO=CO01, Enjoyment EN=EN02, Time distortion TI=TI02, Balance between skills and challenges BA=CH03, Cognitive replication LR=LR03, Cognitive adaptation LA=LA03, Cognitive innovation LI=LI02. The items were chosen based on the best loadings. In addition, all items of perceived usefulness (PU), PU01, PU02, PU03 were chosen. Furthermore, Goal GO that was measured using school grades (4-10) and converted to the scale 1-7 was used in the SEM-analysis.

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Paper 4

Learning to Use IT Adaptively: Flow Experience Increases Transfer of Learning

Abstract

Information systems (IS) theory is in need of ideas for how to help people increase their practical competence of using information technology (IT) to better meet the demands of the everyday living. We argue that better understanding of how the capacity to adapt IT to new situations and uses develops is central to this end. In this paper, we explore how flow experience in the IT learning process compares to motivation as a determinant of one’s capacity for adaptive IT use. We integrate learning transfer, flow experience, and self-determination theory into a research model, which we test with longitudinal quantitative data and structural equation modelling (SEM). We find that learning process related flow experiences, rather than motivation, directly determine one’s capacity for adaptive IT use.

Keywords: adaptive use, learning transfer, flow experience, motivation, structural equation modelling, SEM
Introduction

The very meaning of practical competence of IT use is changing: Information technology has changed radically during the past few decades and so has its role in the everyday life of people. IT use has shifted from predominantly organizational behaviour toward individual consumption (e.g. Venkatesh et al, 2012). At the same time, IT use has transformed from being mandated, planned, and predictable into being voluntary, unplanned, and unpredictable. IT use has become part of the mundane. Today, information technology is increasingly used as means to one’s everyday ends (e.g. Bagozzi, 2007). It is used adaptively as a “fixer” to take on the little surprises of the life (e.g. Salovaara et al, 2011; Öörni & Lyttinen, 2015). In line with this thinking businesses are actively promoting IT with the argument that it offers increased freedom and flexibility (Chae & Kim, 2003; Mallat et al, 2009).

Our knowledge on increasing one’s capacity to use IT adaptively is lagging behind. Few studies have been published on adaptive IT use and its antecedents (cf. Choi et al, 2007; Elie-Dit-Cosaque & Straub, 2011; Ho & Kuo, 2010; Sun, 2012). Rather, most studies that seek to explain IT use or its antecedent conditions operate inside the planned behaviour paradigm (Ajzen & Fishbein, 1980; Ajzen, 1991) to find motivational factors that predetermine IT use. The gap between IT use research and the increasingly adaptive actual use persists even though eminent IS researchers have called attention to it for some time now: For example, Benbasat & Barki (2007) invite “researchers broaden their perspective of system use from one that exclusively focuses on a narrow ‘amount’ view of users’ direct interaction with systems to one that also includes users’ adaptation, learning, and reinvention behaviors around a system.” (p. 215) Advancing theory on adaptive IT use should benefit both the academia and the industry. Businesses that produce and market IT will benefit in the form of better advice for increasing use of their products. Academia, in turn, should directly benefit from bringing theory in line with the current practice of IT use.

In this paper, we aim to model determinants of capacity for adaptive use. The basic idea of our paper is as follows: Adaptive behaviour is in many ways the antithesis of planned behaviour (Öörni & Lyttinen, 2015) and, thus, it is questionable if determinants of planned use, such as motivation to use IT, should directly predict individuals’ capacity to perceive opportunities for and innovate novel ways of using IT. Rather, we argue that the learning encounters with IT should determine one’s capacity to use the technology adaptively. To test this idea, we combine learning transfer (Byrnes, 1995; Bransford et al, 1999), flow experience (Csikszentmihalyi, 1990), and self-determination (Ryan & Deci, 2000) theory into a research model. Learning transfer theory allows us to explain how IT use adapts to novel situations. Flow experience theory, in turn, identifies characteristics of the IT learning process that determine learning transfer and facilitate adaptive IT use. Finally, self-determination theory helps us explain how motivation, drawn from perceived characteristics of IT, can further learning transfer through facilitating flow experience. We answer to the following research questions: 1) Does motivation influence learning transfer for adaptive IT use? 2) Does flow experience influence learning transfer for adaptive IT use? 3) Is flow experience antecedent to motivation or motivation antecedent to flow experience?
The structure of the paper is as follows: In the theory section of the paper, we explain how we construct, using the aforementioned theories, a research model, which defines the causal relationships between learning transfer, flow experience, and motivation. We also derive a number of testable hypotheses from the model. In the methodology section we explain both our operationalization of the key concepts found in the hypotheses and the field experiment set up for collecting data needed for hypotheses testing. In the results section, we report the characteristics of the measurement and structural equation models used for testing our research hypotheses. Finally, in the discussion section, we explain the implications of our findings in terms of advancing adaptive IT use. Our theorizing and empirical testing call for several changes in the current information systems practice of conceptualizing and operationalizing transfer, flow, and motivation to accurately model antecedents of adaptive IT use.

**Theory**

In this chapter we elaborate on the idea that a meaningful learning process is the most important means for advancing adaptive IT use. We explain why *transfer of learning*, the process through which past experiences affect performance in a new situation (Ellis, 1965), is central to one’s capacity to use IT in adaptive and even innovative manner. Next, we tell how *flow experience*—completely focused motivation (Csikszentmihalyi, 1990)—correlates with high performance learning (Csikszentmihalyi, 1993) and with one’s capacity for adaptation and innovation (Gray & Meister, 2004). Finally, we explain how motivation, in the form of perceived IT characteristics, facilitates flow experience. We conclude by deriving our research model and presenting the research hypotheses for the relationships between motivation, flow experience, and learning transfer.

*Learning transfer as an antecedent of adaptive IT use*

Learning transfer (LT) is, in its core, the influence of improvement in one mental function upon the efficiency of other functions (Thorndike & Woodworth, 1901). Transfer is a key issue of learning because it determines whether the newly learned skill or information can be accessed in an opportune situation for its application. Transfer overcomes the normal limitations of learning: Information is recalled more easily in a situation that is similar to the learning context (Godden & Baddeley, 1975). The scope of the learning transfer concept has expanded from the classic definition of “the degree to which a behaviour will be repeated in a new situation” (Detterman & Sternberg, 1993, p. 4) to include flexible adaptation of old responses to new settings and preparation for future learning (Bransford & Schwartz, 1999). Current definitions (Byrnes, 1995; Bransford *et al*, 1999, p. 39) of the concept agree that learning transfer is the ability to extend what has been learned in one context to new contexts.

Learning transfer has been applied to IT context to explain human–computer interaction for more than four decades now. For example, domain-focused cognitive models have been used to study how end users learn and perform while interacting with IT (e.g. Card *et al*, 1980a, 1980b; Card *et al*, 1983; Payne & Green, 1986; Polson, 1987; Polson, 1988; Olson & Olson, 1990; Scott, 2000). Originally, the focus of interest rested on how user knowledge transferred from one application, such as an editor (Singly & Anderson, 1985;
Singley & Anderson, 1987–1988), to another application inside the same application category. Also of interest was how knowledge about elements of the user interface, such as a menu structure, transferred between applications (Foltz et al., 1988). As of late, transfer of learning has featured in IS literature in relation to IT as a learning technology (Bossard et al., 2008). As most of these studies have adopted a relatively narrow definition of transfer, it is hardly surprising that transfer has not played a major role in theories of IT use: Reported studies have regularly found local and task-specific knowledge rather than general strategies of transfer.

We argue that IS research should benefit from seeing transfer of learning in a wider perspective: Transfer of learning should be understood in terms of one’s capacity to apply and adapt IT to novel situations and uses. Recent knowledge management studies offer conceptual tools to this end: Gray & Meister (2004) report learning outcomes, which embody transfer of learning and comprise the dimensions of cognitive replication, cognitive adaptation, and cognitive innovation (Gray & Meister, 2004). Replication refers to efficiency: One can repeat what has been learned in one context to new contexts. Adaptation, in turn, involves changes in the underlying structures of understanding. Finally, innovation is a radical change in the use of applications. Learning transfer can be understood as an antecedent of adaptive IT use when it is construed in this contemporary manner.

The extent to which newly acquired knowledge transfers to novel contexts depends on the characteristics of the learning process that produced that knowledge. It has been demonstrated, for example, that the choice of a teaching method can profoundly influence the balance of efficiency and innovativeness in transfer (Schwartz et al., 2005). In connection to learning to use IT, Choi et al. (2007) and Ho & Kuo (2010) find a positive relationship between flow experience and learning outcomes indicative of transfer.

**Flow experience in learning transfer**

Flow experience (FE) is the mental state of complete immersion or engagement in an activity (Csikszentmihalyi, 1990). Csikszentmihalyi’s flow theory integrates motivation, personality, and subjective experience with the completely focused attention. The core idea in the theory is that committing to an activity may result in feelings ranging from boredom to anxiety, depending on the balance of one’s skills and challenges of the task. When skills and challenges are in balance, however, one may experience flow, a complete immersion in the activity (see Figure 1).
It is possible to enter a flow state while performing any activity. Effortless activities, however, seldom elicit flow experience, as they do not consume one’s attention to the limit. Flow theory postulates three conditions for achieving a flow state (Csikszentmihalyi et al., 2005): First, the activity contains a clear set of goals. Clear goals give direction and purpose to behaviour: “Their value lies in their capacity to structure experience by channelling attention rather than being ends in themselves” (p. 601). Second, the perceived challenges must match the perceived skills. When this happens, task completely absorbs one’s attention. When the balance is disturbed, attention is distracted. Overly challenging tasks cause anxiety while undemanding tasks lead to boredom. Third, flow depends on clear and immediate feedback. Feedback helps the individual negotiate changing environmental demands, it “dictates whether to adjust or maintain present course of action” (p. 602).

Under these conditions, an individual may enter flow, a subjective state with the following characteristics (Nakamura & Csikszentmihalyi, 2009, pp. 195–6): 1) intense and focused concentration on the present moment, 2) merging of action and awareness, 3) loss of reflective self-consciousness (i.e., loss of awareness of oneself as a social actor), 4) a sense that one can control one’s actions; that is, a sense that one can in principle deal with the situation because one knows how to respond to whatever happens next, 5) distortion of temporal experience (typically, a sense that time has passed faster than normally), and 6) experience of the activity as intrinsically rewarding, such that often the end goal is just an excuse for the process. These characteristics reflect the seamless unfolding of the experience from moment to moment. They can appear independently of each other in connection to different experiences. Only in combination, though, they constitute flow experience.
Flow experiences produce positive affect and lead to better performance (Csikszentmihalyi, 1990; Snyder & Lopez, 2007). Also, flow correlates with high performance in learning (Csikszentmihalyi, 1993): Concentrated attention, consistent repetition of activity, and positive emotions produced by flow experience are conducive to learning. These characteristics of flow correspond with the principles of readiness, exercise, and effect, respectively, collectively known as Thorndike’s laws of learning (Thorndike, 1932), which remain the foundation of current learning theories. Later empirical evidence connects flow experience to positive learning outcomes in IT (Choi et al., 2007) and e-learning (Ho & Kuo, 2010) contexts. Choi et al. (2007) and Ho & Kuo (2010) find a positive relationship between flow and learning outcomes indicative of learning transfer, even though somewhat unorthodox instruments were used to measure flow experience. Choi and colleagues apply measures such as learner interface, interaction, instructor’s attitude towards students, and the contents of the course. Ho and Kuo, in turn, adopt their operationalization from Trevino & Webster (1992), who suggested four indicators of flow experience: feel of being in control, focusing attention on activity, feeling curiosity, and having intrinsic interest. Despite the somewhat ambiguous operational definitions of flow experience, these studies suggest that FE is an antecedent to learning transfer.

H1. Flow experience determines learning transfer.

Motivation in learning transfer

Motivation is a theoretical construct that captures the reasons behind actions. Rather than being a unitary phenomenon, motivation can substantially vary in its orientation: Intrinsic motivation refers to inherent interest or joy of action while extrinsic motivation refers to a separable outcome of an action (Ryan & Deci, 2000). Recent evidence from IT use context tells that in practice intrinsic and extrinsic motives, fun and usefulness, usually combine to influence IT use (Gerow et al., 2013). From our perspective the crucial property of motivation is its relation to flow experience and learning transfer.

IS literature has overwhelmingly focused on motivation as a determinant of IT use. This focus is so strong that co-variation between motivation and other constructs such as flow experience are almost habitually interpreted to indicate that motivation is the consequent. Motivations are usually operationalized as perceived IT characteristics in IS research (e.g. Venkatesh, 1999). Studies have consistently reported a positive association between flow experience and extrinsic motivational factors such as perceived ease of use (PEOU) (Venkatesh, 1999) and perceived usefulness (PU) (Agarwal & Karahanna, 2000). According to this view, enjoyable IT-related activities can influence PU and PEOU of technology and, therefore, flow experience influences extrinsic motivation (i.e., flow→motivation) rather than vice versa (e.g., Roca et al., 2006; Saadé & Bahl, 2005; Shang et al., 2005). When judging such reports it is useful to keep in mind that these studies have sought to extend the technology acceptance model (TAM) with antecedents of IT beliefs. In contrast, earlier IS research (Davis et al., 1992; Trevino & Webster, 1992) has interpreted the observed association of flow and extrinsic motivation in line with the flow theory, meaning that perceptions of usefulness, for example, would be antecedents of flow experienced while using IT (i.e., motivation→flow).
That the direction of causality between extrinsic motivation and flow experience remains undecided warrants a discussion on the motivation–flow experience relation. In particular, we are interested in the discrepancy between IS theory and psychological theory on this matter: to us it seems unlikely that the causality in an IT domain would be different from other areas of human life. As already noted, Csikszentmihalyi (1990) relates flow experience to motivation by characterizing flow experience as completely focused motivation. Flow theory is equally clear on the outcomes of flow: Flow is an autotelic experience, activity that is intrinsically rewarding. It produces enjoyment rather than perceptions of usefulness or ease of use. The theory is less clear, though, about the relationship between antecedent motivations and flow experience, which may have led researchers to interpret the relationship between motivation and flow differently. One can enter a flow state while performing any activity, although enjoyable tasks seem to be more opportune to flow (Csikszentmihalyi, 1988; Snyder & Lopez, 2007). As flow theory does not take a clear position in this matter, we have to source elsewhere for advice.

Self-determination theory suggests that extrinsic motivation is more likely an antecedent rather than a product of flow for there is a general tendency of extrinsically motivated behaviours becoming more self-determined through the processes of internalizing and integrating (Ryan & Deci, 2000). Further support for this position comes from recent findings in cognitive psychology, which suggest that extrinsic motives can non-consciously guide attention: Attention is the product of selection processes that proactively filter behaviourally relevant stimuli from clutter (Anderson, 2011). Considering the amount of information our senses produce, circa 1 megabyte per second of raw visual data only (Koch & Tsuchiya, 2006), in proportion to the problem solving capacity of the human brain (Cowan, 2005a, 2005b), it is not so surprising that only a portion of this information is attended to. Information relevant to one’s current goal is implicitly prioritized (Dreisbach & Goschke, 2004; Aston-Jones & Cohen, 2005; Della Libera & Chelazzi, 2006, 2009) and gets selected with disproportionately high probability for further processing (Dijksterhuis & Aarts, 2010). In other words, extrinsic motivation modulates attention, and this modulation is automatic: We can’t directly observe attention modulation processes even though we can, on occasion, override them with conscious effort. Because extrinsic motivations affect attention, and flow is characterized as a state of completely focused attention, extrinsic motivation (such as perceived usefulness) should be considered antecedent to flow and not the other way around.

To summarize, the received wisdom from self-determination theory and psychological literature on attention strongly suggests that extrinsic motivation is causative of flow, rather than the other way around. The automatic (non-conscious) mental processes that control attention are sensitive to rewards. When these processes “determine” that the rewards are sufficiently high to allocate one’s full attention to the task at hand, we observe flow. The individual experiences flow when the task fully absorbs her resources of attention. This translates to the IT context as follows: perceptions of motivational factors—such as PU—should be seen as antecedents of flow as opposed to the received wisdom from recent IS theory.

H2. Extrinsic motivation determines flow experience.
Until now, we have theorized that motivation should influence transfer of learning indirectly through flow. As recent IS literature favours the idea that motivation influences aspects of IT use directly rather than through the flow construct, empirical testing of such direct influence is in our interest. Motivational factors are usually operationalized in IS research through the behavioural beliefs PU and PEOU (Davis, 1989; Davis et al, 1989). A multitude of studies has found PU to be the most important determinant of IT acceptance (Davis, 1989; Davis et al, 1989; Davis et al, 1992; Karahanna & Straub, 1999; Venkatesh & Davis, 2000; Chau & Hu, 2002) and use (Bhattacherjee, 2001; Koufaris, 2002; Castaneda et al, 2007; Lee, 2010; Kan-Min et al, 2011; Limayem & Cheung, 2011). In line with recent IS research, learning theory has found some evidence for a direct link between extrinsic motivation and learning transfer: In their study, Pugh & Bergin (2006) demonstrate that motivational factors can directly influence transfer of learning. To complete our model, we posit that extrinsic motivation to use IT can directly influence learning transfer:

**H3.** Extrinsic motivation determines learning transfer.

**Research model**

Our research model, based on the previously presented research hypotheses, is presented in Figure 2. Learning transfer is the key to one’s capacity for adaptive and innovative IT use. It is the natural criterion to assess the influence of extrinsic motivation and learning process on IT learning. Our model connects learning transfer to its antecedent constructs: flow experience and motivation.

![Figure 2: Research Model.](image)

While the research model comes close to some previous research efforts (e.g. Ho & Kuo, 2010), similarities to the previously published models are superficial as our model makes important amendments to the original models. Most importantly, existing theory does not explicitly connect learning outcomes to learning transfer. We have sourced transfer of learning theory to better reason how motivation and flow experience...
would increase one's capacity for adaptive IT use. We also conceptualize motivation and its influence on both flow experience and learning transfer differently from the previous efforts.

**Research method**

In this section we discuss the context of the study, instrument development, and the data collection procedure. Much of the following discussion focuses on the causal relationship between extrinsic motivation, flow experience, and learning transfer. The direction of the relationship between extrinsic motivation and flow experience is critical, for existing evidence is insufficient to make firm claims about the causality in the relationship. To test the direction of the extrinsic motivation → flow experience causal relationship, we set up a longitudinal study in which we measured extrinsic motivation (PU) of IT learning in the beginning of our learning period (t1), and flow experience and learning transfer three weeks later, at the end of the learning period (t2).

**The participants**

The participants of the study came from the population of business school students attending the spreadsheet section of a Bachelor level course that introduced a set of commonly used ICT tools: spreadsheets (MS Excel), word processing (MS Word), presentation graphics (MS PowerPoint), information search (Journals database in the university library), and reference management (RefWorks). The course focuses on these tools' advanced features and their utilization. Even though it is possible to pass the course through a proficiency test, the majority (approx. 75% each year) of the students take part in the voluntary contact teaching lessons during their first year of the studies.

In fall 2012, when the data for this study was collected, the Excel section of the course comprised 12 contact hours and 12 hours of individual working during 3 weeks. Students were divided into 5 groups, each with 40 students on average. Teaching took place in a computer class, where each student had the opportunity to practice the material individually.

**Instrument development**

We adopted measurement items from relevant earlier studies and modified the wordings of the items to fit with our context when necessary.

Flow experience (FE) consisted of six sub-constructs adapted from Csikszentmihalyi (1996): perceived skills (SK), perceived challenges (CH), clear goals (GO), concentration (CO), enjoyment (EN), and time distortion (TD). These constructs were operationalized as follows. We included scales for skill (SK) and challenge (CH) from Wu & Liang (2010). We measured the clarity of goals (GO) using a seven-step scale of school grades (4 to 10, 10 denoting exceptional performance). This decision was based on our consideration of the study's population, which had an extensive experience of this scale type. We included concentration (CO) and enjoyment (EN) in our study in the form presented by Ghani & Deshpande (1994). They were measured using a seven-point semantic differential scale anchored from positive to negative adjective pairs. Finally, the time distortion construct (TD) was adapted from Wu & Liang (2010). Previous efforts that have sought
to connect motivation, flow experience, and transfer of learning, have operationalized flow experience in ways that do not conform to the advice found in the flow theory (e.g. Csikszentmihalyi, 1993). We find our operationalization of the flow construct more faithful to the original conceptualization.

Learning transfer construct (LT) comprised three measurement items, adapted from Gray & Meister (2004): cognitive replication (LR), adaptation (LA), and innovation (LI). We operationalized extrinsic motivation as perceived usefulness (PU), adopted from UTAUT’s performance expectancy construct (Venkatesh et al, 2003) and containing six items. These were measured using a seven-point Likert scale validated in the earlier studies. All measurement items are listed in Appendix 1.

Since all constructs in our research model are in causal relationship with each other, item-priming effect is the most likely source of common method variance (CMV) (see e.g. Podsakoff et al, 2003). Since there are no means to tell CMV apart from common variance resulting from the causal relationship, we tried to minimize CMV by positioning the measurement variables used in the study far apart. We interleaved the variables used in the present study by other questions in the questionnaire.

**Data collection**

The data were collected with a pen and paper survey in two stages: in weeks 2 and 6 of the training period lasting six weeks. We introduced a time delay between measuring the cause (motivation) and effect (flow experience, learning transfer) to demonstrate the causal relationship: We used the measurement of PU from \( t_1 \) and the measurements of the other constructs from \( t_2 \). This was essential, since the previous efforts on motivation–flow experience and motivation–learning transfer relationships have not empirically established the direction of these causal relationships. We obtained 190 fully completed responses at the first round (\( t_1 \)) and 116 fully completed responses at the second round (\( t_2 \)). Responses of these two surveys were matched using student numbers to create a single record for each student. After screening the responses for missing items, 113 responses were accepted for the analysis. We checked the data for outliers and normality. No severe outliers were found, and the multivariate skewness and kurtosis were clearly below the critical values (Mardia coefficient) for all variables.

**Results**

In this section we present the empirical findings of the survey. The demographic profile of the respondents is presented in Table 1. Fifty per cent of the respondents were female and fifty per cent male. Most respondents were young adults and mainly first year students. They had less than four years of spreadsheet software experience on average and less than a monthly median frequency of use.
Table 1. Descriptive Statistics of the Respondents

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>N</td>
<td>113</td>
</tr>
<tr>
<td>Gender proportion (percentage of females)</td>
<td>50 %</td>
</tr>
<tr>
<td>Average age (years)</td>
<td>21.8</td>
</tr>
<tr>
<td>Time in the university (years)</td>
<td>1.2</td>
</tr>
<tr>
<td>Average Excel use before ICT course (years)</td>
<td>3.76</td>
</tr>
<tr>
<td>Median frequency of Excel use before ICT course</td>
<td>Less than monthly</td>
</tr>
</tbody>
</table>

To examine the antecedent conditions of learning transfer, we tested the research model shown in Figure 2 using Amos 19.0 software and maximum likelihood estimation. In evaluating the model, we followed the two-step procedure recommended by Jöreskog & Sörbom (1993, pp. 128-9). First, we carried out confirmatory factor analysis to examine the adequacy of the measurement component of the proposed model. Next, we evaluated the structural portion of the model.

**Measurement model**

The standardized and unstandardized estimates and standard errors for the measured variables in the measurement model are reported in Table 2. The model fit was good: $\chi^2$/df was 1.341 ($\chi^2$ = 79.104, df = 59, $p = .041$), CFI=.977, RMSEA=.055, PCLOSE=.375, and SRMR=.053. All measurement items had statistically significant ($p < .01$) loadings on their hypothesized factors.
<table>
<thead>
<tr>
<th>Construct</th>
<th>Item</th>
<th>Std Est</th>
<th>Unstd Est</th>
<th>Std Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow experience</td>
<td>TD</td>
<td>.70</td>
<td>1</td>
<td>1.35</td>
</tr>
<tr>
<td></td>
<td>EN</td>
<td>.52</td>
<td>.76</td>
<td>1.33</td>
</tr>
<tr>
<td></td>
<td>CH</td>
<td>.61</td>
<td>.93</td>
<td>1.37</td>
</tr>
<tr>
<td></td>
<td>SK</td>
<td>.78</td>
<td>1.12</td>
<td>1.31</td>
</tr>
<tr>
<td>Learning transfer</td>
<td>LR</td>
<td>.89</td>
<td>1</td>
<td>1.22</td>
</tr>
<tr>
<td></td>
<td>LA</td>
<td>.92</td>
<td>1.04</td>
<td>1.21</td>
</tr>
<tr>
<td></td>
<td>LI</td>
<td>.75</td>
<td>.85</td>
<td>1.23</td>
</tr>
<tr>
<td>Perceived usefulness</td>
<td>PU1</td>
<td>.90</td>
<td>1</td>
<td>1.19</td>
</tr>
<tr>
<td></td>
<td>PU2</td>
<td>.96</td>
<td>1.01</td>
<td>1.13</td>
</tr>
<tr>
<td></td>
<td>PU3</td>
<td>.79</td>
<td>.88</td>
<td>1.20</td>
</tr>
<tr>
<td></td>
<td>PU4</td>
<td>.71</td>
<td>.80</td>
<td>1.20</td>
</tr>
<tr>
<td></td>
<td>PU5</td>
<td>.76</td>
<td>.82</td>
<td>1.16</td>
</tr>
<tr>
<td></td>
<td>PU6</td>
<td>.75</td>
<td>.84</td>
<td>1.20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model Fit Statistics</th>
<th>Threshold</th>
<th>Results</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chi Square (df)</td>
<td></td>
<td>79.1 (59)</td>
<td></td>
</tr>
<tr>
<td>Probability</td>
<td></td>
<td>.041</td>
<td></td>
</tr>
<tr>
<td>CMIN/DF</td>
<td>&lt; 2</td>
<td>1.341</td>
<td>(Tabachnick et al, 2013)</td>
</tr>
<tr>
<td>CFI</td>
<td>&gt; 0.95</td>
<td>.977</td>
<td>(Hu &amp; Bentler, 1999)</td>
</tr>
<tr>
<td>RMSEA</td>
<td>&lt; 0.08</td>
<td>.055</td>
<td>(Hu &amp; Bentler, 1999)</td>
</tr>
<tr>
<td>PCLOSE</td>
<td>&gt; 0.05</td>
<td>.375</td>
<td>(Hair et al, 2010)</td>
</tr>
<tr>
<td>SRMR</td>
<td>&lt; 0.08</td>
<td>.053</td>
<td>(Hu &amp; Bentler, 1999)</td>
</tr>
</tbody>
</table>
Convergent and discriminant validity and reliability were acceptable: the measured variables correlated more highly with each other within their parent factor than with variables outside their parent factor (Table 3). Cronbach’s alpha (CA) is above the generally agreed lower limit of .70, composite reliability (CR) is well above the generally suggested threshold of 0.7. Average variance extracted (AVE) is above the threshold of 0.5 for Learning transfer and Perceived usefulness yet marginally below for Flow experience. Maximum shared variance (MSV) and average shared variance (ASV) are less than AVE for all factors. Taken together, these findings demonstrate that the measurement model fits the data well.

<table>
<thead>
<tr>
<th>Table 3. Convergent and Discriminant validity of the constructs</th>
</tr>
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<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Flow experience</td>
</tr>
<tr>
<td>Learning transfer</td>
</tr>
<tr>
<td>Perceived usefulness</td>
</tr>
</tbody>
</table>

Values on diagonal are square roots of AVE.

**Structural model**

We run the structural model using maximum likelihood estimation by starting with the hypothesized model and pruning non-significant paths (Hair et al. 2010). The final model again had a good fit: $\chi^2/df = 1.341$ ($\chi^2 = 79.104$, $df = 59$, $p = .041$), CFI = .977; RMSEA = .055; PCLOSE = .375; SRMR = .053. The predictors accounted also for a reasonable proportion of the variance in later use behavior ($R^2 = 44\%$). The final structural model is shown in Figure 3.
As shown in Figure 3, flow experience has a statistically significant effect on learning transfer (standardized \( \gamma_{t,2} = .62, p < .01 \)) as hypothesized (support \( H_3 \)). This finding demonstrates that learning transfer can significantly benefit from a learning process in which learning challenges are in balance with one’s available attention resources.

Perceived usefulness at \( t_1 \) has a statistically significant effect on flow experience at \( t_2 \) (standardized \( \gamma_{t,1} = .25, p = .026 \)) as hypothesized (support \( H_2 \)). This finding demonstrates that extrinsic motivation can be causative of flow experience in IT learning. It is in line with current theorizing on flow experience and attention: extrinsic motivation can entice the attention mechanism, which, in turn, gives rise to the flow experience. It should be understood that this indirect effect on learning transfer mediated by flow experience is, by definition, non-conscious, and therefore not empirically captured in our study. However it hints, supported with the theory presented above, that while people have only limited conscious control over attention and while flow experience can’t be forced, rewards can still facilitate flow experience.
Perceived usefulness has no direct effect on learning transfer (standardized $\gamma_{11} = .11$, $p < .20$) *(H$_3$ not supported)*. Hence, perceived benefits of technology use can motivate the individual indirectly through flow experience even in the absence of a direct, conscious motivational effect. In our data, PU facilitates flow experience by attracting attention to the learning process, which in turn helps the student learn to apply technology, adapt technology to her ends, and even use the technology to reshape her everyday tasks.

**Discussion**

In this study, we explored the relationships of learning transfer, flow experience, and extrinsic motivation in an IT learning context. The findings suggest that flow experience is a major determinant of learning transfer in IT learning. Flow theory informs us that exceptional concentration of attention, captured by the flow concept, is conducive to meaningful learning. Extrinsic motivation such as perceived benefits of using technology (i.e., PU) seem to play an important role in non-consciously attracting attention to learning, which is a central condition for flow experience. Such a relationship between perceived benefits of IT use and the flow experience has been observed in previous literature *(Ho & Kuo, 2010)* but a strong theoretical explanation for the connection has been, at least to our knowledge, missing.

**Theoretical contribution**

The main theoretical contribution of our study is the novel demonstration of the connections between extrinsic motivation, flow experience, and learning transfer: 1) Meaningful learning process is the direct determinant of one’s capacity for adaptive IT use, and 2) the learning process can fully mediate the effect of IT related extrinsic motivation on that capacity. Extrinsic motivation, such as PU, should be treated as a possible determinant rather than as a consequent of flow experience.

Our findings contradict some of the previous efforts that have used similar approach to study the effects of motivation and learning process on IT use. The most important difference is that we do not obtain direct influence between motivation and transfer of learning. There are three possible reasons for that: 1) Our operationalization of the flow experience construct was more faithful to the original flow theory than the operationalizations found in previous studies, 2) we measured extrinsic motivation more in line with existing IS literature, and 3) we instituted a time delay in between measuring the cause (motivation) and the effect (flow experience, transfer of learning).

Even more importantly, our findings depart from the mainstream IS research on the role of flow experience in IT use. The current position of IS research is that flow experience is an antecedent to extrinsic motivation (perceived usefulness) to use IT, as we have previously explained. The supporting findings are mostly based on cross-sectional data and do not empirically establish the causality between the two constructs but rather settle to interpret observed co-variation of flow experience and motivation constructs, obtained at the same time, as evidence for causal relationship. Our findings challenge this position.

An obvious question resulting from our finding is whether the models following the prevailing flow→motives viewpoint should be updated. In our opinion, those studies that observe a relationship
between flow experience and IT beliefs and interpret this relationship to indicate that flow experience is an antecedent to external motivation, should be treated with care. Our results do not deny that flow experience and its near concepts, such as cognitive absorption, could also act as antecedents to PU and PEOU. Our results do, however, demonstrate that the reports of extrinsic motivation → flow experience relationship should not be interpreted to mean that flow experience was the antecedent of extrinsic motivation, unless the direction of causality was expressly tested with longitudinal data.

Nevertheless, our suggestion on the causality poses a challenge to models and theories, such as TAM, based on theory of reasoned action (TRA; Ajzen & Fishbein, 1980). In TAM PU is a direct antecedent of IT use intention. Including flow in this model as a consequent of PU means a deviation from TAM’s theoretical scope. TAM, by being based on TRA, addresses only conscious and rational action. Flow, however, is not consciously controllable cognitive phenomenon and thus cannot be satisfactorily captured by TRA-based theories. Therefore, our contribution cannot be subsumed in IS theories based on TAM and TRA; it should be approached as their complement.

A more fundamental contribution to the IT use theory comes from identification of the non-conscious yet motivated mechanism (attention) that influences IT use related behaviours. We have suggested in this paper that there may be other mechanisms besides conscious reasoning that are able to channel IT use related extrinsic motivation factors, such as PU. This finding offers an explanation to the disconcerting recent observations of extrinsic motivation factors and IT use being unrelated (e.g. Nistor, 2014). We observed in our study that PU—the most important extrinsic motivation factor of the technology acceptance and use models—and learning transfer were not directly related to each other. The conventional IS theorizing that sees the learning process as the cause and extrinsic motivation as the effect would tell us that both extrinsic motivation and flow experience were dead-ends in our data as neither could have impacted learning transfer because of the missing link between extrinsic motivation and learning. Our findings suggest that the missing usefulness – IT use link does not necessarily mean that extrinsic motivation did not have any effect on IT use.

**Practical contribution**

The practical contribution of the paper lies in its more advanced advice for promoting meaningful learning in IT use context. It is imperative to understand how to support adaptive and innovative IT use as these kinds of behaviours will become more important when effective self-directed IT use is increasingly required in tomorrow’s knowledge economy (e.g., Scheepers & Middleton, 2013). The more versatile information technologies become and the more varied their use contexts are, the better IT use is characterized by one’s ability to apply the technology in novel situations and innovate new uses for it (see Salovaara et al, 2011). Ability to transfer learning will be increasingly beneficial in such settings, and understanding the antecedents to transfer will gain on importance.

The most important conclusion we can make is that adaptive IT use is a skill that can be learned if the learning process has suitable characteristics. Full immersion in the learning process, i.e. flow experience,
was the direct determinant of transfer of learning for adaptive IT use. The most important conditions for flow experience in our data were the balance between perceived challenges of the task (i.e. learning) and one's perceived skills. It seems that designing learning events that are suitably challenging is the best way to help people learn to apply and adapt IT to new situations and uses. Motivation is a necessary yet insufficient determinant of transfer of learning. If we really want to advance transfer of learning, we need to focus on the learning process.

To summarize, when IT training succeeds in foregrounding IS features that users perceive as useful, these extrinsic motivation factors also increase the likelihood that further learning becomes inherently enjoyable through moments of flow experience (cf. Gerow et al, 2013). With further research, it may be possible to tap the potential of this partially non-conscious cognitive mechanism, as a complement to the more consciously and rationally guided IT behaviour that has been receiving much more attention in IS research.

**Limitations and future research**

We identify some limitations in our research. First, we have relied on self-reports for measuring transfer of learning. We have adapted a construct that has been validated in multiple previous studies yet it provides indirect evidence on one's actual ability to adapt and innovate with information technology in somewhat novel situations. A controlled laboratory experiment with carefully constructed tasks to measure the participants' ability to apply and adapt their learning to novel problems and innovate with the technology would produce direct evidence in support of transfer of learning. Second, we have demonstrated that the *extrinsic motivation → flow experience → transfer of learning* chain of logic applies to a single context (MS Excel). The research should be replicated in other domains to evaluate the boundary conditions of our findings. In particular, the domain of mobile computing would be particularly potent for testing our ideas because handheld devices and mobile applications are the epitomes of adaptive IT use. Empirical support from such contexts would further strengthen the findings and yield important information about the generalizability of our findings. It is evident that we have taken a tentative step toward charting the antecedents of adaptive IT use rather than fully explained the phenomenon. That our knowledge on adaptive IT use and its antecedents remains so limited suggests that transfer of learning is likely to become a fruitful arena for future research on advancing adaptive IT use.
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THORDIKE EL and WOODWORTH RS (1901) The Influence of Improvement in One Mental Function upon the Efficiency of Other Functions. Psychological Review 8, 247-261.

**Appendix A (Questionnaire)**

**Learning Transfer**

| LA | I am able to adapt what I learned in the spreadsheet course to increase the efficiency and effectiveness of my studies and work. (Strongly disagree...Strongly agree) |
| LR | I am able to apply what I learned in the spreadsheet course at studying and work. (Strongly disagree...Strongly agree) |
| LI | I am able to find a new way of doing my job based on what I learned in the Excel course (Strongly disagree...Strongly agree) |

**Flow Experience**

| SK | I am good at using Excel. (Strongly disagree...Strongly agree) |
| CH | Learning to use Excel challenges me. (Strongly disagree...Strongly agree) |
| GO | The goal of learning Excel was clear to me. (school grade 4-10) [dropped] |
| CO | I was deeply engrossed in Excel activity ... Not deeply engrossed [dropped] |
| EN | Learning to use Excel is interesting ...Not interesting. |
Time seems to pass quickly when learning to use Excel. (Strongly disagree...Strongly agree)

**Perceived Usefulness**

| PU1  | 1. Using Excel would enable me to accomplish tasks more quickly. (Strongly disagree...Strongly agree) |
| PU2  | 2. Using Excel would improve my job performance. (Strongly disagree...Strongly agree)               |
| PU3  | 3. Using Excel in my job would increase my productivity. (Strongly disagree...Strongly agree)       |
| PU4  | 4. Using Excel would enhance my effectiveness on the job. (Strongly disagree...Strongly agree)      |
| PU5  | 5. Using Excel would make it easier to do my job. (Strongly disagree...Strongly agree)               |
| PU6  | 6. I would find Excel useful in my job. (Strongly disagree...Strongly agree)                        |
Adaptive IT use refers in general to the practice of adapting IT skills learned in one context for use in new contexts, or the practice of adapting IT skills in different ways. It implies a change from automatic thinking to actual thinking. The antecedent of adaptive IT use is successful learning transfer which, in turn, requires an effective learning process. Central to a meaningful learning process are flow experiences, which, together with motivational factors, help learners to gain the capacity for adaptive IT use. In addition, the principles of cognitive and experiential learning are constantly present. Cognitive learning modifies the underlying structures of understanding, and experiential learning helps when combining new skills with earlier experiences. In this dissertation, such a theoretical model of the IT learning process is developed and tested in the context of office applications.