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# The role of self-determination theory in explaining teachers' motivation to continue to use e-learning technology

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ABSTRACT

Based on self-determination theory, this study proposes an extended information systems continuance theory in the context of teachers' utilization of e-learning technology in connection with on-site courses. In the proposed model teachers' extrinsic motivation (i.e. perceived usefulness), confirmation of pre-acceptance expectations and intrinsic motivation are predicted to be influenced by perceived autonomy, perceived competence and perceived relatedness. Even though information systems continuance theory has received quite extensive attention in prior research, this study is among the first to examine the effects of self-determination theory constructs in the context of teachers' utilization of e-learning technology. The results show that extension of IS-continuance theory with constructs that represent users' basic psychological needs and intrinsic motivation can be useful for predicting their e-learning continuance intentions.



## 1. Introduction

While traditional learning methods, such as lectures and project work remain dominant in higher education, universities are investing considerable resources in e-learning technology to support traditional methods with access to complementary electronic information, alternative communications channels, and possibilities for electronic collaboration. The great advantage of using such technology in connection with on-site courses is that it increases flexibility, through resources that facilitate learning anytime and anywhere (Liaw, 2008). However, the basic nature of this technology is that it enables teachers and students with "possibilities", not with a "ready to use" resource. Jasperson, Carter, and Zmud (2005) claim that the utilization of possibilities inherent in a new technology is a key to implementation success, and in the prolongation of this we assert that teachers' willingness to utilize e-learning possibilities in the long run is essential for realization of long-term benefits from investments in e-learning technology. Bhattacherjee (2001, pp. 351–352) stress this issue when he claims that long-term viability of an IS like e-learning technology and its eventual success depend on its continued use rather than its first-time use.

Teachers' willingness to utilize e-learning possibilities in the long run is also important as a matter of their role as initiators and facilitators to students' utilization of e-learning (Mahdizadeh, Biemans, & Mulder, 2008). That teachers' e-learning perceptions and e-learning behavior is critical for students' use of e-learning is emphasized in a numerous of previous studies (e.g., Albirini, 2006; Mahdizadeh et al., 2008). It is therefore plausible to believe that teachers' lack of willingness to utilize e-learning possibilities beyond the initial adoption stage may lead to underutilization by students, and hence, in the next instance this may leads to reduced learning outcomes.

As stressed above, we assert here that continuance intention is an important indicator of teachers' willingness to utilize e-learning technology beyond the initial period of usage. This is supported by previous e-learning research that views continuance intention as a key antecedent to predict e-learning success in the meaning "behavior of reuse" (Chiu, Hsu, Sun, Lin, & Sun, 2005; Chiu, Sun, Sun, & Ju, 2007; Chiu & Wang, 2008; Hayashi, Chen, Ryan, & Jiinpo, 2004; Limayem & Cheung, 2008; Roca, Chiu, & Martinez, 2006; Roca & Gagné, 2008).

IS-research concerned with behavior of reuse, or more precisely intention to continue the usage, is by Larsen, Sørebø, and Sørebø (2009) divided into three different but somewhat overlapping groups. We propose that this is also the instance for e-learning continuance research. The first group consists of studies employing information systems adoption variables as antecedents for explaining e-learning continuance (e.g., Limayem & Cheung, 2008; Roca et al., 2006). These publications usually use variables from the originally proposed information systems (IS) continuance theory (cf. Bhattacherjee, 2001) as their core variables. In the second group one finds studies that

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aim at decomposing the originally proposed IS continuance variables and tests them as antecedents for explaining e-learning continuance (e.g., Chiu et al., 2005; Chiu, Sun, et al., 2007). The third and last group consists of studies trying to integrate the IS-continuance theory with complementary theoretical perspectives (e.g., Chiu, Chiu, & Chang, 2007; Liu, Liao, & Pratt, 2009; Roca & Gagné, 2008).

The present study belongs in the third group. Our starting point is the IS-continuance theory as originally proposed by Bhattacherjee (2001), and our additional perspective is the self-determination theory (e.g., Gagné & Deci, 2005). The latter perspective was introduced to e-learning research by Roca and Gagné (2008). They demonstrated, through a study of students' use of e-learning technology, that self-determination theory is complementary to IS-continuance theory in explaining continuance intentions. The strength of IS-continuance theory is that it emphasizes teachers' e-learning pre-adoption expectations and post-adoption usefulness beliefs. The latter of these, i.e. usefulness beliefs, was as early as in 1992 conceptualized as an extrinsic motivation by Davis, Bagozzi, and Warshaw (1992). Self-determination theory on the other hand emphasizes basic need fulfillment and development of genuine intrinsic motivation, although extrinsic motivation also is an important element in this theory. As it appears from this, IS-continuance theory and self-determination theory has both common (e.g., extrinsic motivation) and distinct factors (e.g., basic needs in SDT), and the latter group of factors does that these two theories can be viewed as complementary to each other. The potential benefit of combining these two theoretical perspectives is that the extended theory makes it possible to answer the following questions:

- How do the fulfillment of basic needs, e.g., as the need for e-learning competence, affect teachers' usefulness beliefs (i.e. extrinsic motivation), together with their genuine interest and enjoyment (i.e. intrinsic motivation) in e-learning?
- How do teachers' usefulness beliefs together with their genuine interest and enjoyment in e-learning influence on their willingness to utilize e-learning possibilities in the long run?

Although the study of Roca and Gagné (2008) shed light on such questions, the transferability of their findings from students to teachers is questionable. Particularly, this is due to the difference between the context of learning and context of teaching. If a teacher chooses to discontinue his/her use of e-learning, the students generally do not have another choice than to leave the technology and adapt to the teachers alternative choice. Therefore, we assert that teachers can be viewed as initiators, administrators and facilitators of students' use of e-learning, whereas students mainly can be viewed as pure users and in some instances also as contributors. Consequently, the purpose of the present study is to extend and validate IS-continuance theory with core concepts from self-determination theory from the perspective of teachers' utilization of e-learning technology in connection with on-site courses.

The organization of this paper is as follows: In Section 2, we present, adjust and integrate the original IS-continuance and self-determination theory in accordance with the purpose of the present study. Sections 3 describe survey procedures, data analyses, and provide the results. In the final section, we discuss the implications of our research findings, identify the limitations of the study, and suggest directions for further research.

## 2. Theoretical framework

### 2.1. e-learning

There are a lot of definitions of e-learning in the literature on e-learning. Sun, Tsai, Finger, Chen, and Yeh (2008) defines e-learning as "... the use of telecommunication technology to deliver information for education and training" (p. 1183). Wan, Wang, and Haggerty (2008) defines it in a more elaborate manner as "... a virtual learning environment in which a learner's interactions with materials, peers and/or instructors are mediated through information and communication technologies" (p. 513). Both these definitions cover important aspects of e-learning, like "delivery of information for education" and "interactions through technology". We suppose, however, that e-learning should be defined simply as *learning and teaching facilitated online through network technologies* (see e.g., Hrastinski, 2008). In our study, we focused mainly on the teaching aspect, which in practice means teachers or instructors in their role as initiators, administrators and facilitators to students' or learners' utilization of such systems.

There are numerous technologies that teachers can use as a tool for e-learning or in combination with e-learning: Internet, Intranets, Extranets, satellite broadcast, audio/video tape, interactive TV, and CD-ROM and many others. In the present study, the focus is on so-called *learning management systems* (also called course management systems or courseware) such as Blackboard, It's learning, Moodle, and Fronter. Such systems are widely used in higher education (Jackson, 2007) and as an example, 95% of all higher education institutions in the United Kingdom were using such systems in 2005 (Browne, Jenkins, & Walker, 2006).

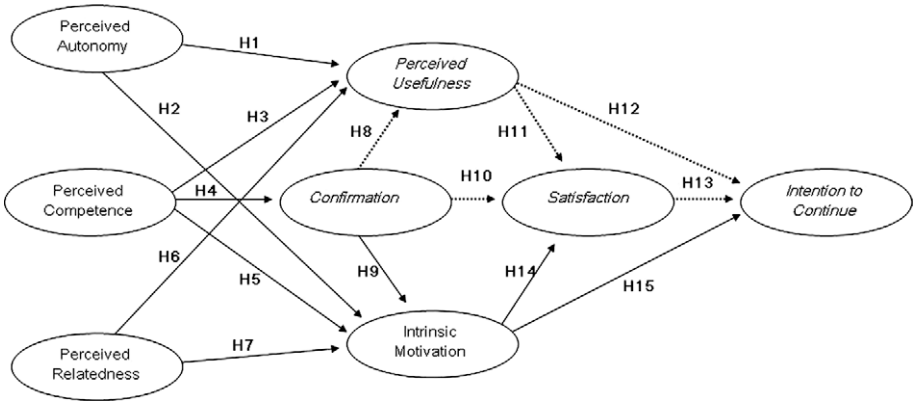


**Fig. 1.** Conceptual model.

### 2.2. Information systems continuance theory

Continuance theory within the field of IS research draws on expectation–confirmation theory in consumer behavior (Oliver, 1980). In the first study on continued use of IS, Bhattacherjee (2001) made changes to the original expectation–confirmation theory by transforming the mixed pre/post-consumption assertion into a pure post-acceptance model. The new theory, which was adjusted to the context of IS usage, was labeled IS-continuance theory. The variables and relationships are shown in Fig. 1 (cf. variable names in italics and dotted relationships). IS-continuance theory seeks to explain IS users' intention to continue (or discontinue) to use an IS. The model builds on the assumption that users after initial acceptance and a period of initial use, form an opinion of the extent to which their pre-acceptance expectations are confirmed (cf. confirmation). Simultaneously, the users develop opinions about benefits (cf. perceived usefulness). After a period of use a degree of confirmation and perceived usefulness develops, and both of these will influence users' perceived satisfaction with the IS (cf. satisfaction). Finally, the perceived usefulness and satisfaction contribute to explaining users' willingness to continue to use the IS (cf. IS continuance intention).

### 2.3. Self-determination theory

The core elements in self-determination theory are extrinsic and intrinsic motivation and a set of basic psychological needs that underlies motivation (Gagné & Deci, 2005). Motivation within this theory refers to reasons for carrying out an activity which vary along a self-determination continuum, where amotivation (i.e. lack of motivation) and intrinsic motivation (i.e. genuine interest and enjoyment) are the extremities. The difference of importance between these extremities is that amotivation is nonself-determined, while intrinsic motivation is self-determined. Extrinsic types of motivation refer to a spectrum of four intermediate regulations, where the reason for carrying out an activity may be external (e.g., a reward), introjected (e.g., avoid shame), identified (e.g., personal importance), or integrated (e.g., fully volitional). The theory proposes that the adoption of intrinsic motivation or the internalization of more self-determined types of extrinsic motivation depends on the satisfaction of three basic psychological needs: *the need for relatedness, competence and autonomy* (Roca & Gagné, 2008).

Relatedness refers to the desire to feel connected to others while competence refers to the desire to feel effective in attaining valued outcomes. Autonomy refers to the desire to self-initiate and self-regulate own behavior. According to the theory, these three needs can be satisfied while engaging in a wide variety of behaviors that may differ among individuals and be differentially manifest in different cultures, but in any case their satisfaction is essential for the healthy development and well-being of all individuals regardless of culture (Deci & Ryan, 2000).

### 2.4. Empirical research on e-learning continuance

As indicated in Section 2.1, continuance theory posit that confirmation/disconfirmation of pre-acceptance expectations and further post-acceptance perceived usefulness is salient beliefs in determining teachers willingness to utilize e-learning possibilities in the long run. Recent studies by Roca et al. (2006) and Limayem and Cheung (2008) support this assumption. However, the endeavor to improve our understanding of e-learning continuance beyond this narrow purpose of testing information systems adoption variables has resulted in two additional research approaches (cf. Larsen et al., 2009). The first one of these two approaches can be labeled as *the decomposing approach* and the second can be labeled as *the complementary theory approach*. The division between these two approaches is not definitely when it comes to empirical research and some of the studies presented here is more intermediate than clearly belonging to one of these approaches.

Four empirical studies on e-learning, with a purpose beyond that of testing information systems adoption variables, were identified through a search in Science Direct and EBSCOhost. All these extend the IS-continuance model, and hence, represent contributions that are close to the purpose of the present study.

The first study that extended the IS-continuance model was published by Chiu et al. (2005). They decomposed e-learners usefulness beliefs into three components; i.e. perceived usability, quality and value. They also added a set of confirmation/disconfirmation constructs based on the three various usefulness components to their model. Their study demonstrated that usability, quality and value beliefs may plays an important role in the formation of e-learners satisfaction and continuance intention, yet the decomposed confirmation/disconfirmation variables was only partially supported.

In a study by Chiu, Sun, et al. (2007) the concept of task value was used instead of usefulness, and decomposed into three components; i.e. attainment, utility and intrinsic value. In addition, they introduced the concept of fairness into their continuance model, which they decomposed in three components; i.e. distributive, procedural and interactional fairness. Their results showed that attainment value, utility value, intrinsic value, distributive fairness, and interactional fairness play significant roles in shaping learners' e-learning satisfaction and intention to continue using e-learning.

Chiu, Chiu, et al. (2007) complement IS-continuance theory with variables from IS-success theory (DeLone & McLean, 2003) and fairness theory (Lind, Kulik, Ambrose, & Deverapark, 1993). The concept of information quality, system quality, and service quality was adopted from the IS-success theory and the concept of distributive, procedural, and interactional fairness was adopted from fairness theory. Their results demonstrated that both variables from IS-success theory (i.e. except service quality) and fairness theory play significant roles in shaping learners' e-learning satisfaction and intention to continue using Web-based learning.

Finally, Roca and Gagné (2008) complement IS-continuance theory with variables from self-determination theory. They added three basic psychological needs (i.e. autonomy, competence and relatedness) in addition to perceived playfulness (i.e. intrinsic motivation). Their results suggest that the added variables from the self-determination theory are important in explaining e-learning users' continuance intention. As it appears from the next section, our study equate Roca and Gagné (2008), the most important difference is that our study focus is on teachers (i.e. as initiators, administrators and facilitators to students' utilization) while Roca and Gagné focus was on students (i.e. as e-learning users).

### 2.5. Research model and hypotheses

As previously expressed, our main argument for extending the theory of IS continuance with core concepts from self-determination theory is to move e-learning research in the direction of understanding how teachers' basic psychological needs influence their e-learning continuance decision. The main proposition is that the concepts from self-determination theory have considerable potential in explaining teachers' continuance intention.

In particular, we agree with Roca and Gagné (2008) in their specification of users' basic needs as exogenous and intrinsic motivation as an endogenous variable in the extended IS-continuance model. Our research model is shown in Fig. 1.

Hypotheses 8, 10, 11, 12 and 13 in Fig. 1 (cf. dotted lines), address relationships in the original IS-continuance model (Bhattacherjee, 2001). Hypotheses 1–7, in addition to 9, 14 and 15 in Fig. 1 represent the new and extended relationships.

A need for autonomy among teachers that organize students' use of e-learning reflects a desire to self-regulate their engagement in utilizing e-learning tools of their own choice, and to be the origin of their own usage patterns (Deci & Ryan, 1985). An important assumption in self-determination theory is that perceived autonomy in connection with an activity increases self-determined types of extrinsic motivation and intrinsic motivation. In the present study, this implies that both perceived usefulness and intrinsic motivation are expected to be positively associated with the degree of autonomy in connection with utilization of e-learning technology. First and foremost we expect autonomy to influence the level of intrinsic motivation. The reason for this is that autonomy stimulates internalization and integration of extrinsic motivation, which in turn may result in genuine intrinsic motivation (Gagné & Deci, 2005). Moreover, we also expect perceived usefulness to be associated with teachers' level of perceived autonomy. The reason for this is that perceived usefulness, here defined as a utility value belief in connection with utilization of e-learning, is classified as extrinsic motivation by prior research (Lee, Cheung, & Chen, 2005; Venkatesh, 1999). More specifically, Roca and Gagné (2008) describe perceived usefulness in identification terms, and hence, as an autonomous form of extrinsic motivation. In line with the self-determination continuum, where autonomy is assumed to influence autonomous forms of motivation (i.e. both extrinsic and intrinsic), we predict that perceived autonomy will increase both the level of perceived usefulness (i.e., which is akin to identified motivation) and the level of intrinsic motivation. Therefore, we hypothesize:

**Hypothesis 1.** Teachers' perceived level of autonomy when they utilize e-learning has a positive effect on their perceived level of usefulness.

**Hypothesis 2.** Teachers' perceived level of autonomy when they utilize e-learning has a positive effect on their level of intrinsic motivation.

A need for competence among teachers that organize students' use of e-learning reflects their desire to be effective in their utilization of the e-learning tool. Satisfying this salient need is by self-determination theory assumed to influence the level of motivation (Deci & Ryan, 1985). The reason for this is that teachers will feel qualified to organize students' use of e-learning when their need for e-learning competence is satisfied. This feeling of being qualified is, in the same manner as perceived autonomy, expected to influence autonomous forms of motivation (i.e. both extrinsic and intrinsic). In addition we also expect perceived competence level to influence teachers' level of confirmation. This is because we expect e-learning competence to make teachers more effective in their utilization of the e-learning tool, and in turn we expect that this will reduce their expectation–performance discrepancy (i.e. increase their level of confirmation). We hypothesize:

**Hypothesis 3.** Teachers' perceived level of e-learning competence has a positive effect on their perceived level of usefulness.

**Hypothesis 4.** Teachers' perceived level of e-learning competence has a positive effect on their confirmation level.

**Hypothesis 5.** Teachers' perceived level of e-learning competence has a positive effect on their perceived level of intrinsic motivation.

Self-determination theory asserts that the most influential antecedents of motivation are competence and autonomy, although relatedness is also assumed to play an important role (Deci & Ryan, 2000). The need for relatedness among teachers that organize students' use of e-learning reflects their desire to feel connected with and supported by people in their social surroundings. Fulfilling the need for being connected and supported within a social context is assumed to influence the level of motivation (Deci & Ryan, 1985). Relatedness is therefore, in the same manner as perceived autonomy and competence, expected to influence autonomous forms of motivation (i.e. both identified and intrinsic). Therefore, the following hypothesis is proposed:

**Hypothesis 6.** Teachers' perceived level of relatedness has a positive effect on their perceived level of usefulness.

**Hypothesis 7.** Teachers' perceived level of relatedness has a positive effect on their level of intrinsic motivation.

Bhattacherjee (2001) asserts that users' confirmation of initial expectations towards a technology is an important precursor of their perceived usefulness beliefs. Moreover, Roca and Gagné (2008) conceptualize users' perceived usefulness beliefs as a form of autonomous motivation. Based on this, we expect teachers' level of confirmation to influence their level of motivation; i.e. both perceived usefulness which is akin to identified regulation and intrinsic motivation which is genuine autonomous motivation. Bhattacherjee leans upon cognitive dissonance theory when he explains why confirmed (possibly disconfirmed) initial expectations may influence users' motivation. For instance, imagine a teacher with high initial intrinsic motivation to use e-learning that adopts a new e-learning system. Imagine further that his/her initial expectations are disconfirmed through actual use. A rational teacher may try to remedy this perceived dissonance through modification or distortion his/her initial perceptions, that is, to be more consistent with reality. As a result, we expect that disconfirmation may reduce his/her motivation, and further, that confirmation will tend to elevate the motivation. This leads to the following hypotheses:

**Hypothesis 8.** Teachers' level of confirmed initial e-learning expectations has a positive effect on their level of perceived usefulness.

**Hypothesis 9.** Teachers' level of confirmed initial expectations has a positive effect on their level of intrinsic motivation.

The IS-continuance theory posits that confirmation is positively related to satisfaction with IS use because confirmation implies a realization of the expected benefits of e.g., use of e-learning technology. On the other hand, disconfirmation (perceived performance lagging expectation) denotes failure to achieve expectation (Bhattacherjee, 2001:356). This confirmation-satisfaction association is supported through a number of e-learning continuance studies (e.g., Limayem & Cheung, 2008; Roca et al., 2006). Thus, we propose the following hypothesis:

**Hypothesis 10.** Teachers' level of confirmed initial e-learning expectations has a positive effect on their satisfaction with e-learning usage.

Perceived usefulness is by previous research found to be the primary motivator of first time acceptance or so called initial acceptance in e-learning (e.g., Ong, Lai, & Wang, 2004; van Raaij & Schepers, 2008). We therefore believe it is plausible that perceived usefulness also influence subsequent e-learning continuance decisions. To understand this assumption, it is important to remind that the ex-post beliefs of e-learning usefulness assess *the degree to which an e-learning technology gives access to increased educational performance*, while post-acceptance satisfaction assess *the teachers' positive, indifferent, or negative experiences from using e-learning technology*. Reduced performance as a result of e-learning use are here believed to create a "negative experience" and hence, dissatisfaction among the users. This leads to the following hypothesis:

**Hypothesis 11.** Teachers' level of perceived usefulness of e-learning usage has a positive effect on their satisfaction with e-learning usage.

Perceived usefulness is also assumed to be a potential cause of instrumental behavior (Bhattacherjee, 2001:356), e.g., instrumental use of e-learning technology, due to the possibility that enhanced e-learning performance may be the source to various rewards that are extrinsic to the task context, such as promotions or monetary gains. This usefulness-behavioral intention association is supported through a number of previous continuance studies (e.g., Limayem & Cheung, 2008; Limayem, Hirt, & Cheung, 2007; Liu et al., 2009). Therefore, we propose the following hypothesis:

**Hypothesis 12.** Teachers' level of perceived usefulness of e-learning usage has a positive effect on their level of intention to continue their use of e-learning technology.

Expectation confirmation theory, which is the basis of IS-continuance theory, assert that continuance intention is mainly determined by satisfaction with prior IS use. To understand this, one has to recall that satisfaction is synonymously with an affect (i.e. *a positive, indifferent, or negative feeling*) and further that affect (as attitude or satisfaction) in prior e-learning studies is found to be an important predictor of intentions concerning use of e-learning (e.g., Chiu et al., 2005; Liu et al., 2009). This leads to the following hypothesis:

**Hypothesis 13.** Teachers' level of satisfaction with e-learning usage has a positive effect on their level of intention to continue their use of e-learning technology.

Intrinsic motivation refers to the performance of an activity for no apparent reason other than the genuine interest in or the enjoyment of the process of performing it (Gagné & Deci, 2005). Based on this definition we expect teachers with a genuine interest in e-learning, that enjoy the process of utilizing this technology to make students' use of e-learning possible, to have a strong desire to continue to use e-learning in the future. This is supported by previous research, which has shown that intrinsic motivation (i.e. typically perceived playfulness) is a significant antecedent of users' intention to use a technology (Davis et al., 1992; Lee et al., 2005; Roca & Gagné, 2008). We further propose that teachers enjoying their use of e-learning are more likely to be satisfied with the actual tool they use. Previous research supports such a positive relationship between intrinsic motivation and satisfaction (Meng-Hsiang & Chao-Min, 2004; Wirtz & Bateson, 1999). Accordingly, the following two hypotheses are proposed:

**Hypothesis 14.** Teachers' level of intrinsic e-learning motivation has a positive effect on their level of satisfaction with their use of e-learning technology.

**Hypothesis 15.** Teachers' level of intrinsic e-learning motivation has a positive effect on their level of intention to continue their use of e-learning technology.

## 3. Methods

The data used to test the research model were obtained through mail questionnaires distributed to 430 teachers of 12 university colleges. Since our main concern was IS continuance and autonomous behavior, only faculty members who had taken advantage of e-learning for ordinary on-site courses were asked to respond. Use of e-learning system was voluntary in the meaning "optional utilization level", however, potential respondents were instructed to respond only if they felt that they could at their own discretion decide to discontinue their use of the e-learning system the subsequent semester.

The items used to operationalize the variables in our research model were adapted from prior studies, with a few changes in wording reflecting the technology targeted in our setting and the specific user context. Examples of such contextual adjustments are the use of words like e-learning tool, next semester, educational work, etc. (cf. Table 1). Instruments on the IS-continuance model were adapted from Bhattacherjee (2001). The basic needs items (cf. perceived autonomy, competence and relatedness) were adapted from the Basic Need Satisfaction at Work Scale which is used by Kasser, Davey, and Ryan (1992) and Baard, Deci, and Ryan (2004). Finally, an instrument on intrinsic motivation was adapted from the Academic Self-Regulation Questionnaire (Ryan & Connell, 1989). All items, except the satisfaction items, were measured using a seven point Likert-type scale, ranging from "strongly disagree" to "strongly agree". Satisfaction items were based on seven-point semantic differential scales. To take into account systematic variations in individual responses, four individual difference variables were included as control measures. These four variables were assessed using standard survey questions: age in years, gender (0 = women, 1 = men), experience in years with IT-usage, and experience in years with teaching.

**Table 1**
Item means, standard deviations, and internal consistencies.

| | Mean | Std. Dev. | Loading | *t*-Stat |
|---|---|---|---|---|
| *IS continuance intention* (*composite reliability* = 0.86) | | | | |
| I intend to continue using the e-learning tool the following semester, rather than discontinue its use[a] | 6.61 | 0.96 | 0.83 | 11.72 |
| My intentions are to extend my use of the e-learning tool the following semester rather than using any alternative means (i.e. traditional learning methods) | 4.74 | 1.72 | 0.77 | 13.91 |
| If I could, I would like to discontinue my use of the e-learning tool the following semester | 6.63 | 1.14 | 0.85 | 22.89 |
| *Satisfaction* (*composite reliability* = 0.89) | | | | |
| How do you feel about your overall experience of e-learning use? | | | | |
| Very dissatisfied/very satisfied | 4.94 | 1.17 | 0.89 | 46.97 |
| Very displeased/very pleased | 4.96 | 1.16 | 0.90 | 27.07 |
| Very frustrated/very contented | 4.79 | 1.36 | 0.78 | 18.18 |
| Absolutely terrible/absolutely delighted | 4.45 | 1.00 | 0.71 | 11.68 |
| *Perceived usefulness* (*composite reliability* = 0.92) | | | | |
| Using e-learning improves the quality of my educational work | 5.32 | 1.33 | 0.87 | 40.16 |
| Using e-learning increases my productivity as a lecturer | 5.53 | 1.42 | 0.85 | 23.57 |
| Using e-learning enhances my effectiveness in my educational work | 4.73 | 1.74 | 0.86 | 30.53 |
| Overall, e-learning is useful in my educational work | 5.82 | 1.30 | 0.85 | 28.96 |
| *Confirmation* (*composite reliability* = 0.89) | | | | |
| My experience with using e-learning was better than what I expected | 4.23 | 1.31 | 0.87 | 26.97 |
| The service level provided by e-learning was better than what I expected | 4.13 | 1.33 | 0.88 | 26.38 |
| Overall, most of my expectations from using e-learning were confirmed | 4.75 | 1.41 | 0.80 | 22.50 |
| Intrinsic motivation (*composite reliability* = 0.95) | | | | |
| I use the e-learning tool because it is fun | 4.24 | 1.60 | 0.90 | 69.61 |
| I use the e-learning tool because I enjoy it | 4.35 | 1.56 | 0.91 | 85.99 |
| *Perceived competence* (*composite reliability* = 0.76/0.80)[b] | | | | |
| *I do not feel very competent when I use e-learning in my educational work*[c] | 5.28 | 1.55 | 0.59 | 4.09 |
| The other faculty tell me I am good at using e-learning in my educational work | 3.55 | 1.79 | 0.63 | 6.09 |
| I have been able to learn interesting new skills in e-learning through my job | 4.35 | 1.68 | 0.67 | 6.64 |
| Most days I feel a sense of accomplishment from working with e-learning | 3.80 | 1.54 | 0.84 | 21.04 |
| *In my job as a teacher I do not get much of a chance to show how capable I am in e-learning* | 4.81 | 1.58 | 0.23 | 1.22 |
| *When I am using e-learning I often do not feel very capable* | 5.50 | 1.53 | 0.49 | 2.98 |
| *Perceived relatedness* (*composite reliability* = 0.89/0.89) | | | | |
| I really like the people I work with | 5.83 | 1.07 | 0.86 | 4.32 |
| I get along with people at work | 5.82 | 1.03 | 0.86 | 4.34 |
| I pretty much keep to myself when I am at work | 5.18 | 1.56 | 0.60 | 1.87 |
| I consider the people I work with to be my friends | 4.70 | 1.53 | 0.65 | 2.88 |
| People at work care about me | 5.21 | 1.27 | 0.82 | 3.82 |
| *There are not many people at work that I am close to* | 4.53 | 1.74 | 0.57 | 1.89 |
| The people I work with do not seem to like me much | 6.02 | 1.04 | 0.60 | 3.00 |
| People at work are pretty friendly towards me | 5.98 | 1.01 | 0.67 | 2.94 |
| *Perceived autonomy* (*composite reliability* = 0.81/0.85) | | | | |
| I feel like I can make a lot of inputs to deciding how I use e-learning in my educational work | 5.89 | 1.35 | 0.75 | 10.12 |
| I feel pressured at using e-learning in my educational work | 5.05 | 1.78 | 0.70 | 8.39 |
| *I am free to express my ideas and opinions on using e-learning in my educational work* | 6.02 | 1.22 | 0.46 | 3.14 |
| When I am using e-learning, I have to do what I am told | 5.15 | 1.99 | 0.60 | 6.36 |
| *My feelings toward e-learning are taken into consideration at work* | 3.75 | 1.50 | 0.16 | 1.19 |
| I feel like I can pretty much use e-learning as I want to at work | 5.86 | 1.26 | 0.73 | 9.30 |
| There is not much opportunity for me to decide for myself how to use e-learning in my educational work | 5.97 | 1.29 | 0.78 | 13.29 |

[a] The items were translated from English to Norwegian.
[b] Composite reliability = initial coefficient/coefficient after items are removed.
[c] Removed item in italic.

The data collection period was 14 days, and 124 usable questionnaires out of 430 were returned, which gives a response rate of 29%. Our sample includes 21% women and 79% men, and the average respondent was 47 years old (1% below thirty, 23% in the thirties, 50% between 40 and 54, and 26% above 54).

## 4. Data analysis

We employed partial least squares (PLS) as our analysis approach and utilized the tool PLS-Graph Version 3.00. PLS is a second generation regression method that combines confirmatory factor analysis with linear regression, and this makes it possible to run the measurement and structural models simultaneously.

### 4.1. Measurement model results

The adequacy of the eight reflective variables in the proposed research model can be determined by looking at: (1) individual item reliabilities, (2) the convergent validities of measures associated with individual variables, and (3) discriminant validity between variables and items (Hulland, 1999).

Table 1 shows items, means, standard deviations and loadings for the eight constructs in the extended IS-continuance model. For each construct the assessment of convergent validity or internal consistency is also included through the composite reliability coefficient

(Fornell & Larcker, 1981). As we can see from Table 1, all the constructs have internal consistency values that exceed the threshold value of 0.70 recommended by Nunnally (1979).

For 13 out of the 41 items the loadings were below 0.7. In practice, it is common to find several measurement items in an estimated model having loading below the 0.7 threshold. Especially when new items are employed, a more suitable lower cut-off value is considered sufficient in SEM analyses (Hulland, 1999). Thus, we decided to apply a cut-off value of 0.60 on the factor loadings to retain items. The result was that a total of six items had to be dropped from the three basic needs variables (cf. items marked with asterisk in Table 1). All retained items had loadings of at least 0.60. In addition, all of the measures had significant loadings.

The discriminant validity of items and variables were examined using both factor (cf. Table 2) and correlation analysis (cf. Table 3) as recommended by Gefen and Straub (2005). As we can see from Table 2, all items have cross loadings coefficients that are at least .10 lower than the factor loading on their respective assigned latent variable, suggesting that discriminant validity on the item level is met for all eight constructs.

The inspection of discriminant validity among variables is based on the correlation between variables and the square root of their respective average variance extracted (cf. Fornell & Larcker, 1981). As Table 3 shows, the average variance extracted value for the variables is consistently greater than the off-diagonal squared correlations, suggesting satisfactorily discriminant validity among variables.

### 4.2. Structural model results

Fig. 2 summarizes the structural model results. Standardized regression coefficients are shown above each path and $R^2$ is shown in conjunction with each endogenous variable.

Eleven out of fifteen path coefficients show positive associations with endogenous variables. We conclude that hypotheses H2–H5, H8–H12, H14 and H15 are supported. Hypotheses1–7 examined the relationships between the teachers' basic needs and perceived usefulness, confirmation and intrinsic motivation. The results from the PLS analysis supported four of these seven hypotheses and we can therefore conclude that:

- *Perceived autonomy has a positive impact on teachers' intrinsic motivation toward use of e-learning.*
- *Perceived competence has a positive impact on teachers' level of perceived usefulness, confirmation and intrinsic motivation in connection with e-learning usage.*
- *Perceived autonomy do not influence teachers' level of perceived usefulness.*
- *Perceived relatedness neither influenced teachers' level of perceived usefulness nor their level of intrinsic motivation.*

Hypotheses 8–10 examined the effects of confirmed pre-expectations on teachers' level of perceived usefulness, satisfaction with e-learning and intrinsic motivation. All three hypotheses were supported and therefore we conclude that: *Confirmation of teachers' pre-expec-*

**Table 2**
Item to latent variable correlations.

| | Continu | Satis | Useful | Confirm | Motiv | Compet | Related | Autonom |
|---|---|---|---|---|---|---|---|---|
| Cont1 | **0.83** | 0.42 | 0.55 | 0.29 | 0.22 | 0.36 | 0.22 | 0.21 |
| Cont2 | **0.77** | 0.32 | 0.44 | 0.43 | 0.52 | 0.40 | 0.15 | 0.25 |
| Cont3 | **0.86** | 0.41 | 0.41 | 0.33 | 0.41 | 0.32 | 0.07 | 0.22 |
| Sati1 | 0.46 | **0.89** | 0.62 | 0.59 | 0.53 | 0.51 | 0.14 | 0.27 |
| Sati2 | 0.40 | **0.89** | 0.54 | 0.47 | 0.38 | 0.35 | 0.10 | 0.11 |
| Sati3 | 0.37 | **0.79** | 0.49 | 0.39 | 0.32 | 0.39 | 0.11 | 0.27 |
| Sati4 | 0.38 | **0.72** | 0.41 | 0.43 | 0.29 | 0.19 | 0.10 | 0.21 |
| Usef1 | 0.53 | 0.64 | **0.87** | 0.52 | 0.40 | 0.45 | 0.20 | 0.20 |
| Usef2 | 0.40 | 0.54 | **0.84** | 0.49 | 0.26 | 0.38 | 0.15 | 0.31 |
| Usef3 | 0.39 | 0.55 | **0.86** | 0.60 | 0.41 | 0.47 | 0.09 | 0.20 |
| Usef4 | 0.61 | 0.55 | **0.85** | 0.58 | 0.33 | 0.45 | 0.14 | 0.29 |
| Conf1 | 0.34 | 0.48 | 0.55 | **0.87** | 0.37 | 0.34 | 0.12 | 0.16 |
| Conf2 | 0.41 | 0.49 | 0.53 | **0.89** | 0.42 | 0.28 | 0.09 | 0.15 |
| Conf3 | 0.34 | 0.53 | 0.54 | **0.81** | 0.45 | 0.48 | 0.08 | 0.36 |
| Moti1 | 0.44 | 0.43 | 0.40 | 0.46 | **0.95** | 0.53 | 0.14 | 0.40 |
| Moti2 | 0.46 | 0.48 | 0.42 | 0.47 | **0.96** | 0.59 | 0.18 | 0.40 |
| Comp2 | 0.22 | 0.16 | 0.17 | 0.12 | 0.44 | **0.65** | 0.23 | 0.29 |
| Comp3 | 0.17 | 0.37 | 0.21 | 0.13 | 0.31 | **0.74** | 0.14 | 0.26 |
| Comp4 | 0.38 | 0.46 | 0.46 | 0.44 | 0.56 | **0.89** | 0.10 | 0.35 |
| Relat1 | 0.04 | 0.02 | 0.02 | 0.06 | 0.07 | 0.09 | **0.86** | 0.08 |
| Relat2 | 0.08 | 0.12 | 0.11 | 0.09 | 0.08 | 0.09 | **0.85** | 0.01 |
| Relat3 | 0.20 | 0.15 | 0.12 | 0.06 | 0.24 | 0.19 | **0.63** | 0.18 |
| Relat4 | 0.04 | 0.00 | 0.01 | 0.07 | 0.02 | 0.00 | **0.64** | 0.09 |
| Relat5 | 0.06 | 0.13 | 0.06 | 0.05 | 0.16 | 0.15 | **0.82** | 0.01 |
| Relat7 | 0.11 | 0.12 | 0.10 | 0.07 | 0.07 | 0.09 | **0.60** | 0.15 |
| Relat8 | 0.04 | 0.03 | 0.07 | 0.02 | 0.01 | 0.11 | **0.66** | 0.08 |
| Auton1 | 0.25 | 0.23 | 0.29 | 0.32 | 0.24 | 0.27 | 0.06 | **0.74** |
| Auton2 | 0.20 | 0.18 | 0.20 | 0.17 | 0.32 | 0.30 | 0.07 | **0.71** |
| Auton4 | 0.06 | 0.12 | 0.11 | 0.07 | 0.32 | 0.35 | 0.01 | **0.62** |
| Auton6 | 0.18 | 0.09 | 0.19 | 0.16 | 0.29 | 0.17 | 0.08 | **0.76** |
| Auton7 | 0.43 | 0.30 | 0.39 | 0.40 | 0.36 | 0.32 | 0.05 | **0.80** |

Continu = Continuance intention; Satis = Satisfaction; Useful = Perceived usefulness; Confirm = Confirmation; Motiv = Intrinsic motivation; Comp = Perceived competence; Related = Perceived relatedness; Autonom = Perceived autonomy.

**Table 3**
Correlations among variables and square root of average variance extracted.

| Construct | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| 1. IS continuance intention | **0.82** | | | | | | | |
| 2. Satisfaction | 0.46 | **0.82** | | | | | | |
| 3. Perceived usefulness | 0.57 | 0.67 | **0.86** | | | | | |
| 4. Confirmation | 0.43 | 0.58 | 0.63 | **0.85** | | | | |
| 5. Intrinsic motivation | 0.47 | 0.48 | 0.41 | 0.49 | **0.95** | | | |
| 6. Perceived competence | 0.44 | 0.46 | 0.51 | 0.43 | 0.59 | **0.76** | | |
| 7. Perceived relatedness | 0.18 | 0.14 | 0.17 | 0.12 | 0.17 | 0.17 | **0.73** | |
| 8. Perceived autonomy | 0.28 | 0.26 | 0.29 | 0.27 | 0.42 | 0.40 | 0.07 | **0.73** |

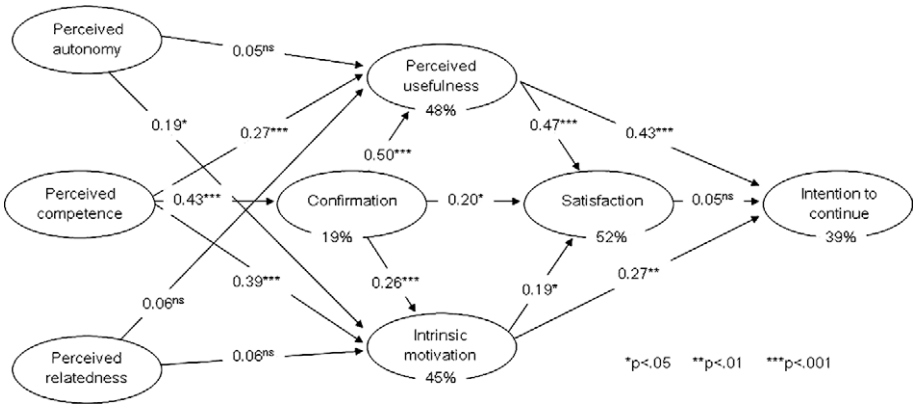


**Fig. 2.** SEM analysis of the research model.

*tations toward the e-learning tool has a positive impact on their level of perceived usefulness, satisfaction with e-learning and intrinsic motivation toward e-learning usage.*

Hypotheses 11 and 12 examined the link between teachers' level of perceived usefulness and their satisfaction with e-learning and their intention to continue their e-learning usage. The results from the PLS analysis supported both hypotheses and we can therefore conclude that: *Teachers' level of perceived usefulness of e-learning usage has a positive influence on their satisfaction with e-learning and their intention to continue their use of e-learning.*

Hypothesis 13 examined the relationship between teachers' satisfaction with e-learning usage and their intention to continue to use e-learning. This hypothesis was not supported, and hence: *Teachers' satisfaction with e-learning use does not influence their intention to continue to use e-learning.*

Finally, Hypotheses 14 and 15 examine the effects of teachers' intrinsic motivation in connection with e-learning usage and their satisfaction with e-learning use and their intention to continue their use of e-learning. Both these hypotheses were supported and we therefore can conclude that: *Teachers level of intrinsic motivation in connection with e-learning has a positive impact on their level of satisfaction and their level of intention to continue their e-learning usage*. Table 4 summarizes the results from the hypotheses testing.

As Fig. 2 shows, the structural model analysis documents acceptable level of explained variance for intention to continue (39%), user satisfaction (52%), perceived usefulness (48%), confirmation (19%) and intrinsic motivation (45%).

As a test of the robustness of our finding regarding e-learning continuance intention, four control variables (i.e. age in years, gender, experience in years with IT-usage, and experience in years with teaching) were included as supplementary predictors of continuance intention. The inclusion of these control variables resulted only in a slight increase (0.04) in the coefficient between intrinsic motivation and

**Table 4**
Summary of the results.

| Hypothesis | Independent variable | Dependent variable | Significant |
|---|---|---|---|
| 1 | Perceived autonomy | Perceived usefulness | No |
| 2 | Perceived autonomy | Intrinsic motivation | **Yes** |
| 3 | Perceived competence | Perceived usefulness | **Yes** |
| 4 | Perceived competence | Confirmation | **Yes** |
| 5 | Perceived competence | Intrinsic motivation | **Yes** |
| 6 | Perceived relatedness | Perceived usefulness | No |
| 7 | Perceived relatedness | Intrinsic motivation | No |
| 8 | Confirmation | Perceived usefulness | **Yes** |
| 9 | Confirmation | Intrinsic motivation | **Yes** |
| 10 | Confirmation | Satisfaction | **Yes** |
| 11 | Perceived usefulness | Satisfaction | **Yes** |
| 12 | Perceived usefulness | Intention to continue | **Yes** |
| 13 | Satisfaction | Intention to continue | No |
| 14 | Intrinsic motivation | Satisfaction | **Yes** |
| 15 | Intrinsic motivation | Intention to continue | **Yes** |

intention to continue. Moreover, only age had a significant (–0.16; $p < .05$) relationship with teachers' intention to continue use of e-learning technology.

## 5. Discussion and further research

We found support for seven out of ten added hypotheses in our self-determination theory extended IS-continuance model. The obtained results suggest that at least two of our four added variables from the self-determination theory are important in explaining teachers' e-learning continuance intention. Thirty-seven percent of the teachers' intentions to continue their use of e-learning were explained by their e-learning motivation. More specifically, 22% of the variance was explained by perceived usefulness (i.e. identified regulation) and 15% was explained by intrinsic motivation. Moreover, teachers' perceived satisfaction of their e-learning competence need explained, respectively, 15%, 19% and 20% of the variation in perceived usefulness, confirmation and intrinsic motivation. Finally, teachers' perceived satisfaction of their autonomy need explained 10% of the variation in teachers' intrinsic motivation. Based on these findings, the main theoretical implication is that an extension of IS-continuance theory with constructs that represent users' basic psychological needs and intrinsic motivation has merit.

Among the three basic psychological needs, perceived e-learning competence seems to be the most important when it comes to the extent to which teachers' pre-acceptance expectations are confirmed. The reason for this may be that competence has the ability to make pre-acceptance expectations more realistic and post-acceptance usage more efficient. When realistic pre-expectations meet efficient usage, a high level of confirmation may be a likely outcome.

Interestingly, the influence of perceived competence was stronger than perceived autonomy on intrinsic motivation. This difference was somewhat surprising since self-determination theory asserts that autonomy is essential to intrinsic motivation (Oulasvirta & Blom, 2008). This finding may, however, be attributable to contextual conditions. University teachers are known for their relatively high general job-autonomy and autonomy in connection with e-learning usage may therefore be taken for granted. The opposite may be true for e-learning competence, since this may be a more scarce resource in the academic context, and thus, probably more important for development of intrinsic e-learning motivation. Notwithstanding, the finding that perceived autonomy influence intrinsic motivation indicates that teachers' having a sense of unpressured willingness to engage in e-learning, in the next turn are likely to experience a high level of pleasure from e-learning usage. This is consistent with self-determination theory where perceived autonomy is assumed to be a redeemer for an internalization process where motivation moves from external to internal (Deci, 1996).

The somewhat weak finding in connection with autonomy in the present research may also be attributable to our choice of conceptualization and measurement of autonomy. Our choice was based on teachers' perceptions of their autonomy need satisfaction in connection with e-learning usage, a choice that is supported by Ryan and colleagues (2006) in their study of computer gaming. However, an alternative is to conceptualize autonomy as autonomy support and measure teachers' perceptions of the extent to which they feel that the university management or IS-management is autonomy-supportive in connection with e-learning usage (Roca & Gagné, 2008). Future research is needed to understand which of these two different conceptualizations that is the most valid one in the context of e-learning usage.

No associations were identified between perceived relatedness and the teachers' extrinsic/intrinsic motivation. A possible explanation for this somewhat unexpected result is that relatedness needs to be measured with context specific e-learning oriented items, e.g., items attributing the e-learning enthusiasts as a group, and not with general work context items. It should be remarked here that Roca and Gagné (2008) utilized the same general work context instrument as we did, and despite of this they found relatedness to influence both students' extrinsic and intrinsic e-learning motivation. However, further research is needed to resolve the question about why the need to feel connected and supported by important people not seems to influence teachers extrinsic/intrinsic motivation to use e-learning.

Our results indicate clearly that ex-post confirmation of initial e-learning expectations through actual use fortify teachers' identified (cf. perceived usefulness) and intrinsic motivation, which in the next turn makes the teachers' intentions to continue their e-learning usage stronger. Assuming such cause–effect associations suggests the presence of reciprocal influence, whereby teachers' confirmation, extrinsic/intrinsic motivation and intention are repeatedly refined and modified from their initial acceptance to long-term continuance (or discontinuance). Reciprocal chains of this type have received little attention in behavioral research thus far. Understanding such complex and dynamic chains as suggested here, although beyond the scope of the current study, represents an interesting and important area for future research.

As expected, perceived usefulness seems to be the most influential predictor of satisfaction and intention to continue e-learning usage. This finding is in line with previous studies on both initial acceptance and IS-continuance (e.g., Limayem & Cheung, 2008; Ong et al., 2004; Roca et al., 2006; van Raaij & Schepers, 2008).

The lack of a significant relationship between satisfaction with e-learning and intention to continue e-learning usage is contradictory to previous research reports (Limayem et al., 2007; Roca et al., 2006). However, none of the previous studies includes perceived usefulness and intrinsic motivation, in addition to satisfaction, as antecedents of intention to continue. Table 3 shows that the correlation between satisfaction and intention to continue is relatively strong ($r = 0.46$). However, when perceived usefulness and intrinsic motivation are controlled for through the PLS regression the correlation decreases approximately to nil. One possible explanation for this may be the difference in the nature of the concept of satisfaction in contrast to the nature of the concept of perceived usefulness and intrinsic motivation. Satisfaction, as conceptualized in the present study, is based on a general experience of "positive, indifferent, or negative feelings toward e-learning", while perceived usefulness is based on a more specific "does e-learning use increase my job performance" experience (cf., Bhattacherjee, 2001). Intrinsic motivation on the other hand is based on an "does e-learning use gives me pleasure" experience (Roca & Gagné, 2008). Could it be that the present study demonstrates that specific experiences as perceived usefulness and intrinsic motivation has the potential to neutralize the impact from the general experience of being satisfied with e-learning? This post hoc explanation could be a basis for future research.

The present research has limitations. First, 76% of the teachers in our sample were above 40 years in age and this might have influenced our results. Prior studies on e-learning demonstrate that age may be an important variable when explaining users' intention to use the technology (Wang, Wu, & Wang, 2009). However, age was included as a control variable in the present study and did not influence the influence of the theoretical variables on e-learning continuance intention.

Second, the response rate was low in the present study (29%). However, only faculty members who had taken advantage of e-learning for ordinary on-site courses were asked to respond. Therefore, the reasons to the low response rate may be that not all the faculty members that get the questionnaire used e-learning in ordinary on-site courses and that some of them worked within distance teaching only. However, the response rate is judged as being acceptable.

Third, there were some low factor loadings on perceived competence, relatedness and autonomy. It might be that a pilot study ahead of our study, where the validity and reliability of the measurement instruments were tested, could have reduced the amount of low loadings. However, the amount of items remaining in perceived competence, relatedness and autonomy scale was within the acceptable range for PLS analysis.

In summary, this research takes an initial step toward extending and validating IS-continuance theory with self-determination theory from the perspective of teachers' utilization of e-learning technology in connection with on-site courses. It provides support for the critical role of teachers' perceptions of autonomy and competence, in addition to their genuine interest and enjoyment in connection with their e-learning usage, as significant determinants of IS continuance variables.

## 6. Practical implications

Our findings have important implications for management of e-learning in educational institutions. Most important of all, users' level of perceived e-learning competence seems to be critical for their confirmation of pre-acceptance expectations, their development of usefulness beliefs, and finally for their development of intrinsic e-learning motivation. This indicates that user training and support is an important complementary investment to e-learning technology, not only in the pre-acceptance phase, but also as a continuous part of the subsequent usage phase. As an example, activating e-learning training as early as possible has the potential to influence teachers' pre-acceptance expectations; because it is our conviction that in-depth knowledge and skills make the grounding for development of realistic expectations. The consequence of an effort to form teachers' pre-acceptance expectations may be a higher degree of confirmation, which in the next instance may strengthen both teachers' e-learning usefulness beliefs and intrinsic motivation toward use of e-learning. The present research indicates that such an effort may culminate in teachers' that is satisfied users of e-learning technology and that demonstrates a high level of willingness to utilize this technology in the long run.

In addition, the present study also illustrates for practitioners how complex and resource demanding it is to strengthening teachers' willingness to continue their use of e-learning. According to our results, five out of seven antecedents in our model plays an indirect (cf., perceived autonomy, perceived competence and confirmation) or direct (cf., perceived usefulness and intrinsic motivation) role in forming teachers' e-learning continuance intentions. In their endeavor to strengthen teachers' continuance intention, persons with e-learning responsibility at the institutional level should therefore: (a) give high priority to e-learning competence development attempts (i.e. both in the implementation and usage phase); (b) be sensitive to the users' e-learning performance expectations and aim at providing them with realistic expectations; (c) place emphasis on use of e-learning, not only as a reliable and efficient tool for student learning, but as much as an arena for realization of the teachers' own professional skills.

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