Effectiveness and Efficiency of Blended Learning – A Literature Review

Completed Research Paper

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Abstract

The aim of this paper is to identify measurements of learning efficiency and learning effectiveness of blended learning and to analyze drivers of learning effectiveness and learning efficiency in learning environments of corporate education. Therefore a literature review of the AIS Electronic Library is done. With a single term search including "learning efficiency", "learning effectiveness" and "blended learning" 14 papers are identified. Regarding learning efficiency, less research is available so that only few measurements are available and no drivers are identified. In contrary, learning effectiveness is in research focus: 10 measurement indicators and 16 drivers are analyzed. Few of these findings concentrate on blended learning environment in corporate education. In conclusion, an evaluation framework including learning effectiveness and efficiency for blended learning environments of corporate education is desirable. This paper discusses opportunities for future search based on the state-of-art knowledge published by the AIS Electronic Library.

Keywords

Blended learning, learning effectiveness, learning efficiency, measurement, literature review

Introduction

Corporate and higher educational learning has been under transformation as well as many other areas during the last decades since information technology (IT) has provided many opportunities for improvements in terms of learning effectiveness and efficiency (Gunasekaran et al. 2002; Hill et al. 2013). Based on traditional learning environments, where learner and instructors meet face-to-face, more and more e-learning solutions have been developed, whereby learning content is provided independent of time and place. However, a lot of challenges for these pure IT-based learning environments are reported (Acton et al. 2005; Singh 2006) such that a new form that combines both traditional and e-learning emerged. These blended learning environments integrate traditional forms of learning with online methods and tools (Singh 2006). These environments are used in both corporate and educational learning (Kaur and Ahmed 2006; Lewis and Orton 2006; Singh 2006; Wright et al. 2006).

Especially in corporate learning, it is important that employees are able to learn in an effective and efficient way (Alavi 1994). A learning environment based on time and cost pressures should still meet employees' needs (Gupta and Bostrom 2005) such that the learning content can be consumed in an effective and efficient way. In this context, blended learning environment have been identified as a potential solution that enables effective and efficient learning (Garrison and Kanuka 2004; Guzzo et al. 2012; Hill et al. 2013; Kaur and Ahmed 2006; Osguthorpe and Graham 2003). However, as indicated by both academia and practice, only few approaches are provided that evaluate the effectiveness and efficiency of blended learning environments (Arbaugh et al. 2010; Bernhard et al. 2004; Skelton 2009) and that identify respective antecedents of these variables (Reiss and Steffens 2010). Nonetheless in the

context of traditional and e-learning, both concepts have been already discussed such that the research questions of this paper are:

> *RQ1: How can learning effectiveness and efficiency of blended learning be measured?*

> *RQ2: What are drivers of learning effectiveness and learning efficiency in blended learning, e-learning and traditional learning environments in both corporate or higher education?*

Based on the answers to these research questions the paper intends to discuss whether the current literature discussing learning effectiveness and efficiency in traditional or e-learning environments can be transferred to blended learning environments in corporate learning settings or whether new approaches are necessary. Therefore, a literature review has been conducted using articles published in the AIS Electronic Library. The review focuses on papers which examine drivers of learning effectiveness and learning efficiency in traditional learning, e-learning and blended learning environments as well as measurement of both variables.

In order to present the results of the review the paper is structured as follows. First, the research background in terms of blended learning and learning effectiveness and efficiency is provided. Second, we describe our research methodology. Third, the results are presented followed by the discussion. Then limitations are explained. A conclusion and implications for future research complete the paper.

Research Background

In this section we provide background information about: blended learning as a learning concept which combines traditional learning and e-learning, learning effectiveness, and efficiency.

Blended Learning

Traditional learning and e-learning environments have both advantages and disadvantages. In a traditional learning environment instructors can control the learning environment. They can use different learning methods or components according to learner's needs. Learners are embedded in a rich social context; they interact with each other and get immediate feedback from other learners or instructors (Acton et al. 2005; Hill et al. 2013). Traditional learning environments are often related to high costs in corporate education. Often employees have to travel to participate in trainings and stay away from work. As a result, e-learning environments have been implemented in corporate education. E-learning environment offers flexible access to training materials irrespective of time or place. Moreover, a large amount of learners can be reached. In contrast, learners have to face some challenges. Through asynchronous learning social context is missing and interaction between e-learners and instructors are often text-based via discussion forums or e-mail. Consequently, e-learners often feel isolated and sometimes also lost in the learning environment when information is presented unstructured (Gunasekaran et al. 2002; Hill et al. 2013; Wan et al. 2012).

In order to compensate weaknesses and to bundle strengths of traditional and e-learning environments, blended learning environments are designed. Blended learning environments combine traditional and e-learning methods and media. As a consequence, didactic improvements by the use of adequate mixes according to learning content and learner groups are possible. This enables individualized learning processes and self-managed learning (Graham 2006; Reiss and Steffens 2010). Moreover, blended learning passes through different levels in order to adapt to learners' needs. First steps of blended learning include virtual classroom, application sharing or two-way audio in addition to the traditional learning environment in order to save costs. After that, asynchronous learning which involves e.g. web-based training modules, assessments, online learning community, discussion forums and simulations to the learning environment are used for time saving reasons. Regarding increasing learning effectiveness, ***simple blending*** offers mixed-mode, dynamic and personalized learning. Asynchronous and synchronous learning is combined. Collaborative learning is possible and learning styles are considered to choose appropriate learning methods and media. As a next step, ***seamless blending*** enables advanced blended learners a learning environment which integrates learning and content management as well as virtual classroom systems. Trainees can switch between self-paced learning and collaborative learning technology through a seamless or unified interface (Singh 2006).

Not only the design of learning environments, but the evaluation of blended learning is also important. Evaluations often focus on different constructs than learning effectiveness or learning efficiency. Therefore, these concepts are introduced in the following section.

Learning Effectiveness and Learning Efficiency

In general, Joy II and Garcia (2000, 33) define **learning effectiveness** as "a function of effective pedagogical practices". However, the measurement of effectiveness is not simple. Often, the learning outcome of learners are considered (Mashaw 2012; Moody and Sindre 2003; Sahasrabudhe and Kanungo 2008). According to Alavi (1994), effective learning processes are characterized by active learning and the construction of knowledge. Learning is done through the solving of a problem in cooperation and in teamwork with other learners. Moreover, effectiveness is often related to success (Alsabawy et al. 2011; Baker and Papp 2004; Fitzgerald 1993; Petter et al. 2012). Sometimes effectiveness is specialized such as teaching effectiveness or educational effectiveness. Looney and Akbulut (2007) use the term teaching effectiveness to look in detail at students' appraisal of the instructional design and its impact on students' beliefs, expectations, emotions and goals.

Learning efficiency looks at the learning outcome or knowledge gain in relation to learning time. Therefore it is often measured by the formula "learning outcome per learning time". Rasch and Schnotz (2009) evaluate learning efficiency as number of correctly answered items in the assignment divided by time in minutes. Regarding the learning process, Field (2005) defines efficiency as the available and offered flexibility with reference to different methods and tools used in the learning environment. Evidence has been provided that learning efficiency has an impact on learning effectiveness (Loukis et al. 2007).

Learning efficiency and learning effectiveness are two important factors for the characterization and the related success or failure of learning environments. Therefore, the two factors should be considered in evaluations. The extent of learning efficiency and learning effectiveness depends on different drivers. As a result, it is important to figure out the influence and effects of the drivers on learning efficiency and learning effectiveness (Reiss and Steffens 2010).

Concerning the evaluation of blended learning environments, less research is available. Reiss and Steffens (2010) developed an evaluation model based on characteristics of the environment. That means the combination of face-to-face instruments, electronic media, and corresponding strengths and weaknesses of the learning environment. As an example, an ideal mix concludes with synergy effects, whereas the abundance of electronic media save costs but also results in the possible de-motivation of learners. Harris et al. (2009) propose a continuous evaluation of blended learning environments especially by participants. The teaching and production team should then analyze the results. The evaluation should include e.g. learning outcomes, learning style/preferences, motivation, clarity of goals/content, perceived value and satisfaction, effectiveness and design.

Research Methodology

To identify measurements and drivers of learning effectiveness and efficiency we perform a literature review to identify measurement models used in prior research. We follow the recommendations of Webster and Watson (2002) as applied for example by Lang et al. 2011. Therefore in the first step we define a procedure for searching articles and in the second step, propose classifications for the identified articles.

Regarding the first step, we review the entire AIS Electronic Library with the help of forward and backward search. As single search terms **learning effectiveness, learning efficiency and blended learning** are used**.** We identify approximately 150 articles. After reading the articles and verifying their thematic consistency with the objective of our literature review, we go backward and have a look at the citations of the articles in order to identify new articles which have not been found in the first step. Then we go forward and search for articles that cite the articles identified in the first step. As our inclusion criteria we define that the articles should discover indicators for the measurement of learning effectiveness and learning efficiency or/and drivers of learning effectiveness or/and learning.

Regarding the AIS Electronic Library 14 articles are identified fulfilling these inclusion criteria. Table 1 shows an overview of articles regarding the respective conference or journal they were published in.

In the next step, the 14 articles are classified. Since the aim of the paper is, on the one side to identify how learning efficiency and learning effectiveness are measured and on the other side to analyze drivers of learning effectiveness and learning efficiency, two classifications are done. Measurement of learning effectiveness and learning efficiency are categorized simply by indicators mentioned in the articles. The classification of drivers is more complex. They are characterized by three dimensions: the learning environment (traditional, e-learning, blended learning) evaluated in the paper, the deployment of the learning environment (corporate/higher education/not defined) and the examined impact of the driver on either learning effectiveness or learning efficiency.

AIS Electronic Library	References	Σ
Conferences		12
ACIS	Laoledchai et al. 2008	1
AMCIS	Hill et al. 2013; Sahasrabudhe and Kanungo 2004	2
BLED	Acton et al. 2005	1
ECIS	Loukis et al. 2007; Moody and Sindre 2003; Sridharan et al. 2010	3
ICIS	Cao et al. 2005; Mahapatra and Lai 1999; Sahasrabudhe and Kanungo 2008	3
PACIS	Alsabawy et al. 2011; Daneshgar et al. 2012	2
Journals		2
Communications of the Association for Information Systems	Looney and Akbulut 2007	1
MIS Quarterly	Piccoli et al. 2001	1
total		14

Table 1. Outlets of literature review

Results

The following sections describe the classification of the identified articles dealing with learning effectiveness and efficiency.

Measurement of learning effectiveness and learning efficiency

Only one reference addresses the measurement of learning efficiency. Loukis et al. (2007) use six indicators for evaluating the efficiency of the e-learning environment: content, electronic support by instructor, development of a community feeling, technical quality and reliability, ease of use and capability to customize the learning process to one's learning style and needs. In that way, learners appreciate the presentation of the content, how they feel supported by the instructor, if they have the feeling that a community is arising, how they measure the systems quality, reliability and its ease of use, as well as whether they feel the possibility that their learning needs and style are considered in the environment.

Regarding learning effectiveness, more measurement models are identified. Kirkpatrick's model (Kirkpatrick 1994, 1998) is used in four articles for measuring learning effectiveness. This model is designed to evaluate trainings of corporate education and includes four levels in order to evaluate training: reactions, learning, behavior and organization. The first level, 'reactions', figures out the satisfaction of the learner with the training. 'Learning', the second level, addresses the ability of the learner to perform in new ways. 'Behavior' measures the job performance after the training. In other words, the learner is able to apply learned knowledge and skills. The last level 'organization' evaluates the extent to which training has an impact on measurable profits (e.g. sales turnover) (Kirkpatrick 1994, 1998). Only the second level of the model concentrates on effectiveness which is why Sahasrabudhe and Kanungo (2004) only use level one and two as indicators for learning effectiveness.

Alsabawy et al. (2011) use Holsapple and Lee-Post (2006) e-learning success model as basis in order to evaluate effectiveness. Holsapple and Lee-Post (2006) accommodate the different dimensions of DeLone and McLean's (2003) information systems (IS) success model to the needs of e-learning environments. In general the model consists of three stages of system design, system delivery and system outcome. Each stage consists of different dimensions e.g. system design is evaluated by system quality, information quality and service quality. System quality measures, among other things, the usefulness of the system. Information quality evaluates e.g. the structure and amount of presented information and service quality analyzes the instruction. System delivery focuses on user satisfaction and the use of methods and tools applied in the e-learning environment. The last stage system outcome raises net benefits of the e-learning environment such as: positive aspects of time savings or, the negative aspects of lack of contact. In contrast to Holsapple and Lee-Post's (2006) approach, Alsabawy et al (2011) apply in the last stage indicators which measures customer, organizational and society values and only use system quality and information quality in the design stage.

The indicators satisfaction and learning performance (also known as outcome), are often used together in order to measure learning effectiveness (e. g. Cao et al. 2005; Sridharan et al.2010). Satisfaction is often the subjective part which evaluates learners' experience of the learning environment whereas learning performance gives an objective view of the learner via e. g. exam scores (Hill et al. 2013; Piccoli et al. 2001). Laoledchai et al. (2008) divide learning outcome in parts to which different factors belong to. It is measured directly after the training through evaluating cognitive, skill-based and affective outcomes, at the actual work environment through skill transfer and through organizational performance. Cognitive and skill-based outcomes describe the ability of the learner to use the learned knowledge and skill for dissolving tasks. Affective outcomes concern the willingness and intentions to use the learning content. Skill transfer analyzes the use of learning content of learners in the working environment. It can be measured by job improvement or an ability to use a skill which has an impact on organizational performance. Besides satisfaction and performance, Piccoli et al. (2001) evaluate self-efficacy as the third factor for effectiveness.

Loukis et al. (2007) implement in their model two indicators for learning effectiveness: usage of e-learning and degree of educational effectiveness. The degree of educational effectiveness figures out the effectiveness of the e-learning system in regards to learning concepts, facts, theories, etc.

In contrary to Loukis et al. (2007), Moody and Sindre (2003) employ contribution to learning and relative effectiveness as a measurement for learning effectiveness. Contribution to learning considers the contribution of the learning activity to learning in the environment. Relative effectiveness questions the effectiveness of learning from the learning activity in comparison with other learning activities in the environment.

The factor used by Looney and Akbulut (2007), indicates the students' rate of the range of material they felt learned during the course. An overview of the findings is found in table 2.

Learning efficiency	Measurement	References
	Content	Loukis et al. 2007
	Instructor support	Loukis et al. 2007
	Community feeling	Loukis et al. 2007
	Technical quality reliability	Loukis et al. 2007
	Learning customization capabilities	Loukis et al. 2007
	Ease of use	Loukis et al. 2007
Learning effectiveness	**Measurement**	**References**
	Reactions, learning, behavior, organization (Kirkpatrick's model)	Acton et al. 2005; Mahapatra and Lai 1999; Sahasrabudhe and Kanungo 2004; Sahasrabudhe and Kanungo 2008
	System design, system delivery, system outcome (E-learning success model)	Alsabawy et al. 2011
	Satisfaction	Cao et al. 2005; Piccoli et al. 2001; Sridharan et al. 2010
	Performance/Learning outcome	Cao et al. 2005; Daneshgar et al. 2012; Hill et al. 2013; Laoledchai et al. 2008; Piccoli et al. 2001; Sridharan et al. 2010
	Self-efficacy	Piccoli et al. 2001
	Usage of the e-learning system	Loukis et al. 2007
	Degree of educational effectiveness	Loukis et al. 2007
	Contribution to learning	Moody and Sindre 2003
	Relative effectiveness	Moody and Sindre 2003
	Student's overall, subjective appraisal of learning	Looney and Akbulut 2007

Table 2. Measurements of learning effectiveness and learning efficiency

Drivers of learning effectiveness and learning efficiency

The literature review identifies a lot of drivers of learning effectiveness. However, there are non for learning efficiency. The articles discussing drivers for learning effectiveness are classified according to the criteria defined in the research methodology section. The results are shown in table 3.

The drivers for learning effectiveness are usually examined in e-learning environments deployed in higher education. Regarding the antecedents, the design components of the learning environment are usually examined: the choice of media, learning objectives, learning domain, learning model, learning processes, learner control, learning content, interaction and instruction. Instruction is often analyzed by teaching styles or the availability of the instructor (Piccoli et al. 2001).

Besides the examination of learning style as antecedent (Laoledchai et al. 2008; Sahasrabudhe and Kanungo 2004; Saharasbudhe and Kanungo 2008), learners' characteristic are in focus. Learners' characteristic can be an affective force such as motivation or attitude (e.g. Cao et al. 2005; Laoledchai et al. 2008; Moody and Sindre 2003; Piccoli et al. 2001) or a cognitive force such as skills and knowledge (Moody and Sindre 2003).

Regarding the technology component of learning environments, the drivers service delivery quality and support, IT infrastructure service and technology can be added. Alsabawy et al. (2011) evaluate the influence of IT infrastructure service and service delivery quality on effectiveness. IT infrastructure service is evaluated via indicators such as communication management or IT education. Service delivery quality uses factors assessing the system availability etc. Piccoli et al. (2001) include technology as a driver in their model with three indicators: quality, reliability and availability of the system used in their virtual learning environment. Antecedents that address management characteristics are used by Sridharan et al. (2010). They implement in their model, management factors and management effectiveness. Management factors include the management's support regarding presentation and access of quality learning resources. Management effectiveness focus on reusability, accessibility and adaptability of learning objects.

Drivers	Learning environment			Deployment			Learning	
	Blended	E-learning	Tradi-tional	Corpo-rate	Uni-verstiy	Not defined	Effi-ciency	Effec-tiveness
Choice of media		Sahasra-budhe and Kanungo 2004; Sahasra-budhe and Kanungo 2008			Sahasra-budhe and Kanungo 2004	Sahasra-budhe and Kanungo 2008		Sahasra-budhe and Kanungo 2004; Sahasra-budhe and Kanungo 2008
Learning objectives		Sahasra-budhe and Kanungo 2004			Sahasra-budhe and Kanungo 2004			Sahasra-budhe and Kanungo 2004
Learning domain		Sahasra-budhe and Kanungo 2008			Sahasra-budhe and Kanungo 2008			Sahasra-budhe and Kanungo 2008
Learning model		Piccoli et al. 2001	Piccoli et al. 2001		Piccoli et al. 2001			Piccoli et al. 2001
Learning processes	Hill et al. 2013; Laoled-chai et al. 2008	Cao et al. 2005; Laoled-chai et al. 2008	Hill et al. 2013; Laoled-chai et al. 2008	Laoled-chai et al. 2008	Cao et al. 2005; Hill et al. 2013			Cao et al. 2005; Hill et al. 2013; Laoled-chai et al. 2008
Learner control		Piccoli et al. 2001	Piccoli et al. 2001		Piccoli et al. 2001			Piccoli et al. 2001

Drivers	Learning environment			Deployment			Learning	
	Blended	E-learning	Tradi-tional	Corpo-rate	Uni-verstiy	Not defined	Effi-ciency	Effec-tiveness
Learning content		Piccoli et al. 2001; Sahasra-budhe and Kanungo 2004; Sridharan et al. 2010	Piccoli et al. 2001		Piccoli et al. 2001; Sahasra-budhe and Kanungo 2004; Sridharan et al. 2010			Piccoli et al. 2001; Sahasra-budhe and Kanungo 2004; Sridharan et al. 2010
Instruct-ion	Laoled-chai et al. 2008	Danesh-gar et al. 2012; Laoled-chai et al. 2008; Piccoli et al. 2001; Sridharan et al. 2010	Laoled-chai et al. 2008; Piccoli et al. 2001	Laoled-chai et al. 2008	Piccoli et al. 2001; Sridharan et al. 2010	Danesh-gar et al. 2012		Danesh-gar et al. 2012; Laoled-chai et al. 2008; Piccoli et al. 2001; Sridharan et al. 2010
Learning style	Laoled-chai et al. 2008	Laoled-chai et al. 2008; Sahasra-budhe and Kanungo 2004; Sahasra-budhe and Kanungo 2008	Laoled-chai et al. 2008	Laoled-chai et al. 2008	Sahasra-budhe and Kanungo 2004; Sahasra-budhe and Kanungo 2008			Laoled-chai et al. 2008; Sahasra-budhe and Kanungo 2004; Sahasra-budhe and Kanungo 2008
Learners' charac-teristic	Laoled-chai et al. 2008; Moody and Sindre 2003	Cao et al. 2005; Danesh-gar et al. 2012; Laoled-chai et al. 2008; Loukis et al. 2007 ; Moody and Sindre 2003; Piccoli et al. 2001; Danesh-gar et al. 2012	Laoled-chai et al. 2008; Moody and Sindre 2003; Piccoli et al. 2001	Laoled-chai et al. 2008	Cao et al. 2005 ; Loukis et al. 2007 ; Piccoli et al. 2001	Danesh-gar et al. 2012; Moody and Sindre 2003		Cao et al. 2005; Danesh-gar et al. 2012; Laoled-chai et al. 2008; Loukis et al. 2007; Moody and Sindre 2003; Piccoli et al. 2001

Drivers	Learning environment			Deployment			Learning	
	Blended	E-learning	Tradi-tional	Corpo-rate	Uni-verstiy	Not defined	Effi-ciency	Effec-tiveness
Inter-action	Laoled-chai et al. 2008	Laoled-chai et al. 2008; Piccoli et al. 2001	Laoled-chai et al. 2008; Piccoli et al. 2001	Laoled-chai et al. 2008	Piccoli et al. 2001			Laoled-chai et al. 2008; Piccoli et al. 2001
Service delivery quality/ support	Laoled-chai et al. 2008	Alsabawy et al. 2011; Laoled-chai et al. 2008	Laoled-chai et al. 2008	Laoled-chai et al. 2008	Alsabawy et al. 2011			Alsabawy et al. 2011; Laoled-chai et al. 2008
IT infra-structure service		Alsabawy et al. 2011			Alsabawy et al. 2011			Alsabawy et al. 2011
Technology	Laoled-chai et al. 2008	Piccoli et al. 2001; Sridharan et al. 2010; Laoled-chai et al. 2008	Piccoli et al. 2001; Laoled-chai et al. 2008	Laoled-chai et al. 2008	Piccoli et al. 2001; Sridharan et al. 2010			Laoled-chai et al. 2008; Piccoli et al. 2001; Sridharan et al. 2010
Manage-ment factors		Sridharan et al. 2010			Sridharan et al. 2010			Sridharan et al. 2010
Manage-ment effec-tiveness		Sridharan et al. 2010			Sridharan et al. 2010			Sridharan et al. 2010

Table 3. Drivers of learning efficiency and learning effectiveness

However since only 14 papers are identified within this literature review, a further analysis of other journals not included in the AIS Library (IS, management and education research) is desirable. Nonetheless, the results of the identified papers are discussed in the following.

Discussion

Measurement of learning effectiveness and learning efficiency

In general there is no consistent use in regards to learning effectiveness and learning efficiency. Authors use different indicators or combinations of indicators as well as models. Moreover, we could not identify clear factors for measuring learning effectiveness and learning efficiency of blended learning environments. For learning efficiency, only one reference with indicators is analyzed whereas the range of learning effectiveness is wider. Certainly the indicators used by Loukis et al. (2007) for evaluating learning efficiency are confusing because they also can be regarded as drivers. So it is questionable if a categorization of learning efficiency is applicable.

In contrary, existing measurements for learning effectiveness could be used for complex blended learning environments in corporate education adapted to evaluation needs. The focus of Kirkpatrick's model (1994, 1998) is on traditional learning environments with the result that the system used in a blended learning environment is not considered in the measurement. Other findings concentrate on subjective and objective evaluation of learning effectiveness by the perceived observation of the learners (Cao et al. 2005;

Daneshgar et al. 2012; Hill et al. 2013; Laoledchai et al. 2008; Looney and Akbulut 2007; Loukis et al. 2007; Moody and Sindre 2003; Piccoli et al. 2001; Sridharan et al. 2010).

As a result, a good approach is Holsapple and Lee-Post's (2006) e-learning success model which is applied by Alsabawy et al. (2011) for the evaluation effectiveness of the e-learning system's success. This framework is oriented on analyzing e-learning environments and can easily be expanded or adapted by measurements needed for the evaluation of blended learning environments. For example, the dimensions information and service quality can also be measured for the traditional part of the blended learning environment according to their needs. The use of applied traditional methods and tools in the blended learning environment can be supplemented in the delivery stage. The outcome of the final stage can be reduced as net benefits consisting only of positive aspects. Negative aspects can be excluded as the face-to-face component is included in blended learning environments. In addition, efficiency measurements considering learners' sites but also corporate's sites should be added to the model. Another approach is Laoledchai et al's (2008) end user training (EUT) effectiveness; it focuses on corporate education. Training effectiveness is measured via different levels of outcomes. Affective, cognitive and skill-based outcomes are imposed directly after the training. The learner's skill to transfer the knowledge to the work environment is regarded as well as the impact on organizational performance. Laoledchai et al's (2008) evaluation of learning effectiveness is an adaption of Gupta and Bostrom's (2006) EUT framework, Kraiger et al.' (1993) classification scheme of learning outcomes, and Maharapatra and Lai's (2005) framework for evaluating EUT effectiveness.

Learning efficiency can be measured by certain indicators. The indicators which Loukis et al. (2007) used and Rasch and Schnotz's (2009) formula (learning outcome per learning time) can provide a basis. An indicator for corporate efficiency could be, for instance, the amount of learners that can be reached by a learning method. Summarizing a flexible model which includes learning effectiveness and learning efficiency measurements and can be adapted to conditions of different learning environments is desirable.

Drivers of learning effectiveness and learning efficiency

Our literature review identifies 16 different drivers for learning effectiveness. However, regarding learning efficiency, no drivers are identified. The reason is probably that the majority of papers are examining learning environments in higher education. In higher education, the focus is on pedagogical strategies and their effects on learning outcome and performance; efficiency reasons like time or cost-savings seem to play a second-class role. In corporate education, however, efficiency aspects of the learning environment are important.

Concerning drivers tested in blended learning environments, only Laoledchai et al. (2008) is identified. Moreover, some researchers compare effectiveness of traditional vs. e-learning environments (Piccoli et al. 2001) or traditional vs. blended learning (Hill et al. 2013) including different drivers. The drivers are mostly identified in learning environments of higher education. The conditions of learners between corporate and higher education are different. Therefore, it can be assumed that the impact of drivers can be different in blended learning environments as compared to corporate education. As a result different drivers, especially regarding learner and design characteristics of the learning environment, should stay in focus and be researched in corporate education.

Therefore, the development of a blended learning success model which includes drivers and measurements for learning efficiency and learning effectiveness in corporate education is desirable. As mentioned above, an adaption of the e-learning success model of Holsapple and Lee-Post (2006) combined with Kirkpatrick's model and Laoledchai et al.'s (2008) model can be used as a basis. Whereas Kirkpatrick's model (1994, 1998) evaluates traditional training, Holsapple and Lee-Post's (2006) model concentrates on the design and delivery of the e-learning system and its net benefits. Laoledchai et al's (2008) approach of end-user training effectiveness focuses on different measurements of learning outcomes as well as the transfer of skills and capabilities learned to the work environment. In comparison to the models of Kirkpatrick (1994, 1998) and Holsapple and Lee-Post (2006) individual characteristics of the learner are included in Laoledchai et al's (2008) approach. In this way factors such as learning style, pre-motivation and −attitude are considered in the approach.

Limitations

The goal of this article is to get an overview of the current knowledge relating to learning effectiveness and efficiency of blended learning in corporate education of IS research. As a result the literature review focuses on the AIS Electronic Library. Literature outside is not considered. This can be regarded as a limitation. Further literature review of management and education research is desirable, including an expansion of search terms.

Conclusion and Future Research

The literature review offers only a few results for learning efficiency. Only one paper includes measurement indicators for learning efficiency and none of the findings analyses drivers of learning efficiency. Moreover, the results must be read carefully as some indicators can also be classified as a driver (e.g. content or instructor support). Ten measurements and 16 drivers for learning effectiveness are identified. Often holistic models are used for measurement such as Kirkpatrick's model (1994, 1998) or the e-learning success model of Holsapple and Lee-Post (2006), or a combination of measurements e.g. satisfaction and performance/learning outcome (Cao et al. 2005; Sridharan et al. 2010). Drivers of learning effectiveness are often examined in e-learning or traditional learning settings, or include in a comparison of them. Most of the research focuses on higher education. Only the approach of Laoledchai et al. (2008) can be arranged to the blended learning environment in corporate education. In general, drivers are often: human, learning design, management or technology categories.

In conclusion the results of the literature review indicate a need for further research. As the article is limited to the current knowledge of the AIS Electronic Library, further literature review including management and business education research should be done. Enhancing the literature review, additional measurements and drivers of learning efficiency and learning effectiveness could be identified. Besides the importance of the driver's impact on learning efficiency, learning effectiveness, should also be examined. The research of drivers in corporate education should especially stay in focus. As already mentioned in the discussion above the development of a blended learning success model which includes drivers and measurements for learning efficiency and learning effectiveness in corporate education is desirable. In order to have a holistic model, a combination of Holsapple and Lee-Post (2006), Kirkpatrick (1994, 1998) and Laoledchai et al.'s (2008) approach can be used as basis and adapted to the needs of blended learning in corporate education.

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