Smart Devices as U-Learning Tools: Key Factors Influencing Users’ Intention

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Abstract

There was a lack of knowledge about the user’s acceptance of smart devices as ubiquitous learning (u-learning) tools at higher education institutions in Sweden. As the mobile technology grows, the demand for mobile devices, particularly smart devices increases as well. With the increase in the usage of smart devices, the higher education institutions provide mobile learning platforms to attract more customers in the competitive industry of education. Thus, understanding the key factors from the perspectives of end-users is important for the institutions to survive in the competitive market. This study explores and explains Behavioral and Continuance intentions of students regarding the acceptance and usage of smart devices (Smartphones and Personal Digital Assistants or PDA) as u-learning tools. Key factors related to the users’ intentions to accept and continue using smart devices as u-learning tools were identified and hypothesized in the Swedish context. Ten hypotheses were suggested based on TAM, UTAUT, and ECT. To achieve the aim and objective of this study, a quantitative approach was chosen, and a survey strategy based on purposive and convenience sampling techniques were used. A web-based questionnaire on five-points Likert Scale was designed to collect the required data. 115 (96 valid) students answered the questionnaire. The collected data were used to conduct statistical operations in SPSS. Five hypotheses were supported, and the other five were not. The findings suggest that Performance Expectancy, Perceived Mobility value, Confirmation, and Satisfaction positively influence both Behavioral and Continuance Intentions of students to accept and continue using smart devices as u-learning tools. According to the findings, Confirmation and Satisfaction from ECT can be included as separate constructs in UTAUT and UTAUT2. Higher education institutions planning to have (and those that already have) learning platforms, compatible with smart devices, can benefit from the findings. Higher education institutions can also design their u-learning platforms according to the Performance Expectancy, Perceived Mobility value, Confirmation, and Satisfaction of the students.

Keywords
Technology Acceptance Model (TAM), the modified Unified Theory of Acceptance and Usage Technology (UTAUT), Expectation-Confirmation Theory (ECT)
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1. Introduction

This chapter provides the readers with a general background in electronic and mobile learning concepts – focusing on previous research. The background is followed by an introductory description of the problem. The chapter also contains short statements about aim and purpose of the study, its contribution to knowledge and approach used during the research.

1.1. Background

E-learning is considered to be sound, effective, and time and cost saving approach of learning (Conacannon, Flynn & Campbell, 2005; Garrison, 2011). In addition, e-learning tools and technologies have been helping students to broaden their knowledge for several decades now (Horton & Horton, 2003; Wang, Shen, Novak & Pan, 2009). However, there are still problems in e-learning such as time limitation, low-bandwidth network, fixed location, stickiness of students to their computers, etc. (Singh & Zaitun, 2006; Sharples, Taylor & Vavoula, 2010). To be able to tackle and solve such problems, scholars now focus on mobile learning (Huang, Lin & Chuang, 2007; Sharples et al., 2010; Traxler, 2009; Wang et al., 2009). The focus on mobile learning has increased after the recent advancements in information and communication technology (ICT), notably mobile technology (Sharples et al. 2010). With mobile learning, students are not limited to time, fixed location, stickiness to their computers, etc. (Traxler, 2009). On the contrary, the education is available anywhere at any time (Sharples et al., 2010; Shin, Shin, Choo & Beom, 2011). That is to say, the learning is becoming ubiquitous.

The need for learning through mobile devices increases as more and more students use their mobile devices to get the necessary information and knowledge (Sharples et al., 2010; Huang, et al. 2007; Chen, et al., 2010). It is essential for students to manage their time to utilize the available learning resources at maximum, particularly in the fast growing technological era. According to Muhlhauser and Trompler (2002) and Traxler (2009), various activities lead students to move regularly leaving their computers at home while carrying their mobile devices. Thus, the need for learning ubiquitously is increasing (Cheng, Chang & Wang, 2008).

In fact, learning lasts for life – cradle to grave (Hargreaves, 2004). That is to say, we are all lifelong learners, and learn new things every day. There is an extensive research on learning. Some say it is an outcome of a process, and others believe learning is a process by itself (Smith, 2009). Learning has been studied from the perspectives of behavioral, cognitive, humanistic and social/situational theories (Caffarella, 1993; Rothwell & Seneseng, 1999; Smith, 2009). Other researchers (Eshach, 2007) have looked into the types of learning – formal, non-formal and informal. Formal learning is learning at schools, training institutions, universities, etc. Non-formal learning is learning from workshops, job trainings, etc. And, informal learning is learning from daily activities that includes skills learned from family member or community.
Some scholars believe there are only two types of learning: formal and informal (Eraut, 2000; Colley, Hodkinson & Malcolm, 2002; Malcolm, Hodkinson & Colley, 2003). No matter if learning is a process or a product of a process, formal or informal, it is something we are continuously involved with throughout our existence. We improve our knowledge through learning that is achieved from a variety of ways.

One way to achieve knowledge, which is still the primary alternative of the learning for many, is the traditional learning, according to which the learners and teacher are bound to time and location. The reliance on time and place of learning paved the way for other types of teaching and learning (Georgiev, Georgieva & Smrikarov, 2004; Sherry, 1995). Another way that revolutionized the traditional education and learning is the concept of distance learning. In distance learning, students and the teacher are geographically separated (Porter, 1997). This type of learning is achieved by the students through the materials (books, notes, CDs, etc.) sent by the teacher (Keegan, 2005). Although, the distance learning might have existed for centuries, the concept gained momentum in late 18th and early 19th centuries (Keegan, 2002). Lack of communication between students and teachers and quality of instructions, and the cost of mailing the learning materials to the students were main problems in traditional distance learning (Galusha, 1997). However, with the invention of internet and World Wide Web (www) in the 1980s, the traditional distance learning found another name – electronic learning (e-learning) (Leung and Chan (2003). According to Leung and Chan (2003), e-learning is educating humans with the use of internet and digital technologies. E-learning has expanded the boundaries and borders of knowledge to the learners at education centers outside the doors, boundaries, and borders of the educational institutions (Leung & Chang, 2003; Biggs & Tang, 2011). Since e-learning offers different ways of interaction between students and teachers, it has been considered a promising approach to overcome issue related to the traditional distance learning. Nowadays, the universities provide various e-learning programs supported by different well-built e-learning platforms. However, when the demands for mobility grow along with the advancements in mobile technology, most of the universities focus on mobile learning (Alexander, 2004; Corbeil & Valdes-Corbeil, 2007).

1.2. Problem Description

According to Pinkwart, Hoppe, Milrad and Perez (2003), mobile learning is a type of e-learning that uses mobile devices and wireless transmission. Georgiev et al. (2004) also believe that mobile learning is an advanced type of e-learning – distance learning. That is to say, mobile learning complements e-learning and consequently distance learning. According to Wu and Chao (2008), mobile learning is the learning environment of the future as it will expand with the growing use of 3G/4G and wireless networks. According to Hylén (2012), an increasing number of countries in Europe are giving the mobile learning a high priority. He states that despite some barriers to the mobile learning (mobile technology immature, internet coverage problems, etc.), the number of mobile learning projects will grow in Europe as mobile devices become cheaper and more user-friendly. As the mobile learning increases so does the expectations of the end users – students in this case. According to Clarke, Keing, Lam and McNaught (2008), flexibility, alternative modes of instruction, and more multimedia-enriched
and interactive learning are some of the demands by the students. Earlier research suggest that the students, who use mobile devices for learning purposes become motivated and engaged in learning, consequently increasing their performance and achievement levels (Rogers, Connelly, Hazlewood & Tedesco, 2010; Shin et al., 2011; Trifonova & Ronchetti, 2003; Wang et al., 2009).

One way to achieve mobile learning is the use of smart devices (Mostakhdemin-Hosseini, 2009). A smart device is digital, active, computer networked, and user reconfigurable device with the ability to operate autonomously to some extent (Shin, 2014). The smart devices include smartphones, Personal Digital Assistants or PDAs and other portable, handheld and palmtop personal computers (Traxler, 2009). The smart devices of the future will be less expensive and equipped with powerful processors, higher random access memory, screens with high-resolution, and open operating systems (Shin, 2014). Therefore, the demand for smart devices is predicted to increase (Clough, Jones, McAndrew & Scanlon, 2008; Corbeil & Valdes-Corbeil, 2007; Hylén, 2012; Sharples et al., 2010).

There are some studies on learning via smart devices that focus only on the technical aspect of the phenomenon. Researchers (Huang et al., 2007; Shin et al., 2011) believe that mobile learning systems and projects and their technical performance (including smart devices) have been extensively studied. However, limited studies are carried out from the end-users perspective on the acceptance of a learning environment with smart devices (Mostakhdemin-Hosseini, 2009). In addition, smart devices are being researched in other fields such as health care, the delivery service industry, and medical (Traxler, 2009; Sharples et al., 2010; Shin et al., 2010). However, it is still not extensively researched in the educational context (Shin et al., 2011).

Understanding the factors that influence users’ intentions and what leads them to be engaged in using smart devices as ubiquitous learning (u-learning) tools are significant, particularly in the dynamic and competitive industry of higher education. The factors are not only considered to be essential to the learning process, but also, such understandings help higher education institutions to develop better learning tools and platforms (Shin et al., 2011).

In fact, findings of Shin et al. (2011) cannot be generalized to other countries’ context as the sample used for their research were exploratory rather than representative. In addition, they conducted their research in Korea, which can be questionable in other countries’ contexts, such as Sweden. Besides, Shin et al., (2011) focused only on smartphones which are one type of smart devices. Thus, there is a need to look at the combination of the most popular personal smart devices – smartphones and PDAs – as u-learning tools at higher education institutions.

Moreover, the increase in demand for smart devices will push the higher education institutions to focus on creating ubiquitous learning environments at their campuses. Thus, in an attempt to attract more students in the competitive education industry, higher education institutions around the world (including Sweden) have to provide opportunities for the students to learn ubiquitously by using smart devices. However, there is a lack of knowledge in understanding the key factors that influence students’ intention to accept and continue using smart devices as
u-learning tools at Swedish higher education institutions. Thus, it is essential to gain a better understanding of the key factors that influence students’ acceptance and usage of smart devices as u-learning tools at higher education institutions in Sweden.

Consequently, in an attempt to gain a better understanding the issue, this study tries to answer the following research question: What are the key factors that influence students’ intentions to continue using smart devices as u-learning tools in higher education in Sweden?

1.3. Aim and Contribution to Knowledge
This study aims at understanding the fundamental factors influencing users’ (student) intentions to continue using smart devices as u-learning tools. This study also examines customer (student) experiences in learning with smart devices to explore the areas of its development as a u-learning application. Thus, finding strategies and u-learning model for smart devices as u-learning tools for practical implications in the education industry, particularly at higher education institutions is intended from this study. Researchers and higher education institutions planning to have learning platforms for smart devices and those that already have can benefit from the findings of the study. Outside the educational institutions, developers of such platforms and market researchers can also benefit from the research.

1.4. Research Approach
A deductive approach was used to conduct this explanatory research involving the students of Stockholm University. Ten hypotheses were suggested based on earlier research on Technology Acceptance Model (TAM), the Unified Theory of Acceptance and Usage Technology (UTAUT) and Expectation-Confirmation Theory (ECT). The hypotheses were tested using the primary quantitative data collected through a web-based survey questionnaire. Two non-representative sampling techniques, namely purposive and convenience sampling methods, were used to collect the required data. The collected data were analyzed with the help of statistical programs, SPSS 22 and SPSS Amos.
2. Literature Review

This chapter contains the literature review and theoretical framework for the proposed thesis. First, main points of the literature on mobile learning are presented leading to the theoretical framework of the research. Concepts related to the research are explained, and ten hypotheses are suggested based on the theoretical framework.

2.1. Introduction

The subject of the thesis is to explore key factors that influence users’ intentions to continue using smart devices as ubiquitous learning (u-learning) tools. There is a lack of knowledge in this field in Swedish higher education institutions. In attempt to fill this gap and to answer the research question, first relevant literature on u-learning such as distance learning, electronic learning and mobile learning is presented under literature survey. Then, relevant theories on the acceptance of a technology such as Technology Acceptance Model (TAM), the modified Unified Theory of Acceptance and Usage Technology (UTAUT) and Expectation-Confirmation Theory (ECT) are presented and discussed in the theoretical framework section. From these theories, ten hypotheses are suggested to be able to find the key factors that influence students’ intentions to accept and use smart devices as u-learning tools at a higher education institution in Sweden.

2.2. Literature Survey

Mobile learning (m-learning) is a relatively new concept. There is a broad range of studies on the concept since it first gained momentum in the early 00s.

Mobile learning has been considered as the overlap of electronic learning (e-learning) and mobile computing, which includes computer programs in portable devices such as Personal Digital Assistant (PDA) and smartphones (Leung & Chan, 2003).

According to Ally (2009), m-learning is when the learning is achieved by using electronic mobile devices and technologies from a non-fixed location. From the perspective of Georgiev et al. (2004, p. 28), m-learning is, “the ability to learn anywhere at any time without permanent physical connection to cable networks”. The physical connection to cables is referred as e-learning in other research. According to Hoppe, Joiner, Milrad and Sharples (2003, p.255), m-learning is, “e-learning that uses mobile devices and wireless transmission”. With other words, according to Caudill (2007, p. 3) m-learning is, “any e-learning application distributed on-demand through mobile digital device”.

Various researchers have sought to define m-learning in educational institution contexts. Kukulska-Hulme and Traxler (2005, p. 262) believe, m-learning is “any educational delivery where the sole or prevailing technologies are handheld or palmtop devices”. Wexler, Brown,
Metcalf, Rogers and Wagner (2008, p. 7) are more specific about m-learning. According to them, m-learning is “any activity that allows individuals to be more fruitful when consuming, interacting with, or generating information, mediated via a compact digital portable device that the individual carries on an ordered basis, has reliable connectivity, and fits in a pocket or purse”. The simplest definition of m-learning in the context of education is provided by Ally (2009, p. 58), who believes that m-learning is, “the process of using a mobile device to access and study learning materials and to communicate with fellow students, instructors or institution”.

The mobile technology industry is one of the most rapidly developing industries. Changes are often visible in the industry with mobile devices becoming more and more portable and stronger than ever. Thus, as the industry further develops more studies will be carried out, and the concept of m-learning may become broader. The definitions of m-learning are now based on device, experience and environment contexts (Simonson, Smaldino, Albright & Zvacek, 2014). However, with future research in the field new definitions may be added.

In fact, in the bigger picture m-learning is part of distance learning (d-learning). According to Georgiev et al. (2004), m-learning is the improved form of electronic or digital learning that are part of distance learning. Pinkwart et al. (2003) also consider m-learning as electronic learning through mobile devices with wireless transmission supported by digital tools and media.

In e-learning, the support of electronic media is crucial. Bachman (2000, p. 8) defines e-learning as “the delivery of content through all electronic media, including the Internet, intranets, extranets, satellite broadcast, audio/videotape, interactive TV, and CD-ROM”. Whereas, in distance learning, time and space separate students and teachers (Williams, Paprock & Covington, 1999). Traxler (2009) is more specific when it comes to differentiating e-learning from m-learning. Traxler (2009) believes that in e-learning PC and laptop is mainly used, whereas, in m-learning contents can be used by mobile devices such as smartphones and PDAs. However, Caudill (2007) believes that m-learning is a distinctive element in distance learning, and cannot be considered the next generation of e-learning as there are many differences between them. The differences are widely studied both in the contexts of terminology (Sharma & Kitchens, 2004) and learning experience (Traxler, 2009).

In fact, extensive research on student’s perception of m-learning is welcoming. Pollara and Broussard (2011) concluded that mobile devices such as Personal Digital Assistants (PDAs) and smartphones are the most common tools for mobile learning. Students in seventeen out of eighteen studies in Pollara and Broussard’s research are highly positive towards m-learning.

As the mobile technology develops further, it is highly likely that demand for using mobile devices as learning tools will increase by the end-users. The need for ubiquitous learning is considered immediate. (Shin et al., 2011).

The increase in demand for using mobile devices as learning tools has pushed universities around the world to adapt to the changes in mobile technology by providing mobile friendly platforms. This in turn has led to the creation of the mobile campus (m-campus) in many universities. M-campus allows students to borrow library books anytime and anywhere.
Students can have 24/7 access to the universities’ online systems to check course schedule and grades, and register for classes. In order to motivate the usage of m-learning in m-campus, a university in Korea had even distributed 1500 smart devices to professors, students, and its staff (Shin et al. 2011).

The ubiquity in m-learning has given it another name – ubiquitous learning or u-learning (Shin, 2014; Shin et al, 2011; Pollara & Broussard, 2011; Liu & Hwang, 2009). U-learning has been defined as an advanced form of mobile learning in which “learning environments can be accessed in various contexts and situations” (Shin et al. 2011, p. 2208). Any setting in which a student can become entirely engrossed in the learning process is referred as the u-learning environment. Shin et al. (2011) believe that the u-learning environment at higher education institutions has to be wisely designed to predict changing contexts and user needs as they occur.

The key tools for u-learning, according to Shin et al. (2011) will be smart devices such as PDAs and smartphones. A smart device is, according to Shin (2014, p. 312), “a device that is digital, active and computer networked, as well as being user reconfigurable, with the ability to operate autonomously to some extent”. A smartphone is one of the most popular smart devices. Shin (2014, p. 312) defines the smartphone as “a mobile device that allows users to make telephone calls, along with having the added features of a PDA or a computer, such as the ability to send and receive e-mail, and edit documents”. That is to say, a smartphone is a combination of a cell phone and Personal Digital Assistant (PDA) where a user can install, configure, and run applications of her choice (Shin, 2014). With other words, a PDA with larger screens, size, weight and processors has almost all the features (some extra) of a smartphone except being a cell phone (Shin, 2014). With extended battery life, barcode readings, wireless/mobile internet access and multimedia functions, PDAs are becoming very popular (Metcalf & De Marco, 2006; Shin, 2014).

In fact, the focus of the paper is on smart devices (PDAs and smartphones) as u-learning tools – not all the portable, handheld and mobile devices. To be able to have a successful u-learning system in a higher education institution, it is important to study the end-users’ acceptance and usage intentions of the system. Thus, continuance theory was thought to best achieve the objectives of the study.

2.3. Theoretical Framework

Continuance theory is the main framework for this paper. The theory can encompass the Unified Theory of Acceptance and Usage Technology (UTAUT) by Venkatesh, Morris, Davis and Davis (2003), the Technology Acceptance Model (TAM) by Davis (1989), and Expectation-Confirmation Theory (ECT) by Oliver (1980). Continuance theory focuses on the experienced users of a technology rather than those in the early stages of the technology acceptance. According to Bhattarcherjee (2001), continuance intention is an individual’s intention to continue using a technology service in the post-acceptance stage.
2.3.1. TAM

Technology Acceptance Model (TAM) of Davis (1986) has been used in information technology and education contexts to describe, explain and predict an individual’s intentions to accept technological innovations for three decades now. It is used to interpret the relationships between Perceived Ease of Use and Perceived Usefulness of any technological advances along with Attitudes, Intentions and Behaviors towards the technological innovations (Davis, 1986; Davis 1989).

Perceived Usefulness refers to the degree to which a user of the technology considers her tasks were well-executed by the technology/system. Perceived Ease of Use is referred to the extent to which a user feels the easiness of the technology/system usage. Attitude refers to the positive or negative feelings from the user to execute a particular behavior when using the system. Behavioral Intention refers to the degree of a user’s plans whether to perform an action in the future or not (Davis, 1989).

According to TAM, an individual’s Actual Use of a technology is affected by his/her Behavioral Intention, Attitude, Perceived Usefulness and Perceived Ease of Use of the technology. The model in Figure 2.1 also indicates that External Variables influence Behavioral Intention and Actual Use of a technology by mediated effects on Perceived Usefulness and Perceived Ease of Use.

2.3.2. UTAUT

The original TAM model has been considered as a powerful and useful tool for researchers to interpret users’ acceptance of information systems and technology. Since its first introduction in 1985 researchers have modified and added extra elements to TAM to predict the user acceptance according to the advancements of the technology. For example, experience, image, output quality, self-efficiency and anxiety related to using computers, etc. were added to TAM later as they were considered to influence Perceived Usefulness and Perceived Ease of Use. The additions led to the birth of TAM2. Such additions have led the original TAM model to be...
modified. The newer version of TAM is referred as “the Unified Theory of Acceptance and Usage Technology” introduced by Venkatesh et al. (2003).

UTAUT theorizes two important determinants of Use Behavior – Behavioral Intention and Facilitating Conditions. The model also includes three direct determinants of Behavioral Intention – Performance Expectancy, Effort Expectancy, and Social Influence – that have mediated effects on Use Behavior (Venkatesh et al., 2003). Perceived Usefulness, a construct that was introduced in TAM has been changed to Performance Expectancy under UTAUT. According to Venkatesh, Thong and Xu (2012) and Venkatesh et al. (2003), Performance Expectancy refers to the degree to which a user of a technology expects certain benefits in performing certain activities. Besides, the Perceived Ease of Use in TAM has been named as Effort Expectancy in UTAUT. Effort Expectancy refers to the degree of ease associated with users’ use of technology. Social Influence is the perceptions of a user that important individuals around him/her (e.g., family and friends) believe he/she should use a particular technology for a particular purpose. Facilitating Conditions refers to the available resources and support required by a user to perform a behavior (use a technology).

Age, Gender, Experience and Voluntariness of use are used as four different variables to mediate the antecedents of UTAUT. Voluntariness refers to the perception of the non-mandatory decision by potential adopters of a technology (Venkatesh, et al. 2003).

2.3.3. UTAUT2

Hedonic Motivation (e.g. enjoyment using a technology), Price Value and Habit were later added as additional constructs by Venkatesh et al. (2012) when implying the model in consumer
context (Figure 2.3). The model was extended to find the key factors that influence Behavioral Intention and Use Behavior of mobile internet consumers. Gender, Age and Experience were used to mediate the constructs. This extension of the model is named as UTAUT2. In UTAUT2, the Voluntariness of Use in the original UTAUT was removed because in the consumer context it was not seen important by the authors. Price Value is defined as the tradeoff between perceived benefits of a system and monetary costs using them. Habit is explained as the degree to which people tend to perform behaviors automatically because of previous learnings (Venkatesh et al., 2012).

![Diagram of UTAUT2](https://via.placeholder.com/150)

*Figure 2.3 Unified Theory of Acceptance and Usage Technology model (Venkatesh et al., 2012)*

### 2.3.4. ECT

UTAUTs interpret an individual’s intentions to use an information system and consequent usage behavior. The four key UTAUT constructs – Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Conditions – and the three extra UTAUT2 constructs – Hedonic Motivations, Price Value and Habit – can better interpret the users’ intentions to accept smart devices as u-learning tools. However, they still cannot tell whether the users would continue using smart devices as u-learning tools in the post-acceptance stage (Shin et al, 2011). Besides, UTAUTs cannot mediate positive or negative confirmation between expectations and performance that will eventually lead to user Satisfaction.
ECT, however, focuses on the explanation of behaviors in the post-acceptance stage. According to the Oliver’s model, both pre and post-acceptance behavior influence Confirmation. Confirmation refers to the judgement or evaluations that a person makes regarding a service or a product. The judgments or evaluations are later compared with the person’s Expectations prior to the use of the service or product. Expectations are a person’s predicted or anticipated attributes associated with a product or service. If Confirmation is influenced, it then affects Satisfaction and Continuance Intention. Here, Continuance Intention is referred to the user’s post-acceptance intention whether to continue using a service (a system) or not. The higher the Perceived Performance of the service or product, more positive the Confirmation by customers (users). Perceived Performance is a person’s perceptions of the actual performance of a product or service. Satisfaction or dissatisfaction of the customers is based on their Confirmation levels. Naturally, the satisfied customers build an intention to reuse the product or service whereas the dissatisfied customers discontinue using. (Oliver, 1980)

![Expectation-Confirmation Theory](image)

**Figure 2.4 Expectation-Confirmation Theory (Oliver, 1980)**

According to ECT (Figure 2.4), first, a customer before making a purchase or using a product or service forms an expectation. Second, after consumption, the customer forms perceptions about the product or service’s performance. Third, the customer assesses the performance of the product or service with his/her initial expectations and confirms whether the performance has met his/her expectations (Confirmation). Based on the Confirmation level and expectations, the customer forms a Satisfaction. At last, the satisfied customer (user) forms a Continuance Intention to re-purchase (re-use) while dissatisfied customer discontinue. Thus, Continuance Intention is an individual’s intention to continue using a technology service in the post-acceptance stage (Bhattarcherjee, 2001)

According to Shin et al. (2011), u-learning tools call for unique constructs that fit nicely into TAM and UTAUT. Shin et al. (2011) believe, TAM and UTAUT help researchers better explain a technology acceptance and usage behavior. However, both TAM and UTAUT fail to cover the Confirmation and Satisfaction of a customer to continue using the technology. Shin et al. (2011) focused only on smartphones as u-learning tools in higher education in Korea. Besides, Shin et al. (2011) have combined the Expectation-Confirmation Theory (ECT) merely with TAM to propose a u-learning model for smartphones. In fact, for this study ECT is combined with UTAUT and UTAUT2 to suggest hypotheses that cover not only smartphones, but also PDAs.
To be able to better understand the key factors that influence users’ intention to continue using smart devices as u-learning tools in higher education institutions in Sweden, the following hypotheses are suggested.

### 2.4. Hypotheses on Smart Device Learning

Based on previous research on continuance theory – TAM, UTAUTs and ECT – ten hypotheses are suggested to answer the research question of this study. The suggested hypotheses are proposed in the form of a research model for smart devices as u-learning tools. The proposed model is mainly the combination of UTAUT2 and ECT. As discussed above, UTAUT2 is the extension of both UTAUT and TAM.

The proposed model hypothesizes six constructs that determine Behavioral Intention, which in turn affects users’ Continuance Intention. Facilitating Conditions are suggested to affect both Continuance and Behavioral Intention. Whereas, Social Influence, Hedonic Motivation, Performance Expectancy, Effort Expectancy, and Perceived Mobility value influence Behavioral Intention to use/not to use smart devices as learning tools. Confirmation and Satisfaction are expected to affect users’ Continuance Intention to accept and continue using smart devices as u-learning tools. The factors that are hypothesized, and expected to influence Behavioral and Continuance Intentions are connected with arrow.

![Figure 2.5 The suggested hypotheses (proposed model for smart devices as u-learning tools)](image)
2.4.1. Satisfaction, Confirmation and Continuance Intention

Pre and post-consumption experience from service performance positively influences disconfirmation. That is to say, higher performance of a service surpasses expectations, which in turn leads to a positive Confirmation. In fact, positive Confirmation results in customer Satisfaction. Conversely, lower performance leads to disconfirmation that affects the customer Satisfaction negatively (Oliver, 1980). According to research (Shin et al., 2011), Satisfaction determines users’ Continuance Intention.

In addition, research shows that in online education services, user Confirmation influences Satisfaction. A positive correlation between Confirmation and Satisfaction was also identified by Shin et al. (2011), raising expectation that Confirmation could also have a relationship with Continuance Intention. The researcher of this study believes that the theory should also hold in using smart devices as u-learning tools in post-acceptance stage. With other words, the higher the Confirmation of smart devices as u-learning tools, the higher the Satisfaction will be, and consequently, users will continue using smart devices as u-learning tools.

H1: Satisfaction has a positive effect on Continuance Intention to use smart devices as u-learning tools

H2: Confirmation has a positive effect on Continuance Intention to use smart devices as u-learning tools

2.4.2. Performance Expectancy, Effort Expectancy and Behavioral Intention

Earlier research on TAM (Davis, 1989) identified Perceived Usefulness and Perceived Ease of Use as vital antecedents of an individual’s intention to use a technology. Venkatesh et al. (2003) associated the Perceived Usefulness with Performance Expectancy while equating Perceived Ease of Use with Effort Expectancy. Both Performance Expectancy and Effort Expectancy remain robust determinants of an individual’s intention to continue using a technology (Venkatesh, et al., 2003 and Venkatesh et al., 2012).

Performance Expectancy and Effort Expectancy as the most influential determinants of UTAUT in predicting the Behavioral Intention of an individual (Venkatesh, et al., 2003), remained vital in technology acceptance and usage settings. The researcher expects the two key determinants would remain statistically significant for an individual’s intention to continue using smart devices as u-learning tools.

H3. Performance Expectancy of smart devices as u-learning tools positively affects Behavioral Intention

H4. Effort Expectancy of smart devices as u-learning tools positively influences Behavioral Intention

2.4.3. Facilitating Conditions, Social Influence and Continuance Intention

Facilitating factors can significantly affect users’ acceptance of a technology. Earlier research in different context of technology acceptance and usage such as mobile internet (Venkatesh et
al., 2012) and the knowledge-intensive website (Koo, Wati, Park & Lim, 2011) identified the Facilitating Conditions as significant influencer of Behavioral Intention of an individual to continue using a technology. Previous studies (Venkatesh et al., 2012; Koo, et al., 2011; Venkatesh, et al., 2003) also found a positive relationship between Facilitating Conditions and Behavioral Intention of individuals to continue using a technology.

In addition, Shin et al., (2011) found out that the relationship between Facilitating Conditions and Continuance Intention to use a technology is significant. Thus, it is expected that the Facilitating Conditions can positively affect both behavior and Continuance Intention.

H5. Facilitating Conditions positively affect Behavioral Intention to use smart devices as u-learning tools

H6: Facilitating Conditions positively affect Continuance Intention to use smart devices as u-learning tools

Furthermore, social norms indicated as Social Influence in UTAUT, are considered to be an important factor to accept and continue using a technology (Venkatesh et al., 2012; Shin et al., 2011). In adopting smartphones as u-learning tools, there is a positive relationship between Social Influence and Continuance Intention (Shin et al., 2011). However, it is not clear if the relationship holds for other smart devices, particularly PDAs. Thus, it is expected that Social Influence affects Behavioral Intention to use smart devices as u-learning tools.

H7. Social Influence positively influences Behavioral Intention to use smart devices as u-learning tools.

### 2.4.4. Perceived Mobility, Hedonic Motivation and Continuance Intention

Mobility value relates to the information accessing, transmitting and receiving anywhere at any time (Huang et al., 2007). Perceived Mobility value relates to the mobile nature of mobile technology, namely – mobility. Mobility is the only factor that differentiates m-learning from e-learning. Perceived Mobility value can affect an individual’s intention to adopt m-learning services (Kargin, Basoglu & Daim, 2009). Smart devices as mobile tools to learn are expected to influence users’ Behavioral Intention.

H8: Perceived Mobility value of smart devices as u-learning tools positively affects Behavioral Intention

Hedonic Motivation defined as the fun, pleasure or enjoyment resulting from using a technology, has been identified significant factor in technology acceptance and use (Childers, Carr, Peck & Carson, 2002; Venkatesh et al., 2012). Hedonic Motivation associated with Perceived Enjoyment in TAM has been identified as a key factor in predicting Behavioral Intention to continue using a technology in the restaurant industry (Ryu, Han & Jang, 2010). Previous research on acceptance of other technologies such as the internet (Ha & Stoel, 2009), short mobile messaging service (Yan, Gong & Thong, 2006), virtual reality (Bertrand & Bouchard), and mobile internet usage (Venkatesh et al., 2012) found Hedonic Motivation as a key predictor of Behavioral Intention towards using the technologies. This study also expects
that Hedonic Motivation would have a positive relationship with an individual’s Behavioral Intention.

H9: Hedonic Motivation positively affects Behavioral Intention to use smart devices as u-learning tools

2.4.5. Behavioral Intention and Continuance Intention

As discussed above, Behavioral Intention to use a technology is expected to be positively influenced by Hedonic Motivation, Perceived Mobility, Social Influence, Facilitating Conditions, Performance Expectancy, and Effort Expectancy. Hence, the researcher expects that Behavioral Intention can also positively affect Continuance Intention to use smart devices as u-learning tools.

According to Lee (2010) and Bhattacherjee (2001), people form intentions to behaviors such as to continue or discontinue a technology service in the post-acceptance stage (Continuance Intention). Venkatesh et al. (2012) and Venkatesh et al. (2003) found positive relationships between Behavioral Intention and Use Behavior. However, Use Behavior does not include the post-acceptance stage of a technology. Behavioral Intention and use behavior are normally associated with the pre-acceptance stage of a technology. Whereas, Continuance Intention encompasses the post-acceptance stage of a technology (Bhattacherjee; 2001). Thus, it is instructive to see if Behavioral Intention can actually affect the Continuance Intention.

H10: Behavioral Intention positively influences Continuance Intention to use smart devices as u-learning tools

2.5. Conclusion

M-learning being relatively newer concept is gaining momentum in the educational context as the mobile technology develops. Universities and colleges around the world provide their students with u-campus environments to make the necessary information available to the students anytime at anywhere. By having u-campus, higher education institutions provide opportunities for their students to learn by using their smart devices such as smartphones and PDAs.

The success of u-learning services at higher education institutions depends on the acceptance of the technology services by the students. The acceptance of any technology by the end-users depends on several factors. Hedonic Motivation, Performance Expectancy, Effort Expectancy, Perceived Mobility value, Social Influence and Facilitating Conditions are among the key factors that are expected to influence an individual’s Behavioral Intention to accept smart devices as u-learning tools. However, Confirmation, Satisfaction, Facilitating Conditions and Behavioral Intention are expected to influence Continuance Intention of users to continue using smart devices as u-learning tools. After going through relevant theories (TAM, UTAUTs and ECT), ten hypotheses were suggested above to be able to answer the research question and achieve the aim and purpose of the thesis.
3. Research Design

This chapter contains the description and motivation of the chosen study design. Under this section, research approach, purpose and strategy, data collection method, data analysis method and ethical issues related to the research are thoroughly explained and discussed.

Lack of knowledge in understanding the key factors that influence students’ intention to continue using smart devices as u-learning tools at higher education institutions in Sweden led to the search for a scientific solution to this problem. The aim of this study was to explore the users’ behavioral and continuance intentions to use smart devices as u-learning tools at higher education institutions in Sweden. The purpose of the study was to find out the fundamental factors that influence users’ intentions to accept smart devices as u-learning tools at higher education institutions. Thus, this study tries to answer the research question: what are the key factors that influence students’ intentions to continue using smart devices as ubiquitous learning tools in higher education in Sweden? To be able to answer the research question, relevant theories such as TAM, UTAUT and ECT were studied, and ten hypotheses were suggested.

3.1. Research Approach

All the research projects focus on either the discovery of theories or testing already existed theories. Thus, research follow two approaches – deductive and inductive. The deductive approach is used to test previously known theory or phenomenon whether that is valid in a given conditions. That is to say, in deductive approach a researcher suggests theories and hypotheses and then test it by proposing a research strategy. It can include both quantitative and qualitative data (Bryman & Bell, 2011).

The deductive approach has certain important features. Explanation of the casual relationship between variables and a well-organized methodology to guarantee reliability are two main features of the deductive approach (Saunders, Saunders, Lewis & Thornhill, 2011). Besides, easing the duplication of the study and the selection of sufficient samples for generalizations are also essential characteristics of the deductive approach (Denscombe, 2010).

To be able to discover information, the inductive approach is usually preferred by researchers (Denscombe, 2010). This approach is used to search for patterns to develop theories and build various perspectives of a phenomenon through the collection of qualitative data (Bryman and Bell, 2011).

Since this paper focuses on earlier research about individuals’ behavioral intention towards u-learning services, it follows deductive approach using the quantitative data. Quantitative data focus on numeric and statistical data to investigate, interpret, and structure the findings (Johannesson & Perjons, 2012). Based on the earlier research on TAM, UTAUT and ECT in the context of higher education, ten hypotheses are suggested to be tested. Besides, the purpose
of the study was to find the key factors that influence students’ behavioral intention towards using smart devices as u-learning tools, not about formulating a theory. Thus, the deductive approach was selected for this study.

3.2. Research purpose

The research purpose is crucial to determine the data collection and analysis. Saunders et al. (2011) have classified the research purpose as explanatory, descriptive and exploratory. Exploratory research is conducted to seek new insights and to explore unexplored issues regarding a phenomenon and lay grounds for further studies. Descriptive research explains a phenomenon as it happens. However, it lacks an explanation of why an event occurs. Besides, explanatory research focuses on cause and effect. It is about how variables come together and interact (Saunders, et al. 2011).

This study is an explanatory research. It is because there is limited research on behavioral intention to accept smart devices as u-learning tools at higher education institutions in Sweden. The issue is not explored sufficiently in the Swedish context. Moreover, the addition of ECT concept to UTAUT is fairly new and not adequately studied. Therefore, finding the cause and effect of such addition falls into the explanatory research characteristics. Understanding the interaction of the variables is another reason for this research to be explanatory. The proposed research model in this paper attempts to explore behavioral intention of students to continue using smart devices as u-learning tools. Therefore, the purpose of this study is explanatory as well.

3.3. Research Strategy

“A strategy is a plan of action designed to achieve a specific goal” (Denscombe, 2010, p. 3). To be able to complete this study, there were two alternatives: survey and case study. When the pros and cons and strengths and weaknesses of both alternatives were compared, it seemed a survey best suits the aims and objectives of the study.

According to Johannesson and Perjons (2012), a case study investigates one particular case of a general phenomenon such as one organization, one project, one program, etc. in detail. According to Johannesson and Perjons (2012, p. 28), the purpose of a case study is, “to paint a rich picture of a single object or situation as a basis for obtaining a deep and comprehensive understanding of some general phenomenon”.

For instance, for this study it was possible to investigate, one m-learning service such as Mondo, iLearn or iLearn2, etc. at Stockholm University. However, completing a valid number of responses for such a case study would have been very difficult considering the time and resources limitations. Plus, this study was merely focusing on end-users of m-learning services. Therefore, including the staff and interviews in the study would have defocused the research from its aim and objective. Thus, instead of focusing on one particular m-learning service at Stockholm University (a case study), a survey was conducted on the students to find out the students’ behavioral intention towards the usage of smart devices as u-learning tools.
3.3.1. Survey

A survey is used to collect data from a large group of objects such as people, organizations, products, etc. usually through the use of questionnaires or document studies (Johannesson and Perjons, 2012). The collected data are analyzed by statistical methods to generalize the findings to valid circumstances, according to Johannesson and Perjons (2012). In surveys, the data are gathered from a sample of a population, and the results are later inferred to the whole population. It is impossible to survey the entire population in most cases (Denscombe, 2010).

As studying customers’ behavioral and continuance intentions to use a u-learning service needs up-to-date information and full coverage, a researcher has to go ‘out there’ to find the empirical data. To gather extensive, up to date and inclusive empirical data are typical characteristics of a survey, according to Denscombe (2010).

In addition, to collect mass information about a larger number of people, surveys are usually preferred. Surveys fit best when gathering data on uncomplicated facts, thoughts, feelings or behaviors (Denscombe, 2010). User’s intentions to accept and continue using a technology service at higher education institutions and their Satisfaction or dissatisfaction from the service needed uncomplicated facts, thoughts and feelings, the survey best fitted this study.

Focus on empirical data, the ability to collect both quantitative data subject to statistical analysis and qualitative data through interview method, and extensive coverage of a social phenomenon in a short period of time at a relatively low cost are the benefits of surveys that attract researchers. However, surveys are not suggested to investigate sensitive subjects, depth insights or practical problems. Low response rates to the requests is another disadvantage of surveys when there is no personal contact (Bryman and Bell, 2011).

Denscombe (2010) identifies seven types of survey: postal, internet, telephone, group-administered, face to face, observational survey and documents study. For this study, postal, internet, telephone and face to face suited. However, internet survey was selected for this study as it is time and cost saving and involves less ethical issues than others.

3.3.2. Data Collection

3.3.2.1. Literature search

Google Scholar and Stockholm University Library search engines were the main means to gather valuable literature resources and information to conduct this study in a scientific way. The search engine of Stockholm University Library includes databases such as JSTOR, Diva, Web of Science, etc. Besides, the advanced search option of the Library’s search engine is user-friendly and easy to find the required article, journal or book.

In fact, Google Scholar was more helpful in finding the necessary reading materials for this study than the Stockholm University search engine. However, retrieving the required articles and books were mainly done using the University’s library services.

Table 3.1 contains the keywords that were searched in Stockholm University’s search engine and Google Scholar.
Table 3.1 Keywords

<table>
<thead>
<tr>
<th>Keywords</th>
<th>Keywords</th>
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</thead>
<tbody>
<tr>
<td>Electronic learning (e-learning)</td>
<td>Technology Acceptance Model (TAM)</td>
</tr>
<tr>
<td>Mobile learning (m-learning)</td>
<td>Smart devices and learning</td>
</tr>
<tr>
<td>Distance learning (d-learning)</td>
<td>Electronic education (e-education)</td>
</tr>
<tr>
<td>Ubiquitous learning (u-learning)</td>
<td>Learning through mobile devices</td>
</tr>
<tr>
<td>e-learning tools</td>
<td>The modified Unified Theory of Acceptance</td>
</tr>
<tr>
<td></td>
<td>and Usage Technology (UTAUT)</td>
</tr>
</tbody>
</table>

3.3.2.2. Secondary Data Source

Secondary data is the data that is collected from the sources other than the researcher. Such data is gained through internet searches, web-sites, Census and electoral statistics (Saunders et al. 2011). The secondary data for this study was mainly collected from the web-sites of Stockholm University and Central Statistical Bureau of Sweden – [www.su.se](http://www.su.se) and [www.scb.se](http://www.scb.se), respectively.

3.3.2.3. Primary Data Source

The data that are specifically collected by the researcher for the research projects are called primary data (Saunders, et al., 2011). The primary data for this study were gathered through survey questionnaire from Stockholm University students. The primary data collected were processed, assessed and analyzed to test the hypotheses.

3.3.3. Population and sample

Population refers to all the items in the category of things that are being researched. With other words, it means a study population that a researcher is interested in to make a generalization of a theory, assumption, hypothesis, etc. (Denscombe, 2010).

Originally, it was intended to research several universities or university colleges in Sweden. However, many factors including accessibility, time and resources limitations hindered the researcher to conduct the research at several universities. Hence, Stockholm University students are the research population for this study.

According to the Swedish National Agency for Higher Education or Höskoleverket, there were more than 300.000 students studying at 50 universities in Sweden (Höskoleverket, 2008). It was quite difficult to access all the Swedish universities and the students within the timeframe of this study and available resources of the researcher. Therefore, only Stockholm University students are included in this research. Thus, a sample from the population of about 70.000
students (su.se) of the university was necessary for this study. The Stockholm University comprises 23% of all the students in Sweden (70,000/300,000=0.23).

A sample refers to a small sub-group that is chosen for a study (Bryman and Bell, 2011). With other words, a sample is a subset of a population that represents the population in research. The sampling units are the individual members of the sample that contribute to the research. For this study, the sampling units are individual students from Stockholm University.

Denscombe (2010) believes, there are two ways to get a sample – exploratory and representative. Each tends to be associated with different kinds of social research. Exploratory samples are often used in small-scale research and concentrate mostly on qualitative data. However, quantitative data can also be collected using the exploratory sample. It is used to explore or discover new ideas and theories. Such samples explore the know-how, experiences and expertise of the respondents. It includes unusual examples of the things to be studied. Conversely, representative samples deal with large-scale surveys. It tends to lend more to the quantitative data from a cross-section of a population. Representative samples should also match all the relevant factors, variables or events of a population. It allows the researcher to generalize the findings for the studied population and draw valid conclusions (Denscombe, 2010).

This study involved relatively small-scale survey to gather quantitative data from Stockholm University students. Hence, any generalization and conclusion based on the exploratory sample (non-representative sample) in this study is relevant only to the students of the Stockholm University.

Two types strategies to the selection of samples are available – probability and non-probability (Saunders, et al., 2011; Denscombe, 2010). Probability approach involves random selection of samples for a representative sampling. It is suited for large-scale surveys that deal with quantitative data. However, non-probability approach to sampling does not involve random selection of the individual units in a sample of a population. When the researcher does not have enough time and resources or adequate information about the population or reaching the sample is extremely difficult (e.g. sample of homeless people), the non-probability approach is used.

In addition, the non-probability approach is usually associated with exploratory research. Hence, as this study involved exploratory sample involving relatively small-scale survey to collect quantitative data from Stockholm University students, the non-probability sampling approach was chosen.

For the non-probability sampling strategy, Denscombe (2010) recommends quota, convenience, purposive, theoretical and snowball sampling techniques. In quota sampling, a sub-group of a population is surveyed based on the known characteristics and traits to compare the relationship with other sub-groups. Theoretical techniques are usually preferred to develop new or existing theories involving multi-stages. Snowball sampling technique is preferred when the target population is very rare and hard to locate. In the snowball technique, the target sample refers similar individuals with the similar conditions and characteristics under the study. In convenience sampling, individuals are selected based on the convenience of a researcher. Limited time and resources are some of the reasons behind the inclusion of some elements of
convenience in most of the research. This technique is quick, cheap and easy (Denscombe, 2010).

For purposive sampling, the respondents should have relevant information and knowledge about the subject being studied. Besides, in the purposive sampling method, the researcher already knows something about particular people to be involved in the sample, and deliberately choose the respondents to produce valuable data. This technique is recommended when a broad cross-section of individuals is intended to be included in the sample, but not randomly selected. Therefore, this technique sometimes emulates representative (probability) sample (Denscombe, 2010)

Considering the proposed non-probability sampling techniques, the researcher of this study chose two of the best-suited techniques – convenience and purposive – to gather the required data for this study. For convenience sampling, the researcher posted the link to the questionnaire on Facebook pages and groups related to Stockholm University (both English and Swedish), where all the students had equal opportunity to be included in the sample. For example, the link to the questionnaire was posted (published) by the researcher on the University’s official Facebook pages such as Stockholm University and Stockholms universitet. A link to the questionnaire was also posted by the researcher on the official Facebook page of Stockholm Business School. Moreover, the questionnaire link was also recommended in the Facebook group of the Stockholm University Student Union, where students from different departments of the university are members.

For purposive sampling, the link to the questionnaire was published in the available discussion forums of the courses that the researcher of this study had completed in the past two years of studying at Stockholm University. The link to the questionnaire with the introduction was then automatically emailed to the participants of the forums. In addition, the questionnaire was also e-mailed to the participants of the classes that involved some sorts of u-learning services. The email addresses were available at Daisy, an internal information system services for students of Department of Computer and System Sciences of Stockholm University. Daisy is the platform, where a student’s personal and study related information such as courses taken at Stockholm University, course results, schedule, etc. are stored. As the researcher had taken some courses in the department, he had access to the email addresses of the fellow students. The students were emailed to make sure the right respondents contributed to the survey. The last option was used to include as many valid number of samples from the target population as possible.

Furthermore, according to Denscombe (2010), for a population of 5000 items/individuals and over, a representative (probability) sample size of 384 respondents from the population is adequate to represent the population. However, for non-probability sampling techniques and exploratory sample, Denscombe (2010) recommends a sample size between 30 to 250 respondents. In fact, to be able to conduct a reliable and valid SEM test, the researcher expected to collect around 200 responses. Due to time and resource limitations, the researcher was able to collect 114 responses for this study, out of which 96 were valid to conduct statistical tests. The valid number of the responses (96) for this study is acceptable for non-probability, non-representative and exploratory sampling strategies, according to Denscombe (2010).
3.4. Data Collection Methods

The data collection methods depend on the type of the data needed for research. For qualitative data usually interviews are preferred. For quantitative data such as this study often the questionnaire through a survey is favored. Quantitative data can also be achieved from observations and document studies (Bryman and Bell, 2011).

3.4.1. The questionnaire

The suitable method for a survey strategy is usually a questionnaire. The questionnaire is designed to gather data from a sample size. For standardized and straightforward data, questionnaires are considered to be the best choice (Denscombe, 2010).

Questionnaires can contain both factual information such age, gender, etc. and experiences, and preferences of respondents. The types of the questions for the questionnaire tend to be closed questions allowing the respondents to choose from already established answers. Closed questions in a questionnaire enables the researchers to codify the answers. The closed questions somehow limit the respondents to express their actual thoughts and facts. The issue can be solved through open questions; however, such questions need more time and effort of a researcher to analyze the data (Denscombe, 2010). To be able to complete this research on time with the available resources, the questionnaire for this study contains closed questions.

3.4.2. Questionnaire Design

The questionnaire for this study was designed as a web page on a host site (kwiksurveys.com). Such questionnaire design is user-friendly and has the attractive web features that respondents can complete and submit them by a keystroke. The link to the questionnaire can be shared on relevant forums on the net, social media pages or groups, and can be emailed to the samples.

<table>
<thead>
<tr>
<th>Concept</th>
<th>Questions</th>
<th>Literature Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hedonic Motivation</td>
<td>8, 9, 10</td>
<td>UTAUT2 (Venkatesh et al., 2012)</td>
</tr>
<tr>
<td>Facilitating Conditions</td>
<td>11, 12, 29</td>
<td>UTAUT2 (Venkatesh et al., 2012)</td>
</tr>
<tr>
<td>Performance Expectancy</td>
<td>13, 14, 15</td>
<td>UTAUT (Venkatesh et al., 2003)</td>
</tr>
<tr>
<td>Effort Expectancy</td>
<td>16, 17, 18</td>
<td>UTAUT, TAM (Venkatesh et al., 2003; Huang et al., 2007)</td>
</tr>
<tr>
<td>Perceived Mobility Value</td>
<td>19, 20, 21</td>
<td>TAM (Huang et al., 2007)</td>
</tr>
<tr>
<td>Social Influence</td>
<td>22, 23, 24</td>
<td>UTAUT2 (Venkatesh et al., 2012)</td>
</tr>
<tr>
<td>Behavioral Intention</td>
<td>25</td>
<td>TAM, UTAUT2 (Venkatesh et al., 2012; Huang et al., 2007)</td>
</tr>
<tr>
<td>Continuance Intention</td>
<td>26</td>
<td>ECT (Koo et al. 2011)</td>
</tr>
<tr>
<td>Confirmation</td>
<td>27, 28</td>
<td>ECT (Koo et al. 2011)</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>30, 31, 32</td>
<td>ECT (Koo et al. 2011)</td>
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</tbody>
</table>
The closed questions in the questionnaire of this study were based on the theoretical framework of the research. To be able to find out what key factors influence students’ behavioral intention to continue using smart devices as u-learning tools at Stockholm University, factors from earlier research in the research field were identified and fitted into the questionnaire. The questions in the questionnaire were used by other researchers in the different context of technology acceptance and usage behavior, such as smartphones, mobile Internet, or consumer context. Most of the questions were adopted from the earlier research and were slightly altered to fit this study. For this study, the combination word “smart devices” were emphasized in the closed questions intentionally to avoid respondents to defocus from the subject. Smart devices in this study included only smartphones and PDAs.

The relationships of each question with the corresponding concept in the theoretical framework of the research are categorized in Table 3.2 above. Besides, the corresponding study that the questions were adopted from is also mentioned in the table. (For complete questionnaire refer to Appendix 2.)

3.5. Data Analysis

3.5.1. Data preparation and Initial exploration

For this research, the web questionnaire to gather the primary data was designed at the free of charge website, kwiksurveys.com. The questionnaire was designed on April 08, 2015. The questionnaire was launched on April 15, 2015 after it was reviewed by a pilot group. The researcher turned off (closed) the survey on April 26, 2015 after consulting the supervisor of the study about the valid number of the collected responses. The website was selected due to several reasons. First, the collected data (texts and numbers) can be imported as Excel or SPSS files. The site also offers some basic statistical graphs for the survey. However, none of these graphs were copied from the site, and used for this study. The researcher’s earlier experience with the site was another reason for choosing the host site. After the completion of the survey, the collected data were imported into Excel, and were codified for further use. The free automatic coding service of the site provides integer values. For this research, mostly ordinal and nominal values were used.

Nominal data such as number of respondents, their gender, etc. (questions 1-6) did not need any statistical analysis. Ordinal data were assigned for the questions 7-32, the main part of the research. The answers for questions 7-32 were based on Likert Scale, and codified according to respondents’ choice of option – strongly disagree, disagree, neutral, agree, strongly agree. Number 5 was assigned to “Strongly Agree”, 4 to “Agree”, 3 to “Neutral”, 2 to “Disagree” and 1 to “Strongly Disagree”. (Refer to Appendix 2 and Appendix 3 to review the categorization)

3.5.2. Data Analysis, Presentation and Tools

Statistical operations such as Pearson’s coefficient correlation, regression analysis, chi-square, Cronbach’s alpha, SEM, etc. were conducted to analyze the data. SPSS 22 and SPSS Amos, Statistical Packages for the Social Sciences, developed by International Business Machine
(IBM) were the tools to analyze the collected data. Besides, these tools provide basic statistical operations such as finding the mode, median, percentile, etc. The data for this study are presented in the forms charts, diagrams and graphs.

3.6. Research ethics and credibility

3.6.1. Informed Consent

To avoid ethical problems during the study, an informed consent form with electrical signing possibility was designed. It was necessary to avoid privacy, social and physical risks to the participants in the survey. Voluntary participation was stressed in the consent form. Moreover, personal or private information such as names, addresses, email accounts, etc. were avoided to be asked in the questionnaire. Thus, the questionnaire was entirely anonymous to ensure confidentiality. The participants were given the option to be able to stop the survey at anytime and anywhere in the survey. Such concerns were clearly stated in the consent form. Although, one of the conditions to participate in the survey was the respondent to be 18 years old, there is no way to find out if any under 18 years did not participate in the survey questionnaire. However, avoiding the participation of the respondents in the web questionnaire (survey on the internet) under the legal age is out of the reach and control of the researcher of this study. (For further information about the informed consent, refer to Appendix 1.)

3.6.2. Research credibility

Research should be credible to add to the existing knowledge or add new knowledge. Therefore, research should follow the scientific methods to be seen as credible. The credibility of any research is judged by reliability, validity and generalizability of the research (Saunders et al., 2011).

3.6.2.1. Reliability

Consistency of the research results is the primary concern of the reliability of any research. In order to tackle this concern, three types of reliability tests are proposed by Gratton and Jones (2010) – inter-observer, test-retest and internal consistency reliability.

In inter-observer reliability test, numerous observers provide similar scores to the same phenomenon. In test-retest reliability, the research offers the same calculation if echoed another time. In internal consistency reliability test, every question within a measure estimates the same phenomenon (Gratton and Jones, 2010).

The internal consistency reliability fitted this research as every question of the questionnaire was reviewed and compared with the research topic, objective and previous research. To ensure this, a pilot study involving ten fellow students from the course “Scientific Communication and Research Methodology”, who had the required knowledge, reviewed the questionnaire. The assessment in the pilot study was taken into the consideration for preparing the final questionnaire. Pilot testing is considered to add reliability, validity and feasibility to a research, according to Denscombe (2010).
For reliability purposes, questions regarding the respondents to be a student at Stockholm University, who had used mobile learning services of the university were taken into consideration. Moreover, to ensure internal reliability the correlation of the questions in the same construct was measured by Cronbach’s Alpha. Testing Cronbach’s Alpha is highly recommended for questionnaires that have several items connected to each other under one construct. For a construct to be reliable, any number above 0.5 is in acceptable range to conduct reliable tests (Lind et al., 2007).

Furthermore, for the reliability and validity purposes of the research, the researcher has put enough effort to include as many respondents as possible.

3.6.2.2. Validity

For the research to be considered valid, findings of the research should represent the reality of what a researcher measures (Saunders et al., 2011). For this research, content validity was taken into the consideration to ensure validity. Content validity ensures the questions in the questionnaire provide enough coverage of the research questions (Saunders, et al., 2011). For this reason, questions were related to the theoretical framework covering the concepts of TAM, UTAUTs and ECT. Questions 7-32 were designed on the five-points Likert Scale. Then, the questions were related to the factors and sub-factors identified in the theories mentioned above. In addition, the construct validity (convergent and discriminant validities) was also tested using SPPS.

3.6.2.3. Generalizability

The external validity or generalizability questions the findings to be applicable in other research settings (Saunders, et al., 2011). Since the selection of the Stockholm University was not random, it cannot statistically represent other universities in Sweden. Thus, the findings may only be generalized to the Stockholm University context. However, the researcher of this study expects that if other universities have similar conditions as Stockholm University the findings may be similar.
4. Analysis and Findings

This section includes the findings of the study. This chapter also reports how the data was actually collected and analyzed.

4.1. Participants’ demographics

An online survey was designed to investigate Stockholm University students’ behavioral intention to continue using smart devices as ubiquitous learning tools. The survey questionnaire was designed in the free online survey website, kwiksurveys.com. The link to the survey questionnaire was posted on Facebook pages and groups related to Stockholm University and its students. A link to the questionnaire was also emailed to 437 fellow students. In total, 115 students participated in the survey, out of which up to 103 participants answered the questions related to demographics (1-6). 96 students answered the degree questions designed on five-points Likert Scale, which were valid to conduct statistical tests and operations.

As shown in Table 4.1, all the participants of the study were Stockholm University students. Students who were not from Stockholm University were excluded in the survey. 102 people answered the question about gender. There were 59 male students and 43 female students who took part in the study, representing 57.8% and 42.2% respectively. Most of the 101 respondents who answered the question regarding their age groups (72.2%) were aged between 25 and 34 years. It is because the students in higher education institutions in Sweden, Stockholm University, in particular, are mostly aged between 25 and 34 years (Högskoleverket, 2008).

Table 4.1 Respondents’ Demographics

<table>
<thead>
<tr>
<th>Respondent’s Characteristics</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SU Students</td>
<td>100</td>
<td>97.1</td>
</tr>
<tr>
<td>Non-SU Students</td>
<td>3</td>
<td>2.9</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>43</td>
<td>42.2</td>
</tr>
<tr>
<td>Male</td>
<td>59</td>
<td>57.8</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-24</td>
<td>17</td>
<td>16.8</td>
</tr>
<tr>
<td>25-34</td>
<td>73</td>
<td>72.3</td>
</tr>
<tr>
<td>35 or older</td>
<td>11</td>
<td>10.9</td>
</tr>
<tr>
<td>Smart Device Experience</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than a year</td>
<td>18</td>
<td>17.6</td>
</tr>
<tr>
<td>More than a year</td>
<td>84</td>
<td>82.4</td>
</tr>
</tbody>
</table>
The rest (27.8%) were aged between 18-24 and 35 or above, representing 16.8% and 10.9% respectively. While 17.6% (18 students) of the 102 respondents had less than a year experience, 82.4% (84 students) of the participants had more than one year of experience in using smart devices as u-learning tools.

The experience of the participants in using their smart devices as u-learning tools was considered to be important for this study as it would add credibility for the research regarding the TAM, UTAUT and ECT. Other researchers (Huang, et al, 2007; Oliver, 1980; Shin, et al., 2011; Venkatesh, et al., 2012; Venkatesh et al., 2003) have considered the earlier experience of using a technology important for their models, as well. Most of these researchers have used experience as a separate variable or a moderator between the constructs. For this study, however, questions regarding the respondent’s experience were asked to understand their usage areas of smart devices to see whether the participants used their smart devices for u-learning purposes or not.

According to Figure. 4.1 about the usage of smart devices as u-learning tools, out of 99 respondents most of them (81) were using their smart devices to access Stockholm University websites for learning purposes. Checking course schedule, downloading course documents, searching for information about a course, reading articles for a course, and interacting with course participants also scored high (78, 66, 65, 64 and 55, respectively). About 30% of the respondents were doing some course assignments with their smart devices while 40% were using smart devices to record course materials during a class.

Figure 4.1 Students' Experience of Using Smart Devices for Learning Purposes

Almost half of the participants were using their smart devices for library services (46) and took notes during the class (44). These numbers were strong indications of smart devices’ popularity as u-learning tools at the University. The University can design and prioritize its u-learning services based on these findings.
4.2. Descriptive measures

The statistical “mode” allows researchers to find out which value occurs the most (Denscombe, 2010). In order to better understand the importance of the factors from the perspectives of respondents, the statistical mode was intentionally chosen over the mean to be able to show the frequency of the responses. It is argued that since the cause of the order and the level of difference for Likert Scale is not known, the usage of the mean does not make any sense. With other words, the difference between the qualitative values for Likert Scale such as “Strongly Disagree” and “Disagree” is not known, and any number can be assigned to these values. Therefore, the usage of the mean is not always recommended (Denscombe, 2010). More specifically to be said, the difference between Strongly Disagree and Agree on Likert scale coded as 2 and 1, respectively, is unknown. The only difference here is that Disagree is more positive than Strongly Disagree. Thus, using the mode would help to understand better the number of occurrence for each factor than the mean.

Figure 4.2 shows which factor was chosen the most by the respondents. (Note: the mode is only used here to show the number of occurrence of each factor. For other statistical operations to test the hypotheses, the usage of the mean was unavoidable.)

![Figure 4.2 Key Factors Based on Number of Responses (n=96)](image)

*In figure 4.2 HM stands for Hedonic Motivation; FC = Facilitating Conditions; PE = Performance Expectancy; EE = Effort Expectancy; PM = Perceived Mobility; SI = Social Influence; CON = Confirmation; SAT = Satisfaction; BI = Behavioral Intention; and CI = Continuance Intention. (For sub-factors of the above main factors, please refer to Appendix 3.)*

The agreement level in Figure 4.2 shows that most of the factors in the questionnaire were important as most of the students either agreed or strongly agreed with the given statements for each factor. Only for *Hedonic Motivation* (HM) and *Social Influence* (SI), most of the students
were either undecided or these factors were not significantly important for them as they chose to be neutral.

As for Hedonic Motivation (HM), out of 96 students 35 of them or 36.5% were neutral about Factor 1, which indicates that learning is fun with smart devices. With other words using smart devices for learning purposes was not fun for most of the students. However, this does not mean that Factor 1 of HM is not important. The total number of the students who “Strongly Agreed” or “Agreed” is higher than the ones who were neutral. 31.3% of the students agreed, and 11.5% strongly agreed that using smart devices for learning purposes was fun. As for the Factor 2 of HM, 29.2% were neutral, 34.4% of the respondents agreed, and 15.6% strongly agreed that using smart devices for learning purposes was enjoyable. Whether using smart devices for learning purposes was to be entertaining (Factor 3 of HM), 37.5% of the students were neutral, 28.1% agreed, and 7.3% strongly agreed. Even though the mode for Hedonic Motivation is 3 (neutral), the total number of students who agreed and strongly agreed that using smart devices for learning purposes is fun, enjoyable and entertaining was, higher. This means Hedonic Motivation can be a key factor to influence users’ behavior to accept smart devices as u-learning tools. SI can follow the same logic. (For further analysis of the figures refer to Appendix 3.)

4.3. Analysis of the Suggested Hypotheses

In this section, the collected primary data associated with the proposed model and hypotheses are presented. The results are provided mainly by the statistical tools SPSS 22 and SPSS AMOS.

4.3.1. Measurement evaluation

Reliability and construct validity tests are usually recommended prior to the examination a proposed model and testing hypotheses. For reliability analysis, the internal consistency of the factors is assessed. Internal consistency for reliability tests correlates the answers to each question in the questionnaire. (Saunders et al., 2011)

For this study, Cronbach’s Alpha or coefficient alpha is used to assess the internal consistency reliability. According to George and Mallory (2003), Cronbach’s alpha greater than 0.9 is excellent, alpha between 0.8 and 0.9 is good, alpha between 0.8 and 0.7 is acceptable, alpha between 0.7 and 0.6 is questionable, alpha between 0.6 and 0.5 is poor, and alpha lower than 0.5 is unacceptable.

According to the results in Table 4.2, apart from the Facilitating Conditions (FC) and Effort Expectancy (EE), all the measures of alpha for the constructs in the proposed model exceeds the acceptance level (0.7). Although, the measure for FC (0.555) is poor, it is not unacceptable. The reason for poor Cronbach’s alpha in Facilitating Condition construct could be either the poor design of the questions or a question might not have fit the constructs as it should have been. The same reasons for FC could also be true for Effort Expectancy (EE) (0.641). However, the Cronbach’s alpha for EE is relatively closer to the acceptance level. For Behavioral Intention (BI) and Continuance Intention (CI), there were only one factor. Therefore, they were not included in the reliability test. The overall coefficient alpha for the constructs was 0.942,
which indicates that 94% of the variability in a composite score by combining the 26 items submitted for the analyses is true score variance or internally consistent reliable.

Table 4.2 Summary of Reliability and Validity Tests

<table>
<thead>
<tr>
<th>Construct Items</th>
<th>Cronbach’s Alpha</th>
<th>Average Shared Variance (ASV)</th>
<th>Average Variance Extracted (AVE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HM</td>
<td>0.893</td>
<td>0.458</td>
<td>0.535</td>
</tr>
<tr>
<td>FC</td>
<td>0.555</td>
<td>0.322</td>
<td>0.559</td>
</tr>
<tr>
<td>PE</td>
<td>0.796</td>
<td>0.519</td>
<td>0.240</td>
</tr>
<tr>
<td>EE</td>
<td>0.641</td>
<td>0.558</td>
<td>0.615</td>
</tr>
<tr>
<td>PM</td>
<td>0.702</td>
<td>0.450</td>
<td>0.360</td>
</tr>
<tr>
<td>SI</td>
<td>0.854</td>
<td>0.277</td>
<td>0.357</td>
</tr>
<tr>
<td>CON</td>
<td>0.773</td>
<td>0.400</td>
<td>0.511</td>
</tr>
<tr>
<td>SAT</td>
<td>0.835</td>
<td>0.408</td>
<td>0.502</td>
</tr>
</tbody>
</table>

N=96

Construct validity is used to find out whether the scale questions in a questionnaire measures the existence of the constructs that should be measured. Average Shared Variance (ASV) and Average Variance Extracted are calculated to find out the construct validity. A construct has convergent validity when the AVE is greater than 0.5, and a construct has discriminant validity when ASV is smaller than AVE (Hair et al., 2006).

AVE and ASV for the construct validity were calculated in SPSS Amos, and the results are shown in Table 4.2. According to the results, although for the proposed model the AVE of Perceived Mobility (PM), Social Influence (SI) and Performance Expectancy (PE) are lower than 0.5, the ASV of all the constructs are smaller than AVE. On one hand, PM (0.360), SI (0.357) and PE (0.240), have lower convergent validity measures (less than 0.5). On the other hand, from the overall ASV measures one could conclude that the constructs of the proposed model have relatively strong divergent validity as all the ASVs were smaller than AVEs of the constructs.

4.3.2. Descriptive analysis of the results

The responses to questions based on Likert Scale were coded as 1 measuring Strongly Disagree, 2 for Disagree, 3 for Neutral, 4 for Agree and 5 representing Strongly Agree. For descriptive statistics assigning such codes are necessary to find out the mean and standard deviation of each sub-factor and blocks of factors (Denscombe, 2010). Standard Deviation (SD) shows the degree of variations from the mean of responses (Lind et al., 2007). A high standard deviation represents the data to be far from the mean (average) responses, and a low standard deviation represents the data to be closer to the mean (Lind et al., 2007). As shown in Table 4.3, all the means of the factors are between 2.5 and 4, and the data are spread around 1. Social Influence (SI) had the lowest mean while Perceived Mobility value had the greatest (3.97).
Table 4.3 Mean, SD and Inter-Construct Correlations

<table>
<thead>
<tr>
<th></th>
<th>HM</th>
<th>FC</th>
<th>PE</th>
<th>EE</th>
<th>PM</th>
<th>SI</th>
<th>BI</th>
<th>CI</th>
<th>CON</th>
<th>SAT</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>HM</td>
<td>1</td>
<td>0.316</td>
<td>0.542</td>
<td>0.430</td>
<td>0.396</td>
<td>0.331</td>
<td>0.427</td>
<td>0.582</td>
<td>0.529</td>
<td>0.483</td>
<td>3.24</td>
<td>1.080</td>
</tr>
<tr>
<td>FC</td>
<td>0.316</td>
<td>1</td>
<td>0.372</td>
<td>0.266</td>
<td>0.345</td>
<td>0.200</td>
<td>0.383</td>
<td>0.264</td>
<td>0.222</td>
<td>0.328</td>
<td>3.75</td>
<td>1.005</td>
</tr>
<tr>
<td>PE</td>
<td>0.542</td>
<td>0.372</td>
<td>1</td>
<td>0.415</td>
<td>0.439</td>
<td>0.291</td>
<td>0.594</td>
<td>0.509</td>
<td>0.501</td>
<td>0.377</td>
<td>3.71</td>
<td>1.032</td>
</tr>
<tr>
<td>EE</td>
<td>0.430</td>
<td>0.266</td>
<td>0.415</td>
<td>1</td>
<td>0.325</td>
<td>0.358</td>
<td>0.376</td>
<td>0.424</td>
<td>0.432</td>
<td>0.389</td>
<td>3.25</td>
<td>1.068</td>
</tr>
<tr>
<td>PM</td>
<td>0.396</td>
<td>0.345</td>
<td>0.439</td>
<td>0.325</td>
<td>1</td>
<td>0.318</td>
<td>0.482</td>
<td>0.381</td>
<td>0.331</td>
<td>0.394</td>
<td>3.97</td>
<td>0.975</td>
</tr>
<tr>
<td>SI</td>
<td>0.331</td>
<td>0.200</td>
<td>0.291</td>
<td>0.358</td>
<td>0.325</td>
<td>1</td>
<td>0.319</td>
<td>0.348</td>
<td>0.412</td>
<td>0.369</td>
<td>2.81</td>
<td>0.905</td>
</tr>
<tr>
<td>BI</td>
<td>0.427</td>
<td>0.383</td>
<td>0.594</td>
<td>0.376</td>
<td>0.482</td>
<td>0.318</td>
<td>1</td>
<td>0.505</td>
<td>0.519</td>
<td>0.454</td>
<td>3.78</td>
<td>0.925</td>
</tr>
<tr>
<td>CI</td>
<td>0.582</td>
<td>0.264</td>
<td>0.509</td>
<td>0.424</td>
<td>0.381</td>
<td>0.348</td>
<td>0.505</td>
<td>1</td>
<td>0.457</td>
<td>0.447</td>
<td>3.42</td>
<td>1.068</td>
</tr>
<tr>
<td>CON</td>
<td>0.529</td>
<td>0.222</td>
<td>0.501</td>
<td>0.432</td>
<td>0.331</td>
<td>0.412</td>
<td>0.519</td>
<td>0.457</td>
<td>1</td>
<td>0.402</td>
<td>3.37</td>
<td>0.979</td>
</tr>
<tr>
<td>SAT</td>
<td>0.483</td>
<td>0.328</td>
<td>0.377</td>
<td>0.389</td>
<td>0.394</td>
<td>0.369</td>
<td>0.454</td>
<td>0.447</td>
<td>0.402</td>
<td>1</td>
<td>3.31</td>
<td>0.973</td>
</tr>
</tbody>
</table>

N=96; p-value at 0.5 significance level

According to George and Mallery (2003), to be able to examine the proposed hypotheses in a model, relations between constructs (inter-construct or inter-item relationships) should be tested. In order to find the inter-construct relationships, a correlation analysis was conducted at 0.05 significance level while trying to calculate the Cronbach’s Alpha. Pearson Correlation explores the strength among variables (Lind et al., 2007). The results are shown in Table 4.3. The correlation coefficients of the proposed hypotheses among the constructs are highlighted in the Table 4.3. For further details about inter-item and inter-construct correlations, means, standard deviations please refer to Appendix 5.

The analysis shows positive relationships between the constructs. Among ten proposed relations, the relationship between BI and SI demonstrates the lowest (0.319) correspondence while the relationship between BI and PE has the highest correlation coefficient (0.594). According to Field (2013), an inter-construct correlation coefficient less than 0.3 indicates that the item fails to measure the same construct that is measured by the other items in the construct. The inter-item construct for the proposed relationships shown as the weighted average of coefficients in Table 4.3 are all above 0.3.

### 4.3.3. Structural Equation Modelling (SEM)

Ten proposed hypotheses were tested through the formulation of an SEM analysis in SPSS Amos (See Appendix 4). Structural Equation Modelling (SEM) is used to estimate the casual relationships among the constructs and the variables in the constructs. SEM can include path analysis, multiple regression analysis, factor analysis, time series analysis and covariance analysis among others (Markus, 2012). The results from the SEM analysis for the proposed hypotheses are shown in Figure 4.3 and Table 4.4. (For detailed version of SEM analysis refer to Appendix 4)
Figure 4.3 Results from SEM analysis of the examined hypotheses

Note: * significant at a 0.01 level; rejected hypotheses are shown with dashed-arrow and supported hypotheses with a normal arrow together with their beta values.

In Figure 4.3, there are two endogenous variables: Behavioral Intention (BI) and Continuance Intention (CI). Each is connected with several exogenous variables. BI is connected with six exogenous variables – Hedonic Motivation (HM), Performance Expectancy (PE), Effort Expectancy (EE), Perceived Mobility value (PM), Facilitating Conditions (FC) and Social Influence (SI). The multi-regression analysis for this path shows that an individual’s HM, PE, EE, PM, FC and SI account for 50% ($R^2$) of his/her Behavioral Intention (BI) to use smart devices as u-learning tools.

The endogenous variable CI is connected with one endogenous variable BI and three exogenous variables Confirmation (CON), Satisfaction (SAT) and Facilitating Conditions (FC). BI, CON, SAT and FC explained 39% ($R^2$) variation an individual’s Continuance Intention to use smart devices as u-learning tools.

The hypothesized casual paths explained above were examined to observe the structural relationships among the constructs’ paths. Based on the findings, five hypotheses were supported, and the other five were rejected. The results are summarized in Figure 4.3 and Table 4.4. In Figure 4.3, the rejected hypotheses are shown with dashed arrows while the supported hypotheses are shown with regular arrows.

According to the results, the relationship between Confirmation, Satisfaction and Continuance Intention are supported by the data as shown by a significant critical ratio and beta. The results indicate that Satisfaction (SAT) has a positive significant effect on Continuance Intention (CI) to use smart devices as u-learning tools (H1, beta = 0.280, CR = 3.345). Confirmation (CON)
appears to be a significant determinant of Continuance Intention (CI) for smart devices as u-learning tools (H2, beta = 0.504, CR = 5.021).

Table 4.4 Summary of hypothesis tests

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Standardized coefficient (beta)</th>
<th>Standard Error (SE)</th>
<th>Critical (CR)</th>
<th>Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1: SAT → CI</td>
<td>0.280*</td>
<td>.100</td>
<td>3.345</td>
<td>Yes</td>
</tr>
<tr>
<td>H2: CON → CI</td>
<td>0.504*</td>
<td>.164</td>
<td>5.021</td>
<td>Yes</td>
</tr>
<tr>
<td>H3: PE → BI</td>
<td>0.673*</td>
<td>.156</td>
<td>5.800</td>
<td>Yes</td>
</tr>
<tr>
<td>H4: EE → BI</td>
<td>-0.011</td>
<td>.095</td>
<td>-0.192</td>
<td>No</td>
</tr>
<tr>
<td>H5: FC → BI</td>
<td>0.050</td>
<td>.039</td>
<td>0.559</td>
<td>No</td>
</tr>
<tr>
<td>H6: FC → CI</td>
<td>-0.001</td>
<td>.020</td>
<td>-0.017</td>
<td>No</td>
</tr>
<tr>
<td>H7: SI → BI</td>
<td>0.065</td>
<td>.079</td>
<td>0.814</td>
<td>No</td>
</tr>
<tr>
<td>H8: PM → BI</td>
<td>0.193</td>
<td>.082</td>
<td>2.143</td>
<td>Yes</td>
</tr>
<tr>
<td>H9: HM → BI</td>
<td>0.023</td>
<td>.060</td>
<td>0.296</td>
<td>No</td>
</tr>
<tr>
<td>H10: BI → CI</td>
<td>0.233</td>
<td>.088</td>
<td>2.989</td>
<td>Yes</td>
</tr>
</tbody>
</table>

*Significant at 0.01 level

Furthermore, Behavioral Intention (BI) to continue/discontinue using smart devices as u-learning tools was positively influenced by Performance Expectancy (H3, beta = 0.673, CR = 5.800) and Perceived Mobility (PM) value (H8, beta = 0.193, CR = 2.143). Performance Expectancy (PE) was the most important determinant of a student’s Behavioral Intention to continue using smart devices as u-learning tools. The strong relationship between PM and BI and a relatively stronger relationship between PE and BI should have had significant effect on BI, which in turn positively influenced Continuance Intention (H10, beta = 0.233, CR = 2.989) to continue using smart devices as u-learning tools.

The results also imply that Effort Expectancy (EE) of students was not significant for Behavioral Intention of the students to accept or use smart devices as u-learning tools (H4, beta = -0.011, CR = -0.192).

Facilitation Conditions (FC) seemed to neither affect BI (H5, beta = 0.050, CR = 0.559), nor it influenced Continuance Intention (CI) to accept or use smart devices as u-learning tools (H6, beta = -0.001, CR = -0.017).

The results also show that Social Influence (SI) had not a significant impact on BI (H7, beta = 0.065, CR, 0.814). Hedonic Motivation (HM) also did not influence BI (H7, beta = 0.023, CR, 0.296). All the supported hypotheses had greater CR value than the rejected hypotheses.
5. Discussion and Critical Reflection

This chapter mainly answers the research question. Clarification of the findings of this study is also included here. The relationship of the findings with previous research and its contribution to the existing knowledge are also discussed in this chapter.

To be able to answer the research question, “What are the key factors that influence students’ intentions to continue using smart devices as ubiquitous learning tools in higher education in Sweden?” the researcher of the study first identified relevant factors previously studied in the field of technology acceptance in education contexts. Based on the early research, Confirmation, Satisfaction, Performance Expectancy, Effort Expectancy, Hedonic Motivation, Perceived Mobility, Social Influence and Facilitating Conditions were identified to be the key factors that could influence users’ intentions to continue using smart devices as u-learning tools. Ten hypotheses were suggested, out of which five hypotheses were supported, and the other five were not statistically significant.

5.1. Supported hypothesis

Regarding the supported hypotheses, the findings of this study are consistent with the findings of Shin et al. (2011), particularly about the influence of Expectation-Confirmation Theory (ECT) on Technology Acceptance Model (TAM) and Unified Theory of Acceptance and Usage Technology (UTAUT). The results of this study imply that both Confirmation and Satisfaction were significant predictors of a user’s intention to continue using smart devices as u-learning tools (H1, beta = 0.280, CR = 3.345; H2, beta = 0.504, CR = 5.021). With other words, the students’ expectations of the performance of smart devices as u-learning tools have been confirmed (met) that have led them to form a higher Satisfaction level towards using smart devices as u-learning tools. Hence, satisfied users formed a Continuance Intention to continue using smart devices as u-learning tools at u-campuses.

Besides, Behavioral Intention was positively influenced by Performance Expectancy (H3, beta = 0.673, CR = 5.800) and Perceived Mobility value (H8, beta = 0.193, CR = 2.143), which was also in conformity with previous studies (Venkatesh et al., 2003; Huang et al., 2007 and Venkatesh et al. (2012). In fact, the studies of Venkatesh et al. (2003), Huang et al. (2007) and Venkatesh et al., (2012) were about acceptance of a technology in different contexts.

Findings of this study in education context regarding the positive effect of Performance Expectancy and Perceived Mobility value on users’ Behavioral Intention to accept smart devices as u-learning tools confirm the previous research on users’ intentions to accept a technology. Moreover, the findings suggest that mobility value of smart devices as u-learning
tools has to some extent met the expectations of the users affecting their Behavioral Intention to accept or use the technology for learning purposes. With other words, the ability of smart devices to allow students to do tasks, to learn from the online material and to search for help anywhere at any time (Perceived Mobility value) has been useful for the students as it saved their time and improved their learning (Performance Expectancy). This in turn had positive effects on their intention (Behavioral Intention) to continue using (Continuance Intention) smart devices as u-learning tools (H10, beta = 0.233, CR = 2.989).

5.2. Rejected hypothesis

There are several reasons associated with the rejected hypotheses. First and foremost, most of the earlier studies (Davis, 1989; Huang et al., 2007; Venkatesh et al., 2003; Venkatesh et al., 2012) on Behavioral Intention of individuals to accept a technology were conducted in pre and post-acceptance stages of a technology. For this study, however, only the post-acceptance stage of smart devices as u-learning tools was considered. The responses of the students regarding the usage of smart devices for learning purposes confirm the fact that most of them (82%) had more than a year of experience. The students had been using their smart devices for various learning purposes, such as surfing the university web, checking courses schedules, using the university’s library services, recording lectures, etc. Therefore, for this study instead of “Actual Use” in TAM and “Use Behavior” in UTAUTs, Continuance Intention of ECT was chosen as it focuses on the post-acceptance stage of a technology. Thus, the focus of the study is on the post-acceptance stage of smart devices as u-learning tools could be the main reason for the rejection of the five out of ten suggested hypotheses – namely, H4, H5, H6, H7 and H9.

Another reason for the rejection of the hypotheses could be the absence of mediators, namely age, experience and gender during the examination of the hypotheses. Other researchers (Huang et al., 2007; Shin et al., 2011; Venkatesh et al., 2003; Venkatesh et al., 2012) have used these variables to mediate the effects of Effort Expectancy, Social Influence, Hedonic Motivation and Facilitating Conditions on intentions. For this study, no such mediators were used as this was thought to defocus and derail the study from its research question, aim and purpose.

The findings of the study suggest that Facilitating Conditions (FC) such as necessary resources and knowledge, and compatibility of smart devices with the contents of e-learning services did not influence both Behavioral and Continuance Intention (H5, beta = 0.050, CR = 0.559 and H6, beta = -0.001, CR = -0.017). This finding is to some extent consistent with the findings of Venkatesh et al., (2012) as they found out that the positive influence of Facilitating Conditions on intention existed only in older women. The participants of this study, however, were mostly young students aged between 18 to 35 years. Besides, smart devices of today have already installed features that help any online service to be compatible with the features of smart devices. The hypothesis was rejected even though the overall statistical mode for the factor was fairly high (4/5).

In this study, Effort Expectancy or Ease of Use of a technology also did not influence students’ Behavioral Intention to use smart devices as u-learning tools (H4, beta = -0.011, CR = -0.192). It could be because the respondents were young and experienced users, who were in the post
acceptance stage of using smart devices as u-learning tools rather than pre acceptance stage. Earlier studies (Huang et al., 2007; Shin et al., 2011; Venkatesh et al., 2003; Venkatesh et al., 2012) have focused on both pre and post acceptances stages of a technology. This study has focused mainly on the post acceptance stage of smart devices as u-learning tools. For the same reasons about EE, the researcher believes that Social Influence had no significant effect on Behavioral Intention of users to use smart devices as u-learning tools (H7, beta = 0.065, CR = 0.814).

Furthermore, the results of the study show that Hedonic Motivation, as well, had no significant positive effect on Behavioral Intention (H9, beta = 0.023, CR = 0.296). In the learning context, this makes sense because most of the students find learning boring and feel forced to learn, according to Packer (2006) and Stoney and Oliver (1998). Thus, learning even u-learning with modern smart devices was neither fun nor entertaining and enjoyable for the students. Most of the responses for Hedonic Motivation were, therefore, neutral (statistical mode 3/5). Hedonic Motivation could have a significant impact on intentions in other contexts such as gaming and social media.

5.3. Contribution to knowledge
The main contribution of this study to the existing knowledge about Behavioral Intention towards acceptance and usage of a technology was the inclusion of factors related to Satisfaction and Confirmation into the UTAUT model. Researchers (Shin et al. 2011) have combined factors from TAM and ECT to develop a theoretical model. However, the author of this study during the research did not come across any study where Confirmation and Satisfaction from ECT concept were included in UTAUTs. The findings of this study show that both Confirmation and Satisfaction had strong positive influences on intentions to continue using smart devices as u-learning tools. By Confirmation, this study meant actual improvements (in knowledge and skills of students) after using the technology (smart devices) for learning purposes. Satisfaction in this study refers to the degree where the usage of the technology (smart devices) matches a user’s expectations, fulfill the user’s needs and actual Satisfaction. Thus, Confirmation and Satisfaction can be included in UTAUT and UTAUT2.

Besides, this study found no significant effect of EE, HM, FC and SI on intentions in the usage of smart devices as u-learning tools. Since this finding contradicts previous research on the acceptance of a technology in different contexts, it can be of a great importance for the researchers focusing in this field.
6. Conclusion

Under this section, the study is summarized. Here, the relationship of the findings with the problem and research question, aim and purpose is discoursed briefly. Some topics are recommended for further research in the chapter. Limitations of the study are also covered in this section.

6.1. Concluding points

Limited knowledge in understanding the fundamental factors that influence users’ intention to continue using smart devices as ubiquitous learning (u-learning) tools at higher education institutions in Sweden was a problem that needed a scientific solution. This study aimed at exploring the users’ Behavioral and Continuance Intentions to accept smart devices as ubiquitous learning tools at higher education institutions in Sweden. The purpose of the study was to find the key factors that influence users’ intentions to continue using smart devices as ubiquitous learning tools at higher education institutions. Thus, the focus of this study was on finding answers to the research question: what are the key factors that influence students’ intentions to continue using smart devices as ubiquitous learning tool for higher education in Sweden?

To be able to answer the research question, relevant theories such as TAM, UTAUT and ECT were studied, and ten hypotheses were suggested. To be able to test the hypotheses of this deductive and explanatory research, quantitative data was collected through a web-based questionnaire via purposive and convenience sampling techniques involving non-representative samples. Prior to the analysis of the data, Performance Expectancy, Effort Expectancy, Hedonic Motivations, Facilitating Conditions, Behavioral Intention, Social Influence, Perceived Mobility value, Confirmation and Satisfaction were identified as key factors influencing users’ acceptance of a technology in the field of education. However, the findings of the study suggested that in the context of u-learning, Performance Expectancy, Perceived Mobility, Confirmation and Satisfaction were the key factors that influenced students’ intentions to continue using smart devices as u-learning tools at Stockholm University.

6.2. Implications

This study provides implications for both theories and practice. Theoretically, the findings add to the existing knowledge about users’ intentions to accept and use a mobile learning technology at higher education institutions. The results suggest that Confirmation and Satisfaction, the two key constructs from the Expectation-Confirmation Theory, can be included as separate constructs of the Unified Theory of Acceptance and Use of Technology (UTAUT, UTAUT2). Furthermore, the results show that Confirmation and Satisfaction could directly affect the Continuance Intention, which can be of a great importance for the researchers in the field of ECT. Moreover, this study found out that Effort Expectancy, Hedonic Motivation, Facilitating
Conditions and Social Influence had no significant effect on Behavioral Intention to continue using smart devices as u-learning tools, which can be of a great importance for the researchers, marketers and developers of ubiquitous learning platforms and tools.

In practice, as the study focused on the end-users (students), the findings are of a great importance for higher education institutions, particularly Stockholm University. Based on the findings, the University can now focus on the factors that influence students’ intentions to continue using their smart devices to learn from the ubiquitous learning platforms provided by the University. Students believed that using smart devices was useful, improved their learning and saved them time (Performance Expectancy of smart devices). According to the responses from the students, using smart devices has allowed them to ask for help, to study and to accomplish tasks quickly, anywhere, anytime (Perceived Mobility value of smart devices). These factors, in turn, have helped the students to improve their knowledge and skills (Confirmation of smart devices), meeting their expectations and fulfilling their needs (forming Satisfaction around smart devices). Hence, students intended to accept (Behavioral Intention) and continue using (Continuance Intention) smart devices as ubiquitous learning tools. Thus, the higher education institutions in Sweden, Stockholm University, in particular, can focus on these factors when designing mobile learning platforms in the future or redesigning the current platforms.

6.3. Suggestions for further research

Future studies can include samples from a larger number of users and higher education institutions to be able to generalize and gain a comprehensive view of the acceptance of smart devices as u-learning tools in Sweden. Hence, to be able to generalize the findings and have more thorough validation globally, the future studies can include representative samplings of both the higher education institutions and the users of smart devices through a global data collection process.

Moreover, further research can also include variables such as age, gender and experience as they might have mediating effects on the key factors that influence users’ intention to continue using smart devices as u-learning tools. These variables were excluded from this study based on the assumption that students are of a certain age group (18-35) and have been using the same mobile learning platforms at Stockholm University regardless of their gender. Furthermore, four factors – Effort Expectancy, Social Influence, Facilitating Conditions and Hedonic Motivation – were not statistically significant in the contexts of smart devices as u-learning tools, which can be further investigated as these factors were significant in other contexts.

Finally, future studies can compare students’ (or any other users) intentions both in pre and post-introduction stages of a particular u-learning platform at higher education institutions. Students of different majors at higher education institutions and a comparison with employees can also be further studied regarding the acceptance and usage of smart devices as u-learning tools.
6.4. Limitations of Research

This study was limited to only students from higher education institutions in Sweden, Stockholm University, in particular. Limited time and resources of the researcher led to the choice of non-probability and non-representative approaches, limiting the generalization of the findings in other contexts – other universities in Sweden and other countries. Although, there was no intended age limit to the study, naturally students aged between 18 up to 35 years old comprised the higher level of contribution to the study. Besides, this study was limited to smart devices, particularly smartphones and PDAs such as iPad, tablets, etc. Generalization of the finding to other mobile smart devices such as e-readers, portable computers, etc. is difficult. In fact, the findings reflect only limited factors that influence intentions of students to continue using smart devices as ubiquitous learning tools. Moreover, constructs related to Behavioral and Continuance Intentions were limited to one.

Furthermore, the study was focusing on the post-acceptance stage of smart devices as u-learning tools. Variables such as age, gender and experience that could have mediating effects on other factors were not involved in the study. The inclusion of such variables could have derailed this study from its aim and purpose. The complexity of statistical operations surrounding the involvement of these variables in the research was considered to be out of the scope of the thesis project, indeed.
References


**Online sources**


Appendices

Appendix 1. Informed Consent

Information about researcher
I am Najibullah Aziz. I am currently a student of Strategic IT Management, a master program at Stockholm University. This survey is a requirement for my thesis project. I am asking for your voluntary participation in my small-scale research project regarding mobile learning at Stockholm University.

For more information, do not hesitate to contact me by my e-mail address – aziznajibullah@gmail.com. For further information about Stockholm University’s School of Business, you can visit www.sbs.su.se.

Information about the research
The aim of the research is to explore the usage of smart devices as learning tools at universities. This study focuses, particularly, on understanding the key factors that influence students’ intentions to continue using smart devices (smartphones, tablets, etc.) as ubiquitous learning tools. The analysis will be based on the evaluations of questionnaires completed by Stockholm University students.

Participation in the study
The target group of the study is the students at Stockholm University – those who use their smart devices as learning tools, in particular. Therefore, if you are not a student at Stockholm University and under 18 years of age, please do not participate in this survey.

If you participate, you will be asked to provide answers regarding your experience, satisfaction, intentions and expectation to use your smart device for learning purposes.

Your participation in the survey is totally voluntary. You may not directly benefit from participating in the study. However, you are encouraged to do the survey as you will be able to get a copy of the final report upon request.

To complete the survey an anonymous questionnaire is designed, where you do not need to give personal information. There is no anticipated discomfort for you to take part in the study. The risk is minimal.

The questionnaire is designed to take about ten minutes. You may decide not to answer any question that you feel uncomfortable with and you can stop the survey at any time.

In fact, the information collected from the questionnaire is only used for study purposes for my thesis project. Your provided information will be kept confidential and will not be released without your prior consent. In addition, the researcher is the only person to analyze the data collected through the questionnaire.

Thank you for your participation!

By ticking the following button “Yes, I Agree” I am attesting that I have read and understood the information above and agree to participate in the survey.
Appendix 2. Questionnaire questions

General Questions about Demographics of Respondents

*2) Are you a student at Stockholm University? (Note: you should be a student at Stockholm University in order to take part in the survey)
   Yes
   No

3) What is your gender?
   Female
   Male

4) Which age group suits you best?
   18-24
   25-34
   Older than 35

*5) Do/Did you have any smart device (smartphone, tablets such as iPad, Galaxy Note, Google Nexus, etc.)?
   Yes
   No

6) How long have/had you been using your smart device(s) for learning purposes?
   Less than a year
   More than a year

7) Please check the options that apply: I have used my smart device (smartphone or tablet)
   o for library services (e.g. borrowed an item, booked a room, etc.)
   o to access university website or system
   o to download a course document
   o to search for information during a class
   o to check course schedule
   o to record information during a class (voice or video recording or take pictures of course items)
   o to write/take notes
   o to read articles for a course
   o to do assignments of a course
   o to interact/communicate with lecturers and course participants

Degree Questions Related to Hypotheses

*8) Using my smart device for learning purposes is fun
   Strongly Disagree   Disagree   Neutral   Agree   Strongly Agree

*9) Using my smart device for learning purposes is enjoyable
   Strongly Disagree   Disagree   Neutral   Agree   Strongly Agree

*10) Using my smart device for learning purposes is entertaining
   Strongly Disagree   Disagree   Neutral   Agree   Strongly Agree

*11) I have the resources necessary to use my smart device as a learning tool
   Strongly Disagree   Disagree   Neutral   Agree   Strongly Agree

*12) I have the knowledge necessary to use my smart device as a learning tool
   Strongly Disagree   Disagree   Neutral   Agree   Strongly Agree

*13) Using my smart device improves my learning
*14) Using my smart device for learning saves me a lot of time
Strongly Disagree Disagree Neutral Agree Strongly Agree

*15) Using my smart device for learning purposes is useful
Strongly Disagree Disagree Neutral Agree Strongly Agree

*16) Using my smart device makes it easy for me to learn the things that I want to learn
Strongly Disagree Disagree Neutral Agree Strongly Agree

*17) Using my smart device does not require me a lot of mental effort to learn
Strongly Disagree Disagree Neutral Agree Strongly Agree

*18) In general, I feel it is easy to learn by using my smart device
Strongly Disagree Disagree Neutral Agree Strongly Agree

*19) Mobility of my smart device allows to accomplish tasks quickly - any place, anytime.
Strongly Disagree Disagree Neutral Agree Strongly Agree

*20) Using my smart device allows me to study anytime, anywhere (ubiquitous)
Strongly Disagree Disagree Neutral Agree Strongly Agree

*21) Using my smart device enables me to search for help if there is any problem during learning
Strongly Disagree Disagree Neutral Agree Strongly Agree

*22) People who are important to me think that I should use smart device for learning purposes
Strongly Disagree Disagree Neutral Agree Strongly Agree

*23) People who influence my behavior think that I should use smart devices for learning purposes
Strongly Disagree Disagree Neutral Agree Strongly Agree

*24) People whose opinions are valuable to me prefer that I use smart devices for learning purposes
Strongly Disagree Disagree Neutral Agree Strongly Agree

*25) I intend to continue using smart devices for ubiquitous learning
Strongly Disagree Disagree Neutral Agree Strongly Agree

*26) I plan to continue using my smart device for ubiquitous learning
Strongly Disagree Disagree Neutral Agree Strongly Agree

*27) I will always try to use my smart device for ubiquitous learning
Strongly Disagree Disagree Neutral Agree Strongly Agree

*28) I have improved my knowledge by using my smart device
Strongly Disagree Disagree Neutral Agree Strongly Agree

29) I have improved my skills by using my smart device
Strongly Disagree Disagree Neutral Agree Strongly Agree

*30) Learning through my smart device matches my expectations
Strongly Disagree Disagree Neutral Agree Strongly Agree

*31) My smart device can largely fulfill my needs for ubiquitous learning
Strongly Disagree Disagree Neutral Agree Strongly Agree

*32) I am very satisfied with ubiquitous learning through my smart device.
Strongly Disagree Disagree Neutral Agree Strongly Agree
Appendix 3. Frequencies (mode), Constructs and Questions’ Categorization

<table>
<thead>
<tr>
<th>Construct Items</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
<th>Code</th>
<th>Mode</th>
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</thead>
<tbody>
<tr>
<td>*8) Using my smart device for learning purposes is fun</td>
<td>9.4</td>
<td>11.5</td>
<td>36.5</td>
<td>31.3</td>
<td>11.5</td>
<td>HM1</td>
<td>3</td>
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<tr>
<td>*9) Using my smart device for learning purposes is enjoyable</td>
<td>5.2</td>
<td>15.6</td>
<td>29.2</td>
<td>34.4</td>
<td>15.6</td>
<td>HM2</td>
<td>4</td>
</tr>
<tr>
<td>*10) Using my smart device for learning purposes is entertaining</td>
<td>7.3</td>
<td>19.8</td>
<td>37.5</td>
<td>28.1</td>
<td>7.3</td>
<td>HM2</td>
<td>3</td>
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<td><strong>Hedonic Motivation</strong></td>
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<tr>
<td>*11) I have the resources necessary to use my smart device as a learning tool</td>
<td>6.3</td>
<td>6.3</td>
<td>24.0</td>
<td>40.6</td>
<td>22.9</td>
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<td>*12) I have the knowledge necessary to use my smart device as a learning tool</td>
<td>4.2</td>
<td>3.1</td>
<td>9.4</td>
<td>49.0</td>
<td>34.4</td>
<td>FC2</td>
<td>4</td>
</tr>
<tr>
<td>*29) Learning platforms at Stockholm University is compatible to smart devices</td>
<td>4.2</td>
<td>10.4</td>
<td>27.1</td>
<td>47.9</td>
<td>10.4</td>
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<td>*13) Using my smart device improves my learning</td>
<td>3.1</td>
<td>13.5</td>
<td>30.2</td>
<td>43.8</td>
<td>9.4</td>
<td>PE1</td>
<td>4</td>
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<td>*14) Using my smart device for learning saves me a lot of time</td>
<td>7.3</td>
<td>8.3</td>
<td>14.6</td>
<td>49.0</td>
<td>20.8</td>
<td>PE2</td>
<td>4</td>
</tr>
<tr>
<td>*15) Using my smart device for learning purposes is useful</td>
<td>4.2</td>
<td>6.3</td>
<td>9.4</td>
<td>45.8</td>
<td>34.4</td>
<td>PE3</td>
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<td><strong>Performance Expectancy</strong></td>
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<td>*16) Using my smart device makes it easy for me to learn the things that I want</td>
<td>7.3</td>
<td>9.4</td>
<td>31.3</td>
<td>43.8</td>
<td>8.3</td>
<td>EE1</td>
<td>4</td>
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<td>*17) Using my smart device does not require me a lot of mental effort to learn</td>
<td>8.3</td>
<td>20.8</td>
<td>29.2</td>
<td>30.2</td>
<td>11.5</td>
<td>EE2</td>
<td>4</td>
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<td>*18) In general, I feel it is easy to learn by using my smart device</td>
<td>7.3</td>
<td>15.6</td>
<td>34.4</td>
<td>34.4</td>
<td>8.3</td>
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<td>*19) Mobility of my smart device allows to accomplish tasks quickly - any</td>
<td>4.2</td>
<td>4.2</td>
<td>11.5</td>
<td>44.8</td>
<td>35.4</td>
<td>PM1</td>
<td>4</td>
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<tr>
<td>place, anytime</td>
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<tr>
<td>*20) Using my smart device allows me to study anytime, anywhere (ubiquitous)</td>
<td>5.2</td>
<td>7.3</td>
<td>6.3</td>
<td>56.3</td>
<td>25.0</td>
<td>PM2</td>
<td>4</td>
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<tr>
<td>*21) Using my smart device enables me to search for help if there is any</td>
<td>3.1</td>
<td>2.1</td>
<td>18.8</td>
<td>49.0</td>
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<td>problem during learning</td>
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<td>22</td>
<td>People who are important to me think that I should use smart device for  learning purposes</td>
<td>11.5</td>
<td>17.7</td>
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<td>23</td>
<td>People who influence my behavior think that I should use smart devices for learning purposes</td>
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<td>19.8</td>
<td>49.0</td>
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<td>24</td>
<td>People whose opinions are valuable to me prefer that I use smart devices for learning purposes</td>
<td>10.4</td>
<td>19.8</td>
<td>52.1</td>
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<td>*25) I intend to continue using smart devices for ubiquitous learning</td>
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<td>5.2</td>
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<td>*26) I will always try to use my smart device for ubiquitous learning</td>
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<td>*27) Using my smart device for learning purposes has improved my knowledge</td>
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<td>12.5</td>
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<td>*28) Using my smart device for learning purposes has improved my skills</td>
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<td>*30) Learning through my smart device matches my expectations</td>
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<td>14.6</td>
<td>31.3</td>
<td>43.8</td>
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<td>*31) My smart device can largely fulfill my needs for ubiquitous learning</td>
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<td>12.5</td>
<td>28.1</td>
<td>46.9</td>
<td>6.3</td>
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<td>*32) I am very satisfied with ubiquitous learning through my smart device</td>
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Appendix 4. Structural Equation Modeling
## Appendix 5. Inter-Item Correlation Matrix and Measurement Scale Summary

### Inter-Item Correlation Matrix

|      | HM1 | HM2 | HM3 | FC1 | FC2 | FC3 | PE1 | PE2 | PE3 | EE1 | EE2 | EE3 | PM1 | PM2 | PM3 | SI1 | SI2 | SI3 | BI | CI | CON1 | CON2 | SAT1 | SAT2 | SAT3 | Mean | SD  | N  |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|----|------|------|------|------|------|-----|-----|-----|
| HM1  | 1.00 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |    |    |      |      |      |      |      |     |     |     |
| HM2  | .764 | 1.00|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |    |    |      |      |      |      |      |     |     |     |
| HM3  | .796 | .854| 1.00|     |     |     |     |     |     |     |     |     |     |     |     |     |     |    |    |      |      |      |      |      |     |     |     |
| FC1  | .355 | .497| .314| 1.00|     |     |     |     |     |     |     |     |     |     |     |     |     |    |    |      |      |      |      |      |     |     |     |
| FC2  | .273 | .650| .283| .383| 1.00|     |     |     |     |     |     |     |     |     |     |     |     |    |    |      |      |      |      |      |     |     |     |
| FC3  | .322 | .446| .317| .459| .023| 1.00|     |     |     |     |     |     |     |     |     |     |     |    |    |      |      |      |      |      |     |     |     |
| PE1  | .437 | .586| .513| .511| .169| .368| 1.00|     |     |     |     |     |     |     |     |     |     |    |    |      |      |      |      |      |     |     |     |
| PE2  | .652 | .402| .589| .495| .465| .109| .404| 1.00|     |     |     |     |     |     |     |     |     |    |    |      |      |      |      |      |     |     |     |
| PE3  | .494 | .621| .500| .643| .228| .356| .615| .655| 1.00|     |     |     |     |     |     |     |     |    |    |      |      |      |      |      |     |     |     |
| EE1  | .653 | .479| .632| .394| .361| .176| .430| .715| .513| 1.00|     |     |     |     |     |     |     |    |    |      |      |      |      |      |     |     |     |
| EE2  | .123 | .167| .133| .346| .303| .260| .257| .095| .200| .154| 1.00|     |     |     |     |     |     |    |    |      |      |      |      |      |     |     |     |
| EE3  | .106 | .436| .641| .800| .323| .183| .398| .578| .485| .611| .393| 1.00|     |     |     |     |     |    |    |      |      |      |      |      |     |     |     |
| PM1  | .317 | .412| .305| .573| .231| .338| .393| .492| .607| .390| .294| .399| 1.00|     |     |     |     |    |    |      |      |      |      |      |     |     |     |
| PM2  | .556 | .338| .459| .362| .413| .265| .206| .586| .471| .492| .490| .499| .550| 1.00|     |     |     |    |    |      |      |      |      |      |     |     |     |
| PM3  | .327 | .444| .398| .381| .200| .339| .414| .278| .505| .234| .263| .312| .426| .293| 1.00|     |    |    |      |      |      |      |      |     |     |     |
| SI1  | .487 | .319| .504| .242| .236| .280| .350| .345| .322| .442| .264| .512| .278| .468| .356| 1.00|    |    |      |      |      |      |      |     |     |     |
| BI   | .406 | .580| .430| .569| .265| .217| .590| .455| .788| .380| .334| .415| .557| .394| .495| .289| .403| .264| 1.00|    |      |      |      |     |     |     |
| CI   | .699 | .486| .601| .310| .268| .214| .482| .656| .441| .666| .397| .508| .380| .564| .248| .446| .179| .418| .505| 1.00|    |      |      |     |     |     |
| CON1 | .434 | .588| .449| .372| .011| .354| .640| .359| .514| .497| .270| .438| .303| .222| .482| .349| .434| .309| .528| .477| 1.00|    |      |      |     |     |     |
| SAT1 | .559 | .403| .505| .343| .296| .316| .188| .371| .231| .438| .153| .547| .299| .481| .268| .485| .178| .360| .348| .477| .315| .419| 1.00|    |      |      |     |     |     |
| SAT2 | .340 | .484| .332| .511| .039| .507| .489| .267| .506| .295| .293| .388| .520| .398| .333| .349| .388| .264| .555| .325| .467| .220| .515| 1.00|    |      |      |     |     |     |

Mean = 4.02; SD = 1.02; N = 95