

The Impact of Learner Control on E-Learning Effectiveness: Towards a Theoretical Model

Research-in-Progress

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Abstract

E-learning systems are changing education and organizational training considerably. With the advancement of online-based learning systems, learner control of the instructional process has emerged as a decisive factor inherent to technology-based learning. However, the conceptual work on the role of learner control in e-learning has not advanced sufficiently to predict how learner control impacts e-learning effectiveness. To extend the research on the role of learner control in e-learning, we derive a conceptual framework as a reference model, which is based on cognitive and motivational learning theories. We then apply our framework to review 58 articles on learner control during the period 1996-2013. Our findings reveal how different individual characteristics, as well as the characteristics of the course and learning environment moderate the impact of learner control on learning effectiveness. Our analysis provides new insight into the role of learner control for e-learning effectiveness, as well as directions for further research.

Keywords: E-learning, Learning models/theory, Learner control, Learning outcome, Literature review, Self-regulated learning

Introduction

Since the 1970s, learner control has been rooted in the individualization of instruction and the enabling of active learning, with learners given control of certain aspects of their learning process, including the sequence, content, and events of instruction (Merrill 1975; Sims 1997; Steinberg 1989; Williams 1996). Within this debate, the emergence of e-learning environments is believed to open up new opportunities for learner autonomy by increasing the flexibility of the learning process and providing access to a large variety of information within different time and space aspects (Sahay 2004). Accordingly, instructional control of the learning process has been established as a decisive factor inherent to technology-based learning (Granger and Levine 2010; Sitzmann et al. 2006; Zhang et al. 2004). Learner-centered environments are regarded as empowering learners to actively participate in the learning process and to emancipate themselves from predetermined knowledge (Bell and Kozlowski 2008). However, despite the rationale for learner control (Hannafin and Land 1997; Williams 1996), empirical work has failed to establish a clear positive link between learner control and e-learning effectiveness. The hypothesis that learners are the best judge of their instructional strategy is thus regarded with caution (Hannafin 1984; Kraiger and Jerden 2007; Niemiec et al. 1996). Although recent research has shifted the focus to identifying the underlying mechanisms of effective learner control (Vandewaetere and Clarebout 2011), the factors determining the impact of learner control on e-learning effectiveness are still unclear (Granger and Levine 2010; Kraiger and Jerden 2007; Orvis et al. 2011).

In this article, we examine and synthesize the factors in the literature that we have found to moderate the effectiveness of learner control in e-learning and, thus, identify the conditions under which e-learning is most effective. We base our analysis on cognitive and motivational learning theories to answer the following research questions: What is the role of learner control regarding the effectiveness of e-learning systems? Which factors determine the effectiveness of learner control in e-learning? As the research tradition on learner control suggests that a direct relationship between learner control and e-learning effectiveness is too narrow (Kraiger and Jerden 2007; Williams 1996), we present a theoretical framework that introduces both cognitive and motivational learning processes as drivers of e-learning effectiveness. The framework offers a novel perspective on the underlying mechanisms that influence the impact of learner control on e-learning effectiveness, and integrates the different streams of research on learner control. More specifically, we contribute to the research as follows: First, we organize our review of the literature in an integrative framework as a reference model of e-learning effectiveness, which is grounded in cognitive and motivational learning theories. Second, we formalize the concept of learner control from an information systems (IS) perspective to extend earlier conceptualizations of learner control. Third, our literature review presents the state of the art of research on learner control and extends earlier reviews and meta-analyses of learner control (Kraiger and Jerden 2007; Niemiec et al. 1996; Williams 1996).

We adopt a multidimensional perspective of learner control (Chung and Reigeluth 1992; Sims 1997) in order to distinguish between different types of control. The majority of research has treated learner control as a black box, with different types of control examined in an undifferentiated way (Granger and Levine 2010). E-learning has the ability to provide learners with control of not only how and what they learn, but also of when and where to learn – a perspective that has seldom been conceptualized. With virtual training becoming established practice, today's asynchronous, self-paced online learning approaches are a constituent of many corporate and academic e-learning courses (ASDT 2012; Derouin et al. 2005; Eryilmaz et al. 2013). In the following section, we derive our theoretical framework and introduce the concept of learner control. Section 3 outlines the methodology of our research. In section 4, we apply the theoretical framework to structure the extant literature and to outline the results. We conclude by discussing the implications of our research and by outlining further research.

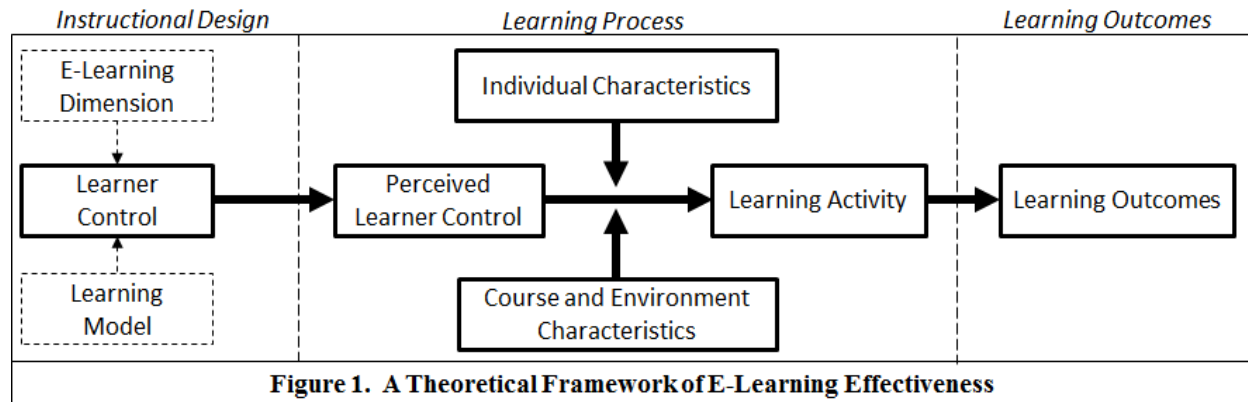
Theoretical Framework

Consistent with approved literature review procedures (Melville et al. 2004; Piccoli and Ives 2005), we develop a theoretical framework through which we organize and review the literature on learner control. Previous research on learner control has claimed that the ambiguous results regarding the role of learner control on e-learning effectiveness are due to a lack of theoretical frameworks from which inferences can be derived on the assignment of learner control (Milheim and Martin 1991; Reeves 1993; Scheiter and

Gerjets 2007; Williams 1996). In response to the inconclusive results provided in the learner control literature, we adopt cognitive and motivational learning theories as a theoretical basis to examine the determinants of individual learning behavior (Bell and Kozlowski 2008; Kinzie 1990; Williams 1996). Accordingly, we suggest that learner control is effective if two conditions are fulfilled: First, if learners are motivated to actively engage in their learning process, and, second, if learners are capable of making rational choices to control their learning process. Synthesizing earlier conceptualizations (Hannafin 1984; Sims 1997), we define learner control as the degree to which learners can decide and influence different aspects of their learning process (instructional control) and the learning environment (schedule control). Control of the learning process ranges along a continuum from complete external control – where learners either have no or very little control – to complete instructional control (Kinzie et al. 1988; Sims and Hedberg 1995).

Motivational learning theory provides an explanation of the effects of individual, environmental, and course factors on learning behavior (Keller 1983). Motivation is defined as the degree of effort, direction, and persistence that is observed in people's behavior (Keller 1983, p.389). It has been suggested that learning motivation not only leads to enhanced learning outcomes, but also to higher learning persistence, engagement, and lower attrition rates (Deci et al. 1991; Kinzie 1990). Based on Keller's (1983) motivational design theory, learning relevance and learning expectancy have been proposed as major determinants of learning motivation in learner-controlled environments (Kinzie et al. 1988; Milheim and Martin 1991). Learning expectancy is rooted in the wider theory of learning attribution, according to which learners ascribe the outcomes of behavior to different external or internal factors, such as ability, effort, luck, or the difficulty of the learning task (Hannafin and Land 1997; Martin and Briggs 1986; Weiner 1985). A higher level of perceived internal control triggers increased learning motivation and personal effort. The perception of internal versus external control of personal success is coined in the concept of the locus of control (Rotter 1966). Bandura (2001) has provided a related approach to personal attributions with the self-efficacy concept. Self-efficacy is defined as the degree of confidence people have in their capability to organize and succeed in particular tasks and, thus, has an important influence on personal motivation. Learners with low self-efficacy tend to avoid learning situations which they believe exceed their abilities. As a result, self-efficacy beliefs induce learners to use self-regulative strategies and are therefore associated with self-regulated learning (Bandura 2001; Pintrich and De Groot 1990; Zimmerman 2008). Learning relevance is tied to tasks that are perceived to satisfy personal needs and values (Keller 1983). Motivation derives from opportunities to satisfy these needs. Depending on the degree of self-determination, motivation can be grouped into intrinsic, internally derived motivation and extrinsic, externally endorsed motivation (Deci et al. 1991). Self-determined, intrinsic motivation is enhanced by learning autonomy, while extrinsic motivation is, to some degree, externally endorsed and has been shown to have a less positive effect on learning persistence, satisfaction, and learning performance (Deci et al. 1991).

Cognitive learning theory describes how individual differences determine the processing of information, the retrieving of knowledge, and the selection of rational choices (Gagne and Dick 1983). It has been suggested that students' lacking ability to self-regulate their learning is a main reason for the poor results of learner-controlled course outcomes (e.g. Azevedo 2005; Sitzmann et al. 2009). Self-regulated learning strategies are defined as proactive processes to support the acquisition of information and skills (Zimmerman 2008). They include meta-cognitive strategies for planning, monitoring, and adjusting the learning process (Pintrich and De Groot 1990). Self-regulated learners are thus considered agents of their learning process as they guide and anticipate their learning goals, select courses of action, and monitor the learning progress (Bandura 2001). Research on learner control has also drawn on the theory of cognitive load (Sweller 1988) to examine the effect of learner control on mental effort in e-learning environments (van Merriënboer et al. 2002). Motivational and cognitive processes underlie individual learning behavior and are central for predicting the impact of learner control on e-learning effectiveness. Integrating earlier conceptual foundations (Alavi and Leidner 2001; Gupta and Bostrom 2009; Piccoli et al. 2001; Sharda et al. 2004) into a single framework, we separate three dimensions of e-learning effectiveness which form the background of our framework: (1) the instructional design, including the combination of learning methods and technological features that activates and guides the learning process; (2) the learning processes and activities through which learning occurs; and (3) learning outcomes. Our framework thereby systemizes and integrates prior conceptual developments into an integrative framework for e-learning effectiveness (see Figure 1).



While learner control is neither new to education nor exclusive to technology-based instruction, it has been suggested that the opportunity for learners to self-determine the learning process is a distinguishing feature of computer-based instruction compared to traditional classroom-based instruction (Granger and Levine 2010; Sitzmann et al. 2006). However, despite its central role for e-learning-based instruction, learner control has so far not been formalized from the perspective of e-learning systems. We therefore derive a set of five conceptual dimensions of learner control from the structural dimensions of e-learning systems in order to base our framework on these (see Table 1). Based on the characteristics of the e-learning environment (Benbunan-Fich 2002; Gupta and Bostrom 2009; Piccoli et al. 2001; Sharda et al. 2004), we thus extend and structure earlier classifications of learner control (Chung and Reigeluth 1992; Milheim and Martin 1991; Sims 1997). In addition, the underlying epistemological learning model determines the degree of learner control in an educational setting (Leidner and Jarvenpaa 1995). Learning models are alternative views of learning and thinking. The tendencies of e-learning environments to be based on differing learning models will determine the instructional design and, thereby, the level of control that learners have (Jonassen 1991).

Table 1. Taxonomy of Dimensions of E-Learning and Learner Control	
E-learning dimension	Learner control dimension
<i>Time</i> : Timing of instructional events	<i>Timing/Pacing</i> : Control of the time to learn and when to learn, as well as of the pace of instruction
<i>Place</i> : Physical environment of instructional events	<i>Location</i> : Control of the learning environment and place of instruction
<i>Technology</i> : Information display and processing capabilities	<i>Navigation</i> : Control of the sequencing of instructional material, as well as of the selection and design of the learning content and delivery medium
<i>Interaction</i> : Type and degree of contact between the participants	<i>Interaction</i> : Control of the virtual interaction, including the interaction with the instructor (learner-instructor interaction) and the other course participants (learner-learner interaction)
<i>Space</i> : Resources and content available to the learner	<i>Content</i> : Control of the learning topic, task, and assessment form, as well as of the program-generated advice referring to a suggested course of action

In addition to the objective level of control contingent on the e-learning design, research has distinguished perceived control as the extent to which learners are aware of having control of their learning process (DeRouin et al. 2004; Kraiger and Jerden 2007). While the level of objective control determines perceived control, there is not necessarily a perfect correlation between the two. Furthermore, our framework depicts the behavioral learning activity as a key learning process in order to portray how individuals actively engage in their instruction (Alavi and Leidner 2001; Brown 2001). Control of the instruction has been found to stimulate learning activity by increasing the intrinsic motivation (Kinzie et al. 1988; Schnackenberg and Sullivan 2000; Williams 1996). However, research has also stressed that learner control causes distraction, disorientation, and cognitive overload (Kay 2001; Scheiter and Gerjets 2007). To account for the different effects, our framework includes individual characteristics, as well as

course and environment characteristics, as moderators (Baron and Kenny 1986) of the learning process. We also suggest that cognitive and motivational differences, as well as personal characteristics account for individual characteristics, while the characteristics of the course and learning environment are contextual factors. Behavioral learning activities enable cognitive and affective learning outcomes which reflect the effectiveness of the e-learning program (Sharda et al. 2004). Cognitive learning outcomes comprise the gain in knowledge (Brown 2001) as well as meta-cognitive learning techniques (Azevedo 2005). In comparison, affective outcomes denote a variety of measures for motivational and emotional reactions and attitudes during and after learning.

Methodology

The basis of this article is a comprehensive literature review on learner control in e-learning environments. While previous reviews have focused on research from the field of educational psychology, we conducted a comprehensive review of research from different fields to account for the multidisciplinary nature of the e-learning literature. To avoid a potentially too narrow focus on selected journals, we undertook a complete keyword-based search of four different electronic databases for articles published between 1996 and 2013 (see Table 2). As a first step, we reviewed articles from previous literature syntheses and meta-analyses of learner control (Chen and Macredie 2002; Kraiger and Jerden 2007; Niemiec et al. 1996; Steinberg 1989; Williams 1996) to inform our search criteria. The time frame was chosen to cover all articles published after the last two comprehensive reviews of learner control in e-learning (Niemiec et al. 1996; Williams 1996). We carried out a full text search for articles containing the keywords “learner control” and/or “learner-controlled”. The results show that the chosen keywords also cover articles that refer to self-directed learning, autonomous learning, and interactive learning as synonyms of learner control and are therefore considered to be comprehensive. To balance the relevance and manageability of the literature, we deliberately omitted books and unpublished manuscripts not subject to a peer review process from our search. This process yielded a total of 884 different articles from all the databases. We analyzed the titles and abstracts to identify relevant articles, focusing on three criteria. First, the articles had to involve some form of e-learning, including online learning, computer-based instruction, or learning with hypermedia. Second, since our aim was to determine the effects of learner control in e-learning environments, we selected only empirical articles. The search process revealed that only a relatively small number of articles (14%) are of a purely conceptual nature. Nevertheless, we consulted these articles for our theoretical analysis. Third, we excluded articles that compare the effectiveness of (learner-controlled) e-learning relative to classroom-based instruction (e.g. Chou and Liu 2005), as they do not allow a direct analysis of learner control in e-learning. Our search of the second keyword “learner-controlled” resulted in only two additional studies, indicating that our search was fairly exhaustive. Nevertheless, we took a further step to complement our sample and conducted a one-step backward search (Webster and Watson 2002) on the articles comprising our final sample (see below).

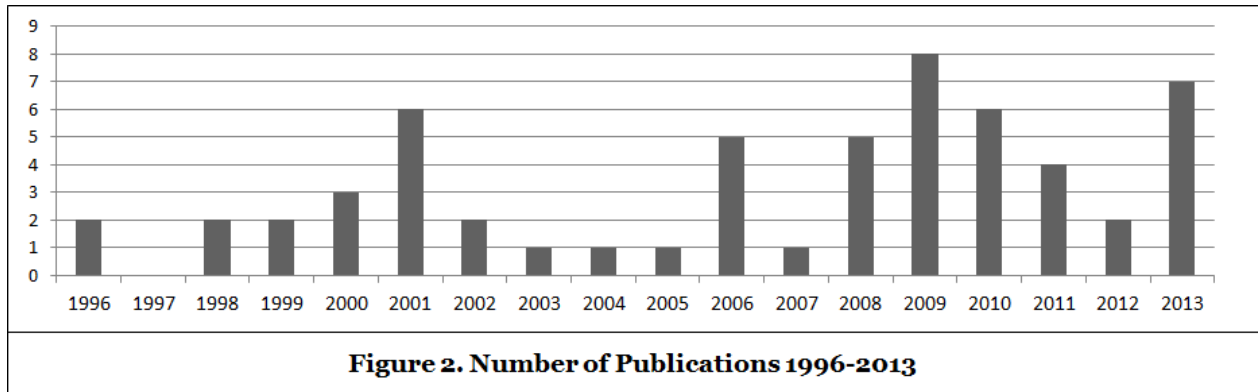
Table 2. Literature Sources and Search Process

Database	EBSCO	ScienceDirect	Social Science Citation Index	PsycINFO	Backward Search
Hits	85	623	102	74	18
Final sample	11	21	6	10	10

As a final step of the search process, we selected relevant articles based on a full-text review of the remaining 94 papers. Studies were excluded that did not directly focus on learner control, including research on learning pedagogy in e-learning (e.g. Guthrie 2010) or intelligent tutoring (e.g. Chen 2008). Furthermore, we excluded meta-analytic articles which report samples or results from other studies (i.e. Niemiec et al. 1996, Kraiger and Jerden 2007). A total of 58 studies fulfilled all the criteria, which resulted in the final sample for our literature review as displayed in Table 2. We achieved the reliability of the final set of studies by at least two of the authors agreeing on the choice. Ambiguous articles (33 out of 94) were discussed until agreement on inclusion or exclusion was achieved.

An analysis of the final sample shows that 55% (32 out of 58) of the papers were published during the last five years (2008-2013, see Figure 2). Most of the studies employ a randomized experimental design (40),

a smaller number of studies are based on a field or quasi-experimental design (9 and 5 respectively). Three studies use self-reported survey data, while only one study uses a qualitative data collection method. Most of the final sample's articles employ web-based e-learning instruction or computer-based instruction (34% and 30% respectively) as an object of analysis. Sixteen studies (27%) analyze hypermedia or multimedia systems, while online and virtual learning environments are introduced in five studies. Furthermore, we noted that 68% of the research investigated a sample of students in higher education, while only 10% analyzed e-learning systems in a work setting and 22% in a school or college setting.



Results

We applied our integrative framework to organize and interpret the obtained literature. Overall, we identified two categories of articles corresponding to our research questions. The first category of articles investigates the effectiveness of learner control in e-learning by examining the direct relationship of learner control on perceived learner control, learning activities, and learning outcomes. Studies in the second category extend the scope of learner control effectiveness to incorporate individual and contextual characteristics as moderators of the learning process. As a result, studies in this category provide conditions under which learner-controlled e-learning is most effective. Table 3 classifies the articles of the first category and summarizes the dimensions of learner control, learning activity, and learning outcomes that emerge from our literature review. We follow a concept-centric approach based on Ennen and Richter's (2010) work to present our results in a structured way. Our findings are described in the following.

Learner control	Perceived learner control	Learning activity		Learning outcomes	
		<i>Time on task</i>	<i>Task involvement</i>	<i>Cognitive</i>	<i>Affective</i>
<i>Timing/pacing</i>	2 [18,54]	7 [3,18,33,42,46,47,53]	4 [3,22,50,53]	14 [3,7,8,9,18,26,27,33,42,46,50,54,56,58]	8 [3,7,9,22,31,46,56,58]
<i>Location</i>		1 [42]		1 [42]	
<i>Navigation</i>	3 [18,41,51]	9 [2,3,4,15,18,33,35,36,53]	5 [3,4,40,52,53]	18 [1,2,3,4,5,7,9,15,18,26,33,35,36,41,51,52,56,58]	3 [51,56,58]
<i>Interaction</i>	1 [51]	1 [42]		3 [7,42,51]	2 [7,51]
<i>Content</i>	4 [11,13,51,54]	8 [3,10,11,15,36,43,46]	7 [3,10,11,12,13,40,43]	12 [3,10,11,12,13,15,36,43,46,51,54,56]	8 [3,12,16,31,40,46,51,56]

Note: Bold numbers denote the coverage of the literature. Numbers in brackets denote studies from the data collection and are indicated by uppercase numbers in the reference list. Double count possible.

Learner control: To obtain an overview of the dimensions of learner control, the studies were categorized according to the different types of control that learners had according to their analysis. Contrary to previous arguments (Granger and Levine 2010), we do not find that different learner control dimensions

have unique effects on learning activity and outcomes, although increasing the degree of learner control tends to increase the affective learning outcomes. Nevertheless, this result may be confounded as the majority of the empirical research focuses on only a few dimensions of learner control: timing, navigation, and content control. In comparison, location and interaction control are only examined in recent web-based learning systems (e.g. Cao et al. 2008; Joo et al. 2013; Sun and Hsu 2013).

Perceived learner control: Despite the theoretical rationale (DeRouin et al. 2004; Kraiger and Jerden 2007), only a few studies address the role of individual perceptions of control. Perceived control corresponds to the extent that learners believe they have instructional control and is a critical condition for effective learning choices (Corbalan et al. 2009a; Corbalan et al. 2011; Fulton et al. 2013; Kettanaruk et al. 2001). Recent research shows that a higher awareness of instructional control leads to higher motivation in the learning phase (Vandewaetere and Clarebout 2011). Interestingly, the availability of control options alone, even if not directly relevant for the learning outcome such as choosing instructional animations, has been found to increase learning performance (Behrend and Thompson 2012, Hasler et al. 2007). Nevertheless, the level of perceived control may diminish over time as learners get used to the e-learning system, thus decreasing the impact of learner control on e-learning effectiveness (Sun and Hsu 2013). Consequently, there is an indication that without the awareness of control, giving learners choices regarding their learning process is likely to be futile. The specific relationship between different dimensions and individual perceptions of control is, however, not fully comprehended.

Learning activity: Learning activity is an aspect of the learning process that has received particular attention in empirical research. Empirical findings suggest that learning activity is reflected by two principal measures: time on task and task involvement. Time on task – including the amount of practice – has been posited as a relevant indicator of learning motivation and the efficiency of e-learning programs (Brown 2001; Salden et al. 2006). On balance, learner control tends to reduce the time on task in e-learning courses (e.g. Lai 2001; Mihalca et al. 2011), suggesting that self-controlled learners access less content than system-controlled learners (Brown 2001; Tabbers and Koeijer 2010). Task involvement refers to the learner's attention and mental effort directed at the learning task. On-task attention and meta-cognitive activity are examined as indicators of the cognitive effort involved in a learning situation and as an approximation of learning engagement (Brown 2001; Orvis et al. 2009; Schmidt and Ford 2003). Mental effort is also posited as a mediator between learner control and learning performance in research based on cognitive load theory (Corbalan et al. 2008; Corbalan et al. 2011; Hasler et al. 2007). Eventually, there is evidence that a higher degree of task involvement is positively related to cognitive and affective learning outcomes beyond differences in time on task (Schmidt and Ford 2003).

Learning outcomes: Consistent with previous reviews on learner control (Kraiger and Jerden 2007; Niemiec et al. 1996), our findings of the impact of learner control on learning outcomes is inconclusive. Of those studies that investigate the impact of learner control on cognitive learning outcomes (e.g. knowledge acquisition, Brown 2001, and learning transfer, Corbalan et al. 2011), a substantial number either reports an insignificant (11) or negative (6) effect, while 11 studies find a positive correlation. Studies that report a positive relationship between learner control and cognitive learning outcomes typically endowed learners with control of the pacing of the learning process (e.g. Hasler et al. 2007, Stiller et al. 2009) or with control of the pacing and navigation (e.g. Zhang et al. 2006, Tabbers and Koeijer 2010). Interestingly, there is evidence that learners in interactive web-based e-learning systems, who are provided with a lower level of control, appear to resort to alternative sources of information outside the primary system (Sun and Hsu 2013). Research has also investigated the effects of additional guidance and support mechanisms to complement the potentially negative impact of learner control. The impact of such features on learning outcomes is, however, found to be limited (Hummel et al. 2006, Yeh and Lehman 2001). For example, Bell and Kozlowski (2002) report that guidance systems that offer feedback and advice during the learning process increase learning performance early in training, but have no significant effects on the later stages.

A tentative finding concerning affective outcomes is that learner control is associated with positive emotional reactions towards a course and the e-learning system, irrespective of the level of control provided (e.g. Kopcha and Sullivan 2008). Studies that found that learner's attitudes have insignificant effects are mostly based on a very limited degree of learner control (Behrend and Thompson 2012, Martin 2008, Singhanayok and Hooper 1998). Notably, satisfaction with the course increases significantly when the participants are provided with control of the virtual interaction (Cao et al. 2008, Sun and Hsu 2013).

In turn, affective outcomes seem to increase further engagement with the course and are positively related to learning performance (Fisher et al. 2010; Olaniran 2009). In summary, empirical evidence that investigates the direct effect of learner control on learning activity and learning outcomes does not support the claim that learner control increases the effectiveness of e-learning systems. Although the majority of studies finds that learner control has a positive impact on affective reactions, the effect on cognitive outcomes is ambiguous.

Following our research framework, we review individual characteristics, as well as contextual factors, as moderators of the learning process. Articles that investigate the underlying mechanisms of effective learner control are classified in Table 4. The empirical evidence suggests that three classes of individual characteristics significantly interact with the effectiveness of learner control: cognitive differences, motivational differences, and personal characteristics. In addition, the characteristics of the course and learning environment are found to determine the underlying relationship with learner control in e-learning.

Individual characteristics	Cognitive differences (self-regulated learning skills, knowledge, cognitive ability)	17 [6,17,18,19,23,25,29,31,32,33,36,37,38,44,48,49,57]
	Motivational differences (goal orientation, attributional style, individual attitude)	10 [6,9,14,15,18,25,28,40,45,54]
	Personal characteristics (preferences for control, learning style, individual traits)	12 [16,17,21,24,29,30,31,34,39,44,54,55]
Course and environment characteristics	Course characteristics (relevance, task complexity)	2 [20,28]
	Learning environment (learning climate, time constraint)	1 [38]
<p><i>Note:</i> Bold numbers denote the coverage of the literature. Numbers in brackets denote studies from the data collection and are indicated by uppercase numbers in the reference list. Double count possible.</p>		

Cognitive differences: Cognitive variables refer to personal capabilities to make rational learning decisions and self-regulate the learning process in a learner-controlled environment (Winne 1996; Zimmerman 2008). Learner-controlled e-learning imposes high demands on learning self-regulation due to the isolation and freedom of choice (Azevedo 2005). In particular, the learning process is influenced by individual differences in meta-cognitive learning skills, including goal setting, self-evaluation, and monitoring of the learning progress (Hughes et al. 2013; Kostons et al. 2010; Schmidt and Ford 2003). There is strong evidence that learners who report a high level of self-regulated learning strategies perform significantly better in the learner control condition than learners who report a low level of self-regulation (Scheiter et al. 2009; Young 1996). In line with early research (Hannafin 1984; Milheim and Martin 1991), our analysis also confirms the significant positive influence that prior knowledge and cognitive ability have on the effectiveness of learner-controlled instruction. Learners who are more experienced and display higher learning abilities are less likely to make adverse learning decisions, thus finding it easier to self-regulate the learning process (Hughes et al. 2013; Moos and Azevedo 2008). In contrast, novice learners profit less from the additional freedom that learner controlled e-learning systems offer and are more likely to experience disorientation during the learning process (Scheiter and Gerjets 2007).

Motivational differences: Research has considered intrinsic goal orientation, attitudes, and attributional styles as determinants of motivation-related behavior in the learning process. Individual goal orientation integrates a learner's mastery and performance goals as predictors of learning activity (Brown 2001; Ely et al. 2009; Olaniran 2009). Mastery-oriented learners are expected to spend more time with the learning material and be deeper involved with the learning task, while performance-oriented learners are more concerned with their attainment level than others. In line with expectations, our analysis shows that performance orientation is negatively related to on-task attention (Orvis et al. 2009, Schmidt and Ford 2003). A second strand of research investigates the moderating effect of attributional styles. Differences in attributional styles, such as inclinations to attribute personal success to external or internal causes, determine self-efficacy and learning motivation in learner-controlled e-learning courses (Vandewaetere and Clarebout 2011). For example, learners with an internal locus of control typically obtain higher

measures of self-efficacy and performance during an e-learning course than learners with an external locus of control (e.g. Chang and Ho 2009; Hughes et al. 2013; Joo et al. 2013). However, a high level of self-efficacy can induce learners to skip relevant tasks, thus reducing learning outcomes (Bell and Kozlowski 2002). Further research is therefore necessary to determine the effects of over-confidence on learner-controlled decisions making.

Personal characteristics: Personal characteristics refer to relatively stable personal attributes, such as preferences for learner control, personal learning styles (Ford and Chen 2000), personal traits (Orvis et al. 2011), and epistemological beliefs (Scheiter et al. 2009). Matching individual preferences for control with the amount of control received is shown to increase learning engagement, as well as affective and cognitive learning outcomes (Fisher et al. 2010). However, other studies provide evidence that a mismatching of preferences increases learning performance, suggesting that some learners are unable to choose the optimal amount of control (Hannafin and Sullivan 1996; Kopcha and Sullivan 2008). Individual preferences for control are in turn determined by learning styles, which presumably predict a student's willingness to make use of learner control (Höffler and Schwartz 2011; Liegle and Janicki 2006).

Course and learning environment characteristics: In light of the scarce empirical evidence, there is an indication that course characteristics, such as task complexity and task value, influence the effectiveness of learner-controlled instruction. A high degree of control is detrimental for learning outcomes when the learning content is complex rather than simple (Granger and Levine 2010). Furthermore, the perceived task value is an indicator of the relevance of the e-learning course for educational or work-related goals (Joo et al. 2013). Regarding the environmental factors, the learning climate, peer and supervisor support, as well as the work requirements have been proposed as important determinants of extrinsic motivation in learner-controlled training (DeRouin et al. 2004; Kraiger and Jerden 2007). In theory, a positive learning climate, which enhances a learner's autonomy and participation, can significantly influence the effectiveness of learner-led e-learning courses. However, with the exception of Murray (1999), there is no empirical research on the role of environmental factors in learner-controlled courses.

Discussion and Next Steps

E-learning provides extensive opportunities for learners to control their instruction and learning processes. However, although the adoption of online learning programs has been significant in recent years, the capabilities and efficacy of such programs have yet to be fully investigated. As a first step, the presented framework conceptualizes the impact of learner control on the effectiveness of e-learning systems. The framework also recognizes that individual characteristics, as well as the characteristics of the course and learning environment, moderate the impact of learner control on learning activity and learning outcomes. Accordingly, our framework serves to position the influencing factors of learner-controlled e-learning and offers a new perspective on the determinants of successful e-learning courses. However, further research is required to specify the role of learning activity and the learning process in a learner-controlled environment. In addition, our findings provide grounds for future research to determine the influence of the learning environment (including the learning climate, peer and supervisor support) and course characteristics (content complexity, personal relevance) on learner-controlled e-learning.

Our research process is still in progress. In order to validate and refine our framework towards a model of e-learning effectiveness, we intend to corroborate the findings from the literature review within an organizational setting. Importantly, our selected e-learning system serves to train geographically dispersed employees and is based on an online learning platform that is aligned to mobile learning. As organizations progress toward online-based instruction, research is needed to further explore the role of learner control in flexible, time and place-independent e-learning systems. Following this line of thought, our work seeks to advance the research on e-learning effectiveness by unifying the perspectives of learner control, cognitive self-regulated learning, individual motivation (reflecting attribution, intrinsic and extrinsic motivation), and the learning environment (capturing employees' perceptions of the organizational learning climate) within an integrated model. Our research thereby has significant implications for organizations and educational institutions employing e-learning systems and which are challenged by learners' low persistence and high attrition rates (Garavan et al. 2010; Romiszowski 2004). In the long term, the adverse effects of learner control may predominate and adoption may be transitory.

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The 58 articles included in our literature review are denoted by a superscript number (see Tables 3 and 4).

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