

Improving Transfer-of-Training with Learning Management Systems: Where We Are and Where We Should Be

Full paper

Sharif Amrou
University of Hamburg
sharif.amrou@uni-hamburg.de

Tilo Böhmann
University of Hamburg
tilo.boehmann@uni-hamburg.de

Abstract

Because of increased job requirements, workforce flexibility and lifelong learning, corporate training services have grown into a key approach for improving organizational performance. Transfer-of-training is a key output of these services, defined as the application and generalization of new competences at work acquired in training.

Today corporate trainings focus on blended learning by combining learning technologies and face-to-face scenarios. Despite the growing prevalence of blended learning, the extent of transfer-of-training support by IT-based learning management system solutions has not yet been sufficiently addressed in research.

We first evaluate to which extent the leading learning management system solutions provide support for transfer-of-training. We do so by building on evaluation criteria that have been developed in a process of theory-driven design and industry requirements. Based on the findings we propose areas for future research and development opportunities where evidence based design knowledge is needed to extend the capabilities of learning management systems.

Keywords

Corporate training services, transfer-of-training, technology enhanced learning, asynchronous virtual classroom, software product evaluation

Introduction

Changing job profiles and competencies are key drivers of the growing prevalence of knowledge-based work that leads to increasing participation in lifelong learning (Eurostat 2011). A key contributor to lifelong learning are corporate education services (Salas et al. 2012; Zolnowski et al. 2013). Given the substantial investment in Germany of € 28.6 billion for corporate trainings in 2010 (Seyda and Werner 2012), companies seek to ensure improved business performance following the training (Saks and Burke 2012). Research has shown that transfer-of-training is positively related to business performance, and therefore is a key output of corporate training services (Saks and Burke-Smalley 2014).

Transfer-of-training is generally understood as the effective application, generalization, and maintenance of knowledge, skills, and behavior by participants from the training to the work (Baldwin and Ford 1988). Studies show that there is a transfer-of-training problem, because only few of what was learned in training is effectively applied at work (Baldwin and Ford 1988; Saks and Belcourt 2006).

Apart from factors related to the intervention design, researchers have identified the learner characteristics as well as the work environment as critical determinants of transfer-of-training (Amrou et al. 2013; Saks and Burke 2012). The transfer-of-training determinant work environment subsumes factors related with the environment of the participants' workplace like transfer climate, peer and supervisor support, and opportunity to perform (Alvarez et al. 2004; Baldwin and Ford 1988; Burke and Hutchins 2007; Ford and Weissbein 1997). The work environment determinant is promising to improve the

transfer-related contextualization and collaboration of all human actors by IT support in corporate training services (Amrou et al. 2015).

Today training focuses on blended learning by combining technology enhanced learning and interactive face-to-face scenarios (Gribbins et al. 2007). Regardless of the expanding prevalence of blended learning in corporate training services, technology enhanced transfer-of-training has not yet been sufficiently addressed in research (Amrou et al. 2013; Bates 2005; Hoic-Bozic et al. 2009; Semmann et al. 2012). Today, learning management systems have become indispensable for supporting corporate training services (Bradstreet 2012; McCormack and Jones 1997). These tools are sometimes also called course management system, learning content management system, managed learning environment, learning support system or learning platform (Lonn and Teasley 2009; Martín-Blas and Serrano-Fernández 2009). One effective intervention to foster transfer-of-training is the use of field projects in which participants apply knowledge and skills acquired in the training to effect improvements in their work environment (Bell 2010; Lim 2000; Olivero et al. 1997). Field projects show how training becomes embedded in work context. From the perspective of IT support for transfer-of-training, managing training-related tasks and projects in a work context becomes a key requirement in order to leverage such a project-based approach for improving the effect of training on the job. This leads us to the following research questions:

- *To what extent do widely used learning management systems support transfer-of-training?*
- *What are future research and development areas to improve transfer-of-training with learning management systems?*

As many learning services are routinely supported by technology these days, we first study to which extent the most widely used learning management system also provides support for transfer-of-training. We do so by building on design knowledge of transfer-supporting IT components that have been developed in a process of theory-driven design and industry requirements (Amrou et al. 2015). In order to validate our findings, we also contrast learning management systems and the transfer-supporting IT components with the capabilities of a state-of-the-art project management system. Such a system is an alternative means for enhancing the conduct of training-related field projects in the work setting. Based on these analyses, we propose areas for future design-oriented research where evidence-based design knowledge is needed to extend the capabilities of learning management systems. The paper ends with a conclusion and limitation of the research.

Design Knowledge on Transfer-Supporting IT Components

According to Hevner et al. (2004) researchers should build on prior research for enhancing design knowledge. We do so by basing our transfer-related evaluation of learning management systems on design knowledge acquired in a design science project for designing transfer-supporting IT components (Amrou et al. 2015). This design research project adopted a theory-driven design approach as proposed by Briggs (2006), focusing on transfer-of-training as the output variable we intend to improve. Moreover, among the factors influencing transfer-of-training the design focuses on factors related to the work environment of the training participants. Figure 1 illustrates the cause and effect relationships underpinning the design of the transfer-supporting IT components.

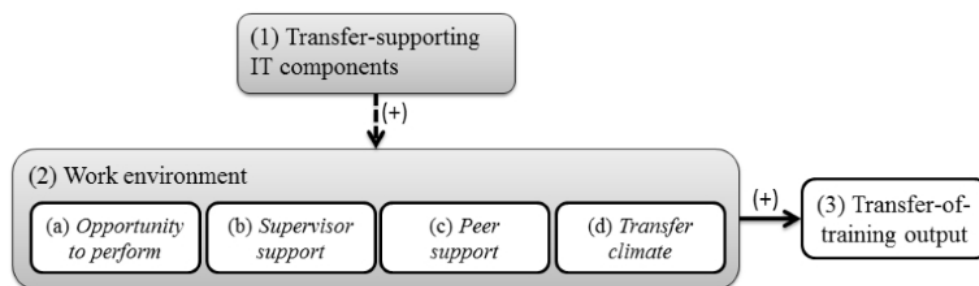


Figure 1: Cause and effect of transfer-supporting IT components (Amrou et al. 2015)

Beside this theory-driven design, expert interviews yielded industry requirements. Not surprisingly, the interviews revealed that it is necessary to closely link the training program to the participants' work, in

order to foster the application and generalization of new competences acquired in a corporate training service. Project-based business is becoming increasingly important these days (Ajmal et al. 2010) and the utilization of field projects is one promising post-training intervention to link the training program with the participants' work (Marsick 1990).

Participants are guided by the field project to apply and generalize new competencies acquired in a training program to improve their work (Bell 2010; Lim 2000; Olivero et al. 1997). To improve the effect of a training program on the job, transfer-supporting IT components should support such a project-based approach. More precisely, participants have to develop an improvement project for their work setting in the project-based approach that uses the competencies acquired in the training program. Once the formal training begins, participants have to capture relevant content, develop project proposals, and receive feedback as well as authorization by management stakeholders to start the project.

Table 1 provides an overview of the functions of the transfer-supporting IT components (C1-C4) and the corresponding factors of the transfer-of-training work environment determinant.

Work environment factors	Description of work environment factors	Functions of transfer-supporting IT components
Opportunity to perform (Figure 1, 2a)	Possibility to utilize training content and learnings in daily business (Brinkerhoff and Montesino 1995; Clarke 2002; Lim and Morris 2006).	Transfer journal (C1), knowledge assets for project (C2), project documentation (C2), project review and authorization (C3), regular traffic-light-report on improvement project (C4)
Supervisor Support (Figure 1., 2b)	Supervisor involvement in process of adapting training content in work environment (Brinkerhoff and Montesino 1995; Burke and Baldwin 1999; Clarke 2002; Sookhai and Budworth 2010).	KPIs (C2), milestones (C2), project documentation (C2), project review and authorization (C3), detailed feedback function (C3), regular feedback cycles (C3)
Peer Support (Figure 1., 2c)	Support of colleagues at training and work environment and of other learners at corporate training service (Chiaburu and Marinova 2005; Facticeau et al. 1995; Hawley and Barnard 2005).	KPIs (C2), milestones (C2), project documentation (C2), project review and authorization (C3), detailed feedback function (C3), regular feedback cycles (C3)
Transfer climate (Figure 1. 2d)	Circumstances at work environment, where learner has to utilize the training content. (Burke and Baldwin 1999; Kontoghiorghes 2001; Lim and Morris 2006; Mathieu et al. 1992; Tracey et al. 1995).	Responsive light weight web-based service, easy access to stakeholders, tracking of measureable improvements of improvement project (KPIs; C4)

Table 1: Relation between work environment factors and transfer-supporting IT components (Amrou et al. 2015)

The context of use of the transfer-supporting IT components prototype within our improvement project approach is illustrated in figure 2. In order to transfer the knowledge from the training to the work setting the trainer instructs participants during the training to capture new knowledge relevant to the specific work setting in a transfer journal (C1).

Participants develop initial improvement project ideas based on the knowledge that is captured in the transfer journal. Supervisors and trainers provide initial feedback to the project ideas and decide whether or not the project idea should be further developed. Based on accepted project ideas and the feedback, learners develop a project charter (C2) in which key aspects of the project are documented.

The resulting project charter serves as a basis for feedback and, possibly, as an agreement between all stakeholders (participant, supervisor, mentor and trainer) of the improvement project (Snyder 2013).

Throughout the improvement project supervisors and peers are encouraged to provide feedback on the specific projects (C3).

In order to be able to implement the improvement project within their work setting, participants develop a detailed project concept based on the project charter. The ongoing status of the improvement project and new insights of achieved improvements (e.g., key performance indicators) are reported to all stakeholders by the participants during the implementation. Furthermore, participants can ask for help related to the project following the training program (e.g., training content and methods). All stakeholders are encouraged to answer those questions and give feedback (C4).

The application of training content and performance improvements is finally assessed by a post-implementation review (C3). Every transfer-supporting IT component of the prototype should make it possible to insert object types like files (videos, pictures, etc.) and styled text.

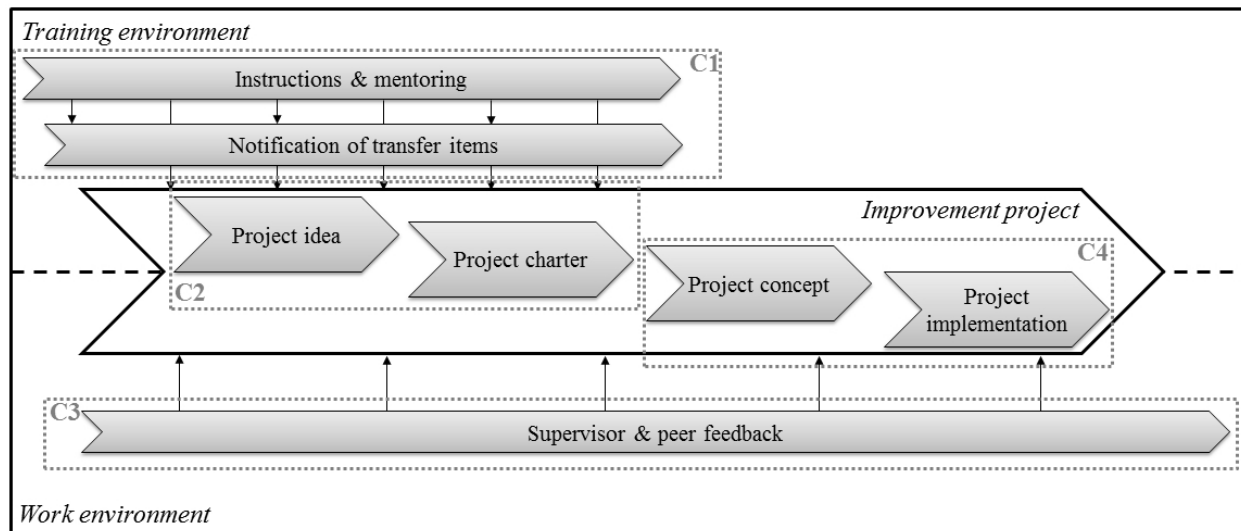


Figure 2: Context of use of transfer-supporting IT components (Amrou et al. 2015)

As of now, we concluded three formative evaluation iterations to improve the transfer-supporting IT components prototype. In the first iteration, blueprints of the transfer-supporting IT components were formatively evaluated in a workshop with four domain experts. In the second iteration, we evaluated mock-ups of the transfer-supporting IT components in a formative way during two independent expert workshops with four and two domain experts. In the third iteration, a partial prototype was formatively evaluated with both domain experts and participants. We conducted six in-depth interviews with program managers and trainers of corporate training services. Moreover, we presented the partial prototype to seven participants of a national corporate training service and collected their feedback in in-depth interviews. Based on the findings of the third formative iteration, we developed a fully functional prototype. Currently, this prototype is subjected to a summative evaluation that seeks to determine the usability and effectiveness of the transfer-supporting IT components.

For further information about the transfer-supporting IT components prototype we refer to Amrou et al. (2015) and Amrou et al. (2014).

Research Design

Our goal is to assess the extent to which software supports IT-supporting functions of transfer-of-training. We are primarily interested in learning management systems but add project management systems, because they could potentially support transfer-of-training, too. As a result, we evaluate (1) a learning management system, (2) a project management system, and (3) an existing prototype of the transfer-supporting IT components. The prototype has been implemented to evaluate the transfer-supporting IT components in a summative manner (Amrou et al. 2015) and serves as a controlling instance in this study.

Kumar et al. (2011) made a comparative study between leading learning management systems. Among others, architecture aspects respectively learning and support functions of the learning management systems are compared. According to the comparative study Desire2Learn (2015), Moodle (2015), ANGEL (2015) und Sakai (2015) feature the majority of learning functions. Desire2Learn, KEWL (2015), ANGEL, Moodle, Caroline (2015), OLAT (2015), and Sakai provide the most of the support functions. With respect to the results of the comparative study it can be emphasized that the learning management systems Desire2Learn, ANGEL, Moodle, and Sakai feature nearly every function that is conceivable today. Capterra (2014a) periodically creates a ranking of 20 learning management systems that is measured by a combination of their total number of customers, active users, and online presence. The last ranking was carried out in 2014. In this ranking, representatives of the four mentioned learning management systems are Desire2Learn (1100 customers, 15 billion users) and Moodle (87,084 customers, 73,753,035 users). Based on this ranking we choose Moodle as the learning management system evaluation candidate in this study.

In a study Cicibas et al. (2010) analyzed latest project management systems and compared these systems using a set of 17 criteria. Collaboration, project reporting, and web-based accessibility were criteria among others. According to the comparison, the project management systems Basecamp (2015), ArtemisViews (2015), Primavera (2015) as well as LiquidPlanner (2015) provide the majority of compared capabilities and a native web-based interface. In addition to a ranking of learning management systems, Capterra (2014b) periodically creates a ranking of 20 project management systems. This ranking is also measured by a combination of their total number of customers, active users, and online presence. Basecamp (285,000 customers, 15,000,000 users) is the only web-based project management system that is represented in the ranking. Therefore, due to the higher amount of customers and users we choose Basecamp as the web-based project management system evaluation candidate.

There are various approaches to evaluate software products (Baumgartner et al. 2004). Most prominent ones are criteria checklists, comparison groups and expert opinion. We adopt the criteria checklist approach by Scriven (1991). For this, we utilize the capabilities of transfer-supporting IT components as evaluation criteria. The functions of these transfer-supporting components represent design knowledge acquired by the researchers in a design research project (Amrou et al. 2015). We summarize the findings of this research in the above section (see table 1). Every function of a transfer-supporting IT component equals an evaluation criterion.

For each function of the transfer-supporting IT components we propose how each software product can be utilized to fulfill the functions required by transfer-supporting IT components. In order to comprehend how the evaluation candidates can be utilized for this purpose, we accessed free accessible demo instantiations of the evaluation candidates that are offered by the providers on their website. Furthermore, we analyzed the documentation of every candidate. Finally, we were able to assess to which extent the software products fulfill the required functions for supporting transfer-of-training. In case the software product fulfills the evaluation criterion without workaround the criterion is considered to be fully supported. If fulfilling the criterion only by applying a workaround the criterion considered to be partially supported. Based on the findings of the evaluation we derive and discuss research as well as development opportunities for learning management systems.

Findings

To study the extents of transfer-of-training support by learning management, transfer-supporting IT components are mapped to the evaluation candidates in table 2. As transfer-of-training can be fostered by work-embedded projects, we contrast our findings with an assessment of a project management system. Such a system could be an alternative for supporting field projects in the work environment. Furthermore, we describe how each evaluation candidate can be utilized to fulfill the evaluation criteria:

- **Fully supported:** evaluation candidate meets the criterion without workaround.
- **Partially supported:** evaluation candidate meets the criterion only by applying a workaround.
- **Not supported:** evaluation candidate does not meet the criterion.

The description of the evaluation candidate application and the rating for every corresponding transfer-supporting IT component function is described in table 2.

	Functions of components	(1) Learning Management System Moodle	(2) Project Management System Basecamp	(3) Transfer supporting components IT Prototype
C1	<i>Transfer Journal</i>	<p>Fully supported</p> <p>Provides feature to create a blog entry or assignment to capture transfer related content and methods. Both opportunities provide a comment function to give feedback.</p>	<p>Fully supported</p> <p>For each project a text document or message can be created to capture transfer related content and methods. Files can be uploaded and commented.</p>	<p>Fully supported</p> <p>Participants can note information out of the training within the project charter to connect their project ideas with the training content. A comment function for feedback is available.</p>
C2	<i>Knowledge Assets</i>	<p>Partially supported</p> <p>Files can be uploaded with private file base of the user, course file base, assignment or workflow. Reference to the project only with hyperlinks. No comment function in private file base.</p>	<p>Not supported</p> <p>Provides a file upload feature for each project. Every file can be commented. There is no central file base to provide course content.</p>	<p>Fully supported</p> <p>Knowledge assets can be created to give the opportunity to easily access and reference training materials related to the project from a central file base. Each knowledge asset can be commented.</p>
	<i>KPIs</i>	<p>Not supported</p> <p>KPIs can only be captured through text-editors or uploaded files. No tracking possible. Feedback possible.</p>	<p>Not supported</p> <p>KPIs can only be captured through text-editors or uploaded files. No tracking possible. Feedback possible.</p>	<p>Fully supported</p> <p>KPIs can be captured for each project. Tracking is possible through the project charter and overviews. A comment function to give feedback for each KPI is offered.</p>
	<i>Milestones</i>	<p>Partially supported</p> <p>Only by calendar feature of the course. No direct reference to the project. References have to be made by hyperlinks. Course calendar contains all milestones of all projects.</p>	<p>Fully supported</p> <p>Calendar feature for every project available to create milestones of a project. Each milestone can be commented to give feedback</p>	<p>Fully supported</p> <p>Milestones can be created and described within each project charter. Each milestone can be commented to give feedback.</p>
	<i>Project documentation</i>	<p>Partially supported</p> <p>Projects can be documented in a blog entry or assignment. Knowledge assets, KPIs, and other sections can be linked through hyperlinks.</p>	<p>Fully supported</p> <p>A project is a root item. Sections of the project can be created as text documents or messages. Every section can be commented.</p>	<p>Fully supported</p> <p>Projects are documented in the project charter. All sections are in a single overview. Each section can be commented to give feedback.</p>

	Functions of components	(1) Learning Management System Moodle	(2) Project Management System Basecamp	(3) Transfer supporting components IT Prototype
C3	<i>Project review and authorization</i>	<p>Partially supported</p> <p>Reviews of the project charter can be written as comments. Within the comment text the project can be declined or accepted. By accepting the project through the review participants get their authorization. The owner of the project charter can get a notification if he subscribes the comment area of the blog entry.</p>	<p>Partially supported</p> <p>Reviews of a project charter can be written as text documents or messages. Within the text document or message title a project can be accepted or declined. Email notifications can be used to inform the participant. Unfortunately, there is no fine graded notification system.</p>	<p>Fully supported</p> <p>Provides mechanisms to review a project charter. Decision (accept, decline) can be chosen within the review form. Project ideas as well as project charters can be accept or declined. Review decision is automatically set to the project. Actors can be invited to write reviews. The participant gets a notification by review completion.</p>
	<i>Detailed feedback function</i>	<p>Partially supported</p> <p>Each section of a project charter has to be captured within one blog entry or assignment to have this opportunity. Feedback can be made by the comment function of the blog entry. Navigation to each section is time-consuming.</p>	<p>Partially supported</p> <p>Every section has a comment section. Owners or interested users can subscribe for notification. Navigation to each section is time-consuming.</p>	<p>Fully supported</p> <p>Each section of a project charter has a comment area that can be directly reached. Owners or interested users can subscribe for notification.</p>
	<i>Regular feedback cycles</i>	<p>Partially supported</p> <p>Triggered through the calendar feature. Each project is manually linked to the event. Notifications if blog entries, calendar entries or assignments are commented. No overview.</p>	<p>Partially supported</p> <p>Each project has a calendar feature that can be utilized to ensure a regular feedback cycle. No overview. No central calendar to coordinate the feedback cycle.</p>	<p>Fully supported</p> <p>Regular feedback cycles are triggered through the generation configuration of a course. Feedback and review overview available. Notification can be subscribed.</p>

	Functions of components	(1) Learning Management System Moodle	(2) Project Management System Basecamp	(3) Transfer supporting components IT Prototype
C4	<i>Responsive light weight web-based service</i>	Partially supported Is responsive and web-based; due to a large amount of features not really light weight.	Fully supported Provides a responsive light weight web interface.	Fully supported Provides a responsive light weight web interface.
	<i>Easy access to stakeholders</i>	Partially supported Stakeholders of the project can be integrated within the course as users. Further contact information can be found in the user profile. References to projects only hardly traceable.	Partially supported Stakeholders of the project could be integrated. Only the owners can grant access to the project.	Fully supported Stakeholders of the project are integrated and referenced to each project charter. An overview of the referenced projects can be found in the user profile. Through a tag function competency of each user is visible.
	<i>Tracking of measureable improvements of improvement project</i>	Not supported Only text can be capture within text-editors or files. Due to this it is not possible to track automatically.	Not supported It is possible to capture improvements over a to-do list. It is not possible to track automatically.	Fully supported It is possible to capture measurable improvements. Tracking is possible for stakeholders.
	<i>Regular traffic-light-report on improvement project</i>	Partially supported Reports can be created with a blog entry or assignment. Trend and status can be captured within the text. The report dates can be set by the course calendar. Notification is possible. Monitoring through supervisors time consuming.	Partially supported It is possible to create reports through text documents or messages. Trend and status can be captured within the text of the report. Notification hardly possible. Monitoring through supervisors time-consuming.	Fully supported Reports can be created for each project charter. Trend and status of the report can be set. The report dates are visualized within the project charter and set for a course generation. Notification is possible. Monitoring through project list available.

Table 2: Mapping of transfer-supporting components to evaluation candidates

The mapping in table 2 indicates that learning management systems do not fully support the evaluation criteria of the transfer-supporting IT components. Knowledge assets (C2), milestones (C2) project documentation (C2), project review & authorization (C3), detailed feedback function (C3), regular feedback cycles (C3), responsive light weight web-based service (C4), easy access to stakeholders (C4), and regular traffic-light-report on improvement projects (C4) are only partially supported. KPIs (C2) and tracking of measureable improvements of improvement projects (C4) are not supported. The transfer journal (C1) is in fact the only evaluation criterion that is fully supported.

The findings indicate that the greatest challenge of learning management systems is to integrate improvement projects. This becomes particularly apparent, as there is a lack of interactive integration of elements of an improvement project like a project charter. Moreover, project review and navigation features are missing. Finally, an opportunity to track key performance indicators is also missing, due to

the fact that integer values cannot be captured. On the other hand, our findings reveal that learning management systems do have adequate capabilities to provide contextual training content and discussion functions. Hence, the learning level of the transfer-of-training proposed by Baldwin and Ford (1988) is supported. Unfortunately, this is not yet the case with regard to the transfer level.

Despite the growing prevalence of project-based business and lifelong learning, according to table 2 support for transfer-of-training by project management systems is not fully supported. Surprisingly, project management systems seem to provide more transfer-supporting IT components than learning management systems. In contrast to learning management systems milestones (C2), project documentation (C2), and responsive light weight web-based service (C4) is fully supported. However, they lack the integration of course material (knowledge assets, C2) and administration, the possibility to capture measureable improvements (C4), and the initiation of regular feedback cycles along with review cycles (C3). As a consequence, project management systems provide inadequate support for learning and transfer-of-training.

Discussion: Research & Development Opportunities for Learning Management Systems

Previous research reveals that improvement projects supported by transfer-supporting IT components are a promising approach to improve transfer-of-training (Amrou et al. 2015). The approach ensures that training content and support is utilized on the job and that the value of a corporate training service is explicated. The maturity of the approach is demonstrated through three formative evaluation iterations and the use in a strategic HR development program of a global manufacturing company. According to researchers, participants have to learn training content and methods in order to transfer them to the workplace (Baldwin and Ford 1988). A learning management system is a solution that handles all aspects of the learning process. Training content delivery, course administration, skills gap analysis, tracking and reporting of learning are provided by learning management systems (Gilhooly 2001). Hence, a learning management system is a perfect foundation for transfer-supporting IT components. As our findings reveal, too many workarounds are needed and functions are not supported yet to utilize transfer-supporting IT components in a learning management system.

The integrate of project support in learning management systems would ensure that training content and support is utilized on the job, just as transfer-supporting IT components do. In addition, value of a corporate training service would be explicated. The reflection of important training content in specific improvement projects would leverage the application of new competencies. Developed and documented transfer-related projects in a structured way would facilitate the easy integration of stakeholders. Furthermore, it would simplify to request and receive feedback from stakeholders and provide feedback to peers. In addition, the authorization of the improvement projects would be facilitated. The communication of the project status and improvements to supervisors and interested colleagues would enhance the peer and supervisor support. Finally, the training evaluation by the service provider and customer would be facilitated, to improve the training constantly.

To realize this opportunities learning management systems should provide functions to add adequate overviews of data, to structure content items as deeply as a project-based approach (work environment) requires, to reference owners and other roles to this content items, to subscribe notifications for every content item, to integrate object types like integers, to measure those integer values, to gather content items on a single page, to reference training content to activities of the project (work environment) and to create workflows in which these content items can be used (e.g. review). Taking this into consideration work environments could be created within learning management systems that are closely linked to the learning environment, just as transfer-of-training reveals (Baldwin and Ford 1988).

For historical reasons the majority of learning management systems utilize the asynchronous virtual classroom metaphor (Hiltz 1994; Papastergiou 2006). A system that integrates the virtual classroom metaphor provides opportunities for teaching and learning, beyond the physical limits of the traditional classroom walls (Hsu et al. 1999). In fact, features of a physical classroom have been transferred to a virtual classroom with improved features. A virtual classroom supports active learning by providing an environment with learning tools, learning materials, and opportunities for contextual discussion (Yang

and Liu 2007). Learning tools, materials, and discussions are structured throughout virtual classrooms and course-rooms, as it is also realized by Moodle (Frank-Voutsas 2012).

Our study indicates that a substantial obstacle to support transfer-of-training with learning management systems is the utilization of the virtual classroom design metaphor as a foundation. The extents to what learning management systems support transfer-supporting IT components and their utilization in a project-based approach demonstrates this substantial obstacle. It is not possible to integrate project support into a system that integrates the virtual classroom metaphor. The metaphor is limited to a flat structure of classrooms as well as courses. This unnecessarily restricts the scope of action by participants.

With respect to corporate training services companies seek to improve business performance following the training (Saks and Burke 2012) which is positively related to transfer-of-training and a key output of corporate training services (Saks and Burke-Smalley 2014). However, the participants are not located in a (virtual) classroom following the training, but rather back to the environment of their specific job. Hence, opportunities to integrate their specific improvement projects (or work environment) with learning content and tools in one virtual environment are required. This indicates that the design metaphor of learning management systems should not be limited to a virtual classroom or course-room. Hence, there is a need for a quest for a better design metaphor for learning management systems, to be able to improve transfer-of-training output with learning management systems.

Conclusion and Limitation

In the course of this paper we identified to what extent learning management systems and project management systems support transfer-of-training. To do so we evaluated how well identified software products of learning management systems and project management systems can be utilized to fulfill our evaluation criteria. Transfer-supporting IT components were utilized as the evaluation criteria that were developed in a process of theory-driven design and industry requirements.

Moodle was identified as the leading learning management system that provides the majority of functions, users and costumers. Moreover, we identified Bootcamp as the leading web-based project management system with the same characteristics. It is striking that project management systems support transfer-supporting IT components better than learning management systems do. In fact, both systems do not support all transfer-supporting IT components but learning management systems do provide must-have functions for learning such as the delivery of course material and administration. Hence, we recommend to utilize learning management systems as a foundation to develop transfer-supporting IT components.

Furthermore, we discussed research and development opportunities for learning management systems that were inspired by the findings of the evaluation. The findings indicate that particularly project management functions should be integrated into learning management systems to fully support transfer-supporting IT components. This recommendation is only limited to the project-based approach. There might be other approaches with different requirements. Therefore, we provided some development opportunities that are not limited to a single approach. Lastly, we identified that the asynchronous virtual classroom metaphor is a substantial obstacle of learning management systems. We recommend not to limit the design metaphor of learning management systems to a virtual classroom and ask for a quest for better design metaphor in future design research for learning management systems.

Nevertheless, there are specific software products available that are specialized to improve the transfer-of-training. Unfortunately, they are not open source and a request to evaluate the software was not answered. Therefore, we could not include these software products in this study. However, a study of the product websites indicate that the focus is more on the monitoring of qualification as well as training and less on the support of transfer-of-training related to the work environment. Furthermore, the components utilized as evaluation criteria aim to leverage the work environment but there are other determinants that can also affect transfer-of-training output.

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REFERENCES

- Ajmal, M., Helo, P., and Kekäle, T. 2010. "Critical Factors for Knowledge Management in Project Business," *Journal of Knowledge Management* (14:1), pp. 156-168.
- Alvarez, K., Salas, E., and Garofano, C. M. 2004. "An Integrated Model of Training Evaluation and Effectiveness," *Human Resource Development Review* (3:4), pp. 385-416.
- Amrou, S., Bitzer, P., Böhmman, T., Hirdes, E., Lehmann, K., Leimeister, J., Semmann, M., Wortmann, F., and Zülch, J. 2014. "Produktivitätssteigerung in Der Aus- Und Weiterbildung Durch Service Engineering (Produse)," in *Produktivität Von Dienstleistungen*, K. Möller and W. Schultze (eds.). Springer Fachmedien Wiesbaden, pp. 437-504.
- Amrou, S., Semmann, M., and Böhmman, T. 2013. "Managing for Transfer of Training: Directions for the Evolution of Learning Management Systems," in: *19th Americas Conference on Information Systems*. Chicago.
- Amrou, S., Semmann, M., and Böhmman, T. 2015. "Enhancing Transfer-of-Training for Corporate Training Services: Conceptualizing Transfer-Supporting It-Components with Theory-Driven Design.," in: *12th International Conference on Wirtschaftsinformatik*. Osnabrück.
- ANGEL. 2015. "Homepage of Angel Learning Management System." Retrieved 15th January, 2015, from http://www.angellearning.com/products/lms/whats_new_74.html
- ArtemisViews. 2015. "Homepage of Artemis Views Project Management System." Retrieved 15th January, 2015, from <http://www.aisc.com/views>
- Baldwin, T. T., and Ford, J. K. 1988. "Transfer of Training: A Review and Directions for Future Research," *Personnel Psychology* (41:1), pp. 63-105.
- Basecamp. 2015. "Homepage of Basecamp Project Management System." Retrieved 15th January, 2015, from <http://www.basecamp.com/>
- Bates, A. 2005. *Technology, E-Learning and Distance Education*. RoutledgeFalmer.
- Baumgartner, P., Häfele, H., and Maier-Häfele, K. 2004. *Content Management Systeme in E-Education: Auswahl, Potenziale Und Einsatzmöglichkeiten*. Studienverlag.
- Bell, S. 2010. "Project-Based Learning for the 21st Century: Skills for the Future," *The Clearing House: A Journal of Educational Strategies, Issues and Ideas* (83:2), pp. 39-43.
- Bradstreet. 2012. "2012 Training Industrie Report USA," *Training Magazin* (49:6), pp. 20-33.
- Briggs, R. O. 2006. "On Theory-Driven Design and Deployment of Collaboration Systems," *International Journal of Human-Computer Studies* (64:7), pp. 573-582.
- Brinkerhoff, R. O., and Montesino, M. U. 1995. "Partnerships for Training Transfer: Lessons from a Corporate Study," *Human Resource Development Quarterly* (6:3), pp. 263-274.
- Burke, L. A., and Baldwin, T. T. 1999. "Workforce Training Transfer: A Study of the Effect of Relapse Prevention Training and Transfer Climate," *Human Resource Management* (38:3), pp. 227-241.
- Burke, L. A., and Hutchins, H. M. 2007. "Training Transfer: An Integrative Literature Review," *Human resource development review* (6:3), pp. 263-296.
- Capterra. 2014a. "The Top 20 Most Popular Learning Management Systems." Retrieved 30th January 2015, from <http://www.capterra.com/learning-management-system-software/#infographic>
- Capterra. 2014b. "The Top 20 Most Popular Project Management Software." Retrieved 30th January 2015, from <http://www.capterra.com/project-management-software/#infographic>
- Caroline. 2015. "Homepage of Caroline Learning Management System." Retrieved 15th January, 2015, from <http://www.claroline.net/>
- Chiaburu, D. S., and Marinova, S. V. 2005. "What Predicts Skill Transfer? An Exploratory Study of Goal Orientation, Training Self-Efficacy and Organizational Supports," *International Journal of Training and Development* (9:2), pp. 110-123.
- Cicibas, H., Unal, O., and Demir, K. A. 2010. "A Comparison of Project Management Software Tools (Pmst)," *Proceedings of the 2010 International Conference on Software Engineering Research & Practice, SERP 2010, July 12-15, 2010, Las Vegas, Nevada, USA, 2 Volumes*, pp. 560-565.
- Clarke, N. 2002. "Job/Work Environment Factors Influencing Training Transfer within a Human Service Agency: Some Indicative Support for Baldwin and Ford's Transfer Climate Construct," *International Journal of Training and Development* (6:3), pp. 146-162.
- Desire2Learn. 2015. "Homepage of D2l Learning Management System." Retrieved 15th January, 2015, from <http://www.d2l.com/>
- Eurostat. 2011. *Europe in Figures - Eurostat Yearbook 2011: Education and Training*.

- Facteau, J. D., Dobbins, G. H., Russell, J. E., Ladd, R. T., and Kudisch, J. D. 1995. "The Influence of General Perceptions of the Training Environment on Pretraining Motivation and Perceived Training Transfer," *Journal of Management* (21:1), pp. 1-25.
- Ford, J. K., and Weissbein, D. A. 1997. "Transfer of Training: An Updated Review and Analysis," *Performance Improvement Quarterly* (10:2), pp. 22-41.
- Frank-Voutsas, G. 2012. "The Virtual Course-Room as a Complement to Face-to-Face Tuition," *Proceedings of the 1st Moodle Research Conference (MRC2012), Heraklion Crete-Greece*, pp. 14-15.
- Gilhooly, K. 2001. "Making E-Learning Effective," *Computerworld* (35:29), pp. 52-53.
- Gribbins, M. L., Hadidi, R., Urbaczewski, A., and Vician, C. 2007. "Technology-Enhanced Learning in Blended Learning Environments: A Report on Standard Practices," *Communications of the Association for Information Systems* (20:1), p. 46.
- Hawley, J. D., and Barnard, J. K. 2005. "Work Environment Characteristics and Implications for Training Transfer: A Case Study of the Nuclear Power Industry," *Human Resource Development International* (8:1), pp. 65-80.
- Hevner, A. R., March, S. T., Park, J., and Ram, S. 2004. "Design Science in Information Systems Research," *MIS quarterly* (28:1), pp. 75-105.
- Hiltz, S. R. 1994. *The Virtual Classroom: Learning without Limits Via Computer Networks*. Intellect Books.
- Hoic-Bozic, N., Mornar, V., and Boticki, I. 2009. "A Blended Learning Approach to Course Design and Implementation," *Education, IEEE Transactions on* (52:1), pp. 19-30.
- Hsu, S., Marques, O., Hamza, M. K., and Alhalabi, B. 1999. "How to Design a Virtual Classroom: 10 Easy Steps to Follow," *T.H.E. Journal* (27:2), pp. 96-98.
- KEWL. 2015. "Homepage of Knowledge Environment for Web Learning (Kewl) Learning Management System." Retrieved 15th January, 2015, from <http://kewl.uwc.ac.za/>
- Kontoghiorghes, C. 2001. "Factors Affecting Training Effectiveness in the Context of the Introduction of New Technology - a Us Case Study," *International Journal of Training and Development* (5:4), pp. 248-260.
- Kumar, S., Gankotiya, A. K., and Dutta, K. 2011. "A Comparative Study of Moodle with Other E-Learning Systems," *3rd International Conference on Electronics Computer Technology (ICECT) 2011: IEEE*, pp. 414-418.
- Lim, D. H. 2000. "Training Design Factors Influencing Transfer of Training to the Workplace within an International Context," *Journal of Vocational Education and Training* (52:2), pp. 243-258.
- Lim, D. H., and Morris, M. L. 2006. "Influence of Trainee Characteristics, Instructional Satisfaction, and Organizational Climate on Perceived Learning and Training Transfer," *Human Resource Development Quarterly* (17:1), pp. 85-115.
- LiquidPlanner. 2015. "Homepage of Liquid Planner Project Management System." Retrieved 15th January, 2015, from <http://www.liquidplanner.com/>
- Lonn, S., and Teasley, S. D. 2009. "Saving Time or Innovating Practice: Investigating Perceptions and Uses of Learning Management Systems," *Computers & Education* (53:3), pp. 686-694.
- Marsick, V. 1990. "Experience-Based Learning: Executive Learning Outside the Classroom," *Journal of Management Development* (9:4), pp. 50-60.
- Martín-Blas, T., and Serrano-Fernández, A. 2009. "The Role of New Technologies in the Learning Process: Moodle as a Teaching Tool in Physics," *Computers & Education* (52:1), pp. 35-44.
- Mathieu, J. E., Tannenbaum, S. I., and Salas, E. 1992. "Influences of Individual and Situational Characteristics on Measures of Training Effectiveness," *Academy of Management Journal* (35:4), pp. 828-847.
- McCormack, C., and Jones, D. 1997. *Building a Web-Based Education System*. John Wiley & Sons, Inc.
- Moodle. 2015. "Homepage of Moodle Learning Management System." Retrieved 15th January, 2015, from https://moodle.org/?lang=en_us
- OLAT. 2015. "Homepage of Olat Learning Management System." Retrieved 15th January, 2015, from <http://www.olat.org/>
- Olivero, G., Bane, K. D., and Kopelman, R. E. 1997. "Executive Coaching as a Transfer of Training Tool: Effects on Productivity in a Public Agency," *Public Personnel Management* (26:4), pp. 461-469.
- Papastergiou, M. 2006. "Course Management Systems as Tools for the Creation of Online Learning Environments: Evaluation from a Social Constructivist Perspective and Implications for Their Design," *International Journal on E-learning* (5:4), pp. 593-622.

- Primavera. 2015. "Homepage of Primavera Project Management System." Retrieved 15th January, 2015, from <http://www.oracle.com/de/applications/primavera/overview/index.html>
- Sakai. 2015. "Homepage of Sakai Learning Management System." Retrieved 15th January, 2015, from <https://sakaiproject.org/>
- Saks, A. M., and Belcourt, M. 2006. "An Investigation of Training Activities and Transfer of Training in Organizations," *Human Resource Management* (45:4), pp. 629-648.
- Saks, A. M., and Burke-Smalley, L. A. 2014. "Is Transfer of Training Related to Firm Performance?," *International Journal of Training and Development* (18:2), pp. 104-115.
- Saks, A. M., and Burke, L. A. 2012. "An Investigation into the Relationship between Training Evaluation and the Transfer of Training," *International Journal of Training and Development* (16:2), pp. 118-127.
- Salas, E., Tannenbaum, S. I., Kraiger, K., and Smith-Jentsch, K. A. 2012. "The Science of Training and Development in Organizations: What Matters in Practice," *Psychological science in the public interest* (13:2), pp. 74-101.
- Scriven, M. 1991. *Evaluation Thesaurus 4th Edition*. Sage Publications.
- Semmann, M., Amrou, S., and Böhmann, T. 2012. "Analysis of Learning Management Systems According to a Holistic View on Corporate Education Services," in: *Proceedings of SIGSVC Pre-ICIS Workshop 2012*.
- Seyda, S., and Werner, D. 2012. "Iw-Weiterbildungserhebung 2011–Gestiegenes Weiterbildungsvolumen Bei Konstanten Kosten," *Iw trends* (1), p. 2012.
- Snyder, C. S. 2013. *A User's Manual to the Pmbok Guide*. John Wiley & Sons.
- Sookhai, F., and Budworth, M. H. 2010. "The Trainee in Context: Examining the Relationship between Self-Efficacy and Transfer Climate for Transfer of Training," *Human Resource Development Quarterly* (21:3), pp. 257-272.
- Tracey, J. B., Tannenbaum, S. I., and Kavanagh, M. J. 1995. "Applying Trained Skills on the Job: The Importance of the Work Environment," *Journal of Applied Psychology* (80:2), p. 239.
- Yang, Z., and Liu, Q. 2007. "Research and Development of Web-Based Virtual Online Classroom," *Computers & education* (48:2), pp. 171-184.
- Zolnowski, A., Semmann, M., Amrou, S., and Böhmann, T. 2013. "Identifying Opportunities for Service Productivity Improvement Using a Business Model Lens," *The Service Industries Journal* (33:3-4), pp. 409-425.