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Evaluating the Quality of Technology-Mediated Learning Services

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EVALUATING THE QUALITY OF TECHNOLOGY-MEDIATED LEARNING SERVICES

Completed Research Paper

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Abstract

Technology-mediated Learning Services (TMLS) play an increasingly important role in the learning services industry. Despite the fact that the importance of a holistic evaluation of TMLS quality has been highlighted in the literature to derive transferable research results on multiple dimensions, it has not yet been examined. To address this gap, we first synthesize the existing insights on structure, recipients' predisposition, process and results quality of TMLS and develop a comprehensive approach to measure TMLS quality. Afterwards, we develop our research model and examine the importance of the different constructs of TMLS quality. We rely on findings in the body of literature, a focus group workshop and a card-sorting exercise to develop our TMLS quality model. Thereafter, we collect data from 163 participants of TMLS software-training to empirically evaluate our scale and research model. Our core results are a TMLS quality model, including a newly developed TMLS process dimension.

Keywords: Technology Mediated Learning, e-learning, quality, evaluation, service quality

Introduction

Arthur et al. (2003) identified the influence of technology in all learning scenarios, and referred to technology-mediated learning services (TMLS) as a major trend in education. The goal of TMLS is to integrate the strengths of synchronous (face-to-face) and asynchronous (IT-based) learning activities (Garrison and Kanuka 2004). TMLS will gain more importance and will lead to innovative, more individual, more resource-preserving ways of learning, e.g. micro-learning at the workplace or location-independent cloud-based learning (MBB 2011). According to Wainhouse Research (2007) the global market value of TMLS is expected to increase from \$802.8 million in 2007 to \$1.5 billion in 2011, for a compounded annual growth rate of 13%.

TMLS have many variations and are often a combination of the following learning modes: web-based or computer-based, asynchronous or synchronous, instructor-led or self-paced, individual-based or team-based (Gupta and Bostrom 2009). Despite its many advantages, such as reduced dropout rates (López-Pérez et al. 2011) or improved student achievements (Alonso et al. 2011; López-Pérez et al. 2011), TMLS pose several fundamental challenges: First and foremost, it still remains challenging for TMLS researchers to fully understand the effects of synchronous and asynchronous learning elements for specific TMLS learning scenarios and participants (Gupta and Bostrom 2009; Gupta et al. 2008). The variety and heterogeneity of research results lead to an inconclusive database regarding a systematic, effective, and efficient TMLS delivery which fosters resource-saving aspects of IT-use with potential learning success gains (Gupta et al. 2008; Lehtinen et al. 1999). The lack of transferable insights can be explained by the fact that many studies used input-output research designs that ignore critical aspects of the learning process (Gupta and Bostrom 2009). Consequently, without a systematic TMLS evaluation approach which considers relevant aspects for various dimensions, TMLS research provides little support for researchers and practitioners to face the increasing use of technology in TMLS, and still is not sufficient for the dynamic development in practice (Alavi and Leidner 2001; Sasidharan and Santhanam 2006). Therefore, a comprehensive view on TMLS including not only selected elements and its effects on the service results but also additionally the consideration of the learning process of TMLS additionally is essential.

Thereby, a systematic evaluation approach of TMLS quality supports the understanding of determinants of TMLS quality and effects on TMLS results (Grönroos and Ojasalo 2004; Parasuraman 2002). Although, e.g., the SERVQUAL approach (Parasuraman et al. 1985) gives general advice in terms of perceived service quality and its causes, it only provides superficial information, especially for complex services such as TMLS, since it ignores specific requirements in the evaluation of TMLS (Gupta and Bostrom 2009). Consequently, there is a research gap in terms of comprehensively explaining causal relationships within TMLS scenarios and to derive general, transferable advice for the design of TMLS scenarios (Alavi and Leidner 2001).

In order to achieve an understanding of formation of input, process factors and dimensions of TMLS results within various TMLS scenarios, TMLS research has to complete two tasks. First, it must investigate how a comprehensive TMLS quality model can be conceptualized (Gupta and Bostrom 2009). This involves consolidating results from the body of knowledge and complementing them with insights from TMLS experts. Second, the model should be investigated to acquire an understanding of the mechanisms of various dimensions of TMLS (Gupta and Bostrom 2009; Seth et al. 2005).

As a result, the objective of the study is to develop a comprehensive TMLS approach helping to investigate and evaluate effects between TMLS inputs and TMLS processes as well as TMLS results. In particular, we aim to answer the following research questions:

1. Which constructs and components have to be included in a comprehensive TMLS quality evaluation?
2. How strong is the impact of the different factors in a comprehensive evaluation of TMLS quality?

This paper aims at helping to solve both questions. On the one hand, we focus on at the development of a comprehensive TMLS evaluation scale, including a variety of dimensions which are, for the first time, simultaneously examined. In addition, the relationship between various constructs is examined, allowing deeper insight into causal construct connections. Furthermore, our study will help practitioners to evaluate TMLS scenarios comprehensively using a validated TMLS quality evaluation approach.

To achieve our desired goal, the remainder of this paper is structured as follows. First, we present the related work regarding research on service quality in general and TMLS quality in particular. Afterwards, we explain our research method, i.e. a literature review, a focus group workshop, a q-sort-application and finally the PLS approach which was applied in our main study. Consequently, we present our results, by explaining the developed constructs and components as well as our model, which are discussed in the following section. Next we elaborate our contribution to theory, the state of existing limitations and the future research agenda, before coming to our conclusion.

Theoretical Background

A Comprehensive Evaluation of TMLS Quality

Service quality has been described as a comparison between customer expectations with actual service provider performance: *Service quality is a measure of how well the service level delivered matches customer expectations. Delivering quality service means conforming to customer expectations on a consistent basis* (Lewis and Booms 1983). According to this understanding of service quality, various researchers developed approaches to operationalize the understanding of the service provider performance, identifying dimensions of service quality which have to be considered in the evaluation of the degree to which the customer expectations have been met (Grönroos 1984; Parasuraman et al. 1988). In this context, there has been additional research in the field of IT -supported services, considering additional IT relevant dimensions, e.g., preference towards traditional services or experience in using IT -based services (Zhu et al. 2002). Thereby, most of the proposed approaches claim suitability for a variety of services (Broderick and Vachirapornpuk 2002; Grönroos 1984; Parasuraman et al. 1988), partly differing between IT -services (Santos 2003; Zhu et al. 2002), and general service quality models (Grönroos 1984; Haywood-Farmer 1988; Parasuraman et al. 1988).

Most research approaches refer to SERVQUAL, a well-known and widely examined approach used to assess the quality of services (Ladhari 2009; Parasuraman et al. 1988). Researchers have emphasized SERVQUAL's diagnostic strength and its applicability for IT service scenarios (Jiang et al. 2002; Kettinger and Lee 1997; Ladhari 2009; Pitt et al. 1995). Nevertheless, difficulties have been experienced across different industries when using a single service quality measurement instrument (Van Dyke et al. 1997). Especially in the case of complex services, such as consulting or learning services, a service specific evaluation approach is recommended to cure existing shortcomings, i.e. too general dimensions of the service provider performance in combination with a too narrow focus on selected dimensions (Cuthbert 1996; Ladhari 2009; McLaughlin and Coffey 1990).

Multi-dimensional perspectives on services are well-known throughout the literature. Three dimensions are widely used to evaluate the quality of services: structure (Broderick and Vachirapornpuk 2002; Donabedian 1980), process (Broderick and Vachirapornpuk 2002; Donabedian 1980; Grönroos 1984) and outcome (Broderick and Vachirapornpuk 2002; Donabedian 1980; Grönroos 1984). These dimensions describe the potentials a service provider provides (structure), the process, which is determined by the interaction between service recipient and service provider (process), and the service results from a customer's perspective (outcome). As mentioned before, during the service process the integration of the customer into service provision and the consideration of the simultaneous production and consumption of services (uno-actu-principle) is necessary (Fitzsimmons and Fitzsimmons 2006). Hence, the service characteristics and service results are significantly determined by the service recipients predisposition (similar to the potentials of the service provider within the structure dimension) and his actions in the process. These individual differences in service recipients' predisposition play an especially important role for complex, person-oriented services (McLaughlin and Coffey 1990; Menschner et al. 2011). Therefore, a multi-dimensional evaluation approach is required to evaluate these services while taking the following dimensions into account (Broderick and Vachirapornpuk 2002; Donabedian 1980; Fitzsimmons and Fitzsimmons 2006):

1. Service recipients' predisposition (predisposition quality)
2. Service provider characteristics (structural quality)
3. Service process dimension (service process quality)

4. Service results (service results quality)

In this context, the structural quality determines the quality of the service process by means of the structural components used to prepare for the service provision, e.g. staff training, facility management (Grönroos 1984; Parasuraman et al. 1988). In addition, as outlined above, the appropriate integration of the customer into the service creation process plays a vital role for the quality of the service process (Broderick and Vachirapornpuk 2002; Fitzsimmons and Fitzsimmons 2006). This is particularly true for knowledge intensive person oriented services, such as TMLS, where the structural quality is significantly influenced by the service recipients' predispositions (Baehr 2012; Gupta et al. 2008; Menschner et al. 2011), e.g. by their attitudes toward technology (Van Der Rhee et al. 2007), or by their abilities to organize their learning activities (Colquitt et al. 2000). Therefore, we hypothesize that the predisposition of the service recipient as well as the structural quality determines the TMLS process:

H1: High predisposition quality has a positive impact on the quality of the TMLS process.

H2: High structural quality has a positive impact on the quality of the TMLS process.

At the same time, the structural components have shown to have an influence on the direct service results quality, i.e. learning success and satisfaction (Kirkpatrick and Kirkpatrick 2005). Components like the physical facilities (Haywood-Farmer 1988), the design of the IT-tools (Kim et al. 2011; Santos 2003) and the learning materials (Broderick and Vachirapornpuk 2002; Ozkan and Koseler 2009a) have been proven to have an influence on the TMLS results. In addition, the predisposition quality is known to have a strong effect on TMLS success. Factors such as expectations (Zeithaml et al. 1991) influence satisfaction, and are fundamental for the comparison of actual service delivery and expected service delivery. Moreover, factors such as cognition and motivation are known for their positive influence on learning success (Pintrich and De Groot 1990). Therefore, we derive further hypotheses:

H3: High predisposition quality has a positive impact on the learning success.

H4: High predisposition quality has a positive impact on the satisfaction.

H5: High structural quality has a positive impact on the learning success.

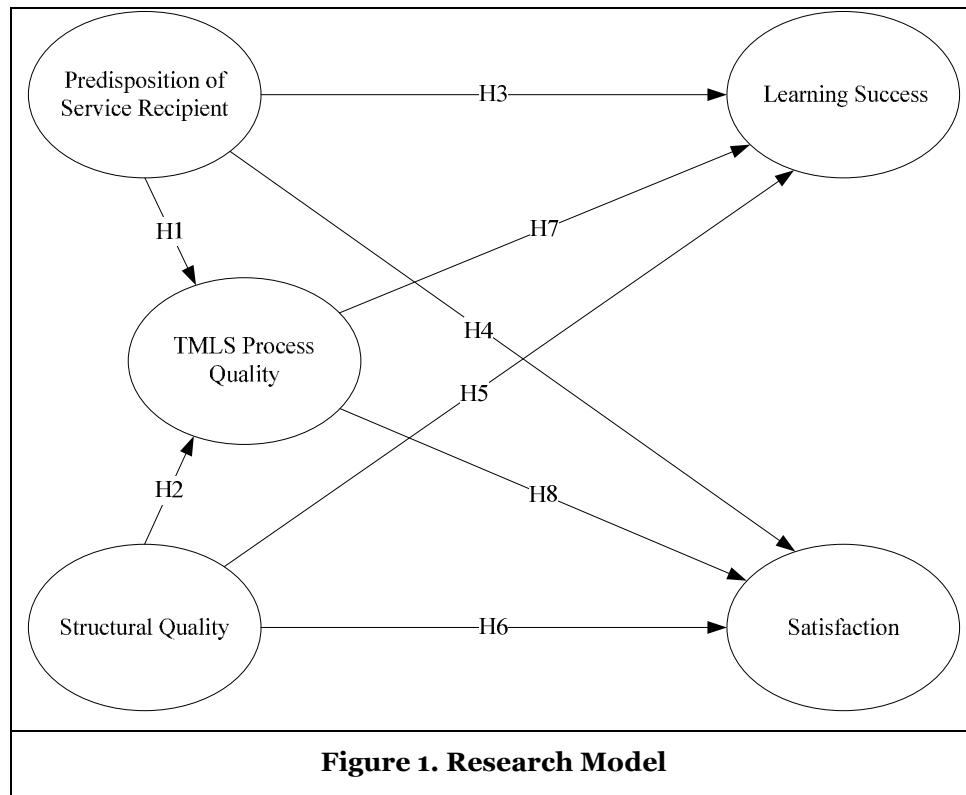
H6: High structural quality has a positive impact on the satisfaction.

Moreover, we assume, in accordance with findings in service science, that service result quality is significantly determined by the service process quality, i.e. the interaction between structural quality and the service recipient (Shostack 1987; Zeithaml et al. 1988). The service process determines the service result quality by means of the adaption of the service concept in alignment with the desires (Spreng and Mackoy 1996), characteristics (Bolton and Drew 1991) and expectations of the service customer (Frost and Kumar 2000; Spreng and Mackoy 1996). Again, this is especially true for knowledge-intensive person-oriented services such as TMLS, since learning is known to happen sequentially within a process (Cranton 1994) in which various phases are known, e.g., cognition, action and autonomous phases (Willingham 1998), which have to be considered and supported by the TMLS provider. Therefore, the prepared structural elements, e.g. learning materials and the training concept, have to be adapted during the process by the service provider (Gupta and Bostrom 2009). Therefore, we are assuming the same for the case of TMLS: Therefore, we derive the following hypotheses:

H7: High TMLS process quality has a positive impact on the learning success of the TMLS service recipient.

H8: High TMLS process quality has a positive impact on the satisfaction of the TMLS service recipient.

To sum up, we derived eight hypotheses (see Figure 1 for a graphical illustration of our research model), aiming at the identification of causal relationship between four service dimensions, which were derived from service science and TMLS research. In the following section we present recent research which was conducted on components of TMLS.



Components of TMLS Quality

From the structural quality perspective, various aspects have been used to describe the structural potential for the TMLS provision. The IT system quality of the trained software and the applied E-learning-tools determines the service process quality and the corresponding service result quality (Delone and McLean 2003; Lin 2007b; Petter et al. 2008). Moreover, the information quality, respectively the quality of the learning materials determines the service result quality (Antonis et al. 2011; DeLone and McLean 1992; Ozkan and Koseler 2009a; Petter et al. 2008; Rasch and Schnotz 2009). Furthermore, the trainer characteristics can be separated into the following aspects. First, the didactical competence of the trainer can be considered as an important determinant for TMLS success (Arbaugh 2001; Kim et al. 2011). Furthermore, the professional competence influences TMLS (Jacobs et al. 2011; Ozkan and Koseler 2009b; Schank 2005). Additionally, analogous to the findings of the SERVQUAL approach (Parasuraman et al. 1985; Seth et al. 2005), social skills, such as empathy (Ladhari 2009; Parasuraman et al. 1988) or attitude towards the students (Choi et al. 2007) play a decisive role in TMLS scenarios. Finally, the learning environment, i.e., the class room or the virtual learning environment, have to be considered for a comprehensive TMLS evaluation. Parasuraman (1988) identifies the component “tangibles”, describing the physical environment of services. In addition, the aspect has been extended to key features and design features of IT -components (Benlian et al. 2011; Ma et al. 2005).

In the field of TMLS, a varying amount of research was conducted within the various dimensions. The service recipient predispositions has been intensively examined since TMLS are knowledge-intensive person-oriented services, which are characterized by a high degree of customer integration and are bound to persons or personal knowledge (Apte and Mason 1995; Menschner et al. 2011). Therefore, in contrast to standardized services, such as fast food services, the recipient’s characteristics significantly determine the TMLS process and its result (Gupta et al. 2008; Pintrich and De Groot 1990). Learner characteristics, such as (meta)-cognition (Pintrich and De Groot 1990), motivation (Colquitt et al. 2000; Pintrich and De Groot 1990), self-efficacy / learning management (Colquitt et al. 2000; Tannenbaum et al. 1991), and

technology readiness (Celik and Yesilyurt 2013; Keramati et al. 2011; Parasuraman 2000; Van Der Rhee et al. 2007) play an important role for the TMLS process and result (Gupta et al. 2008).

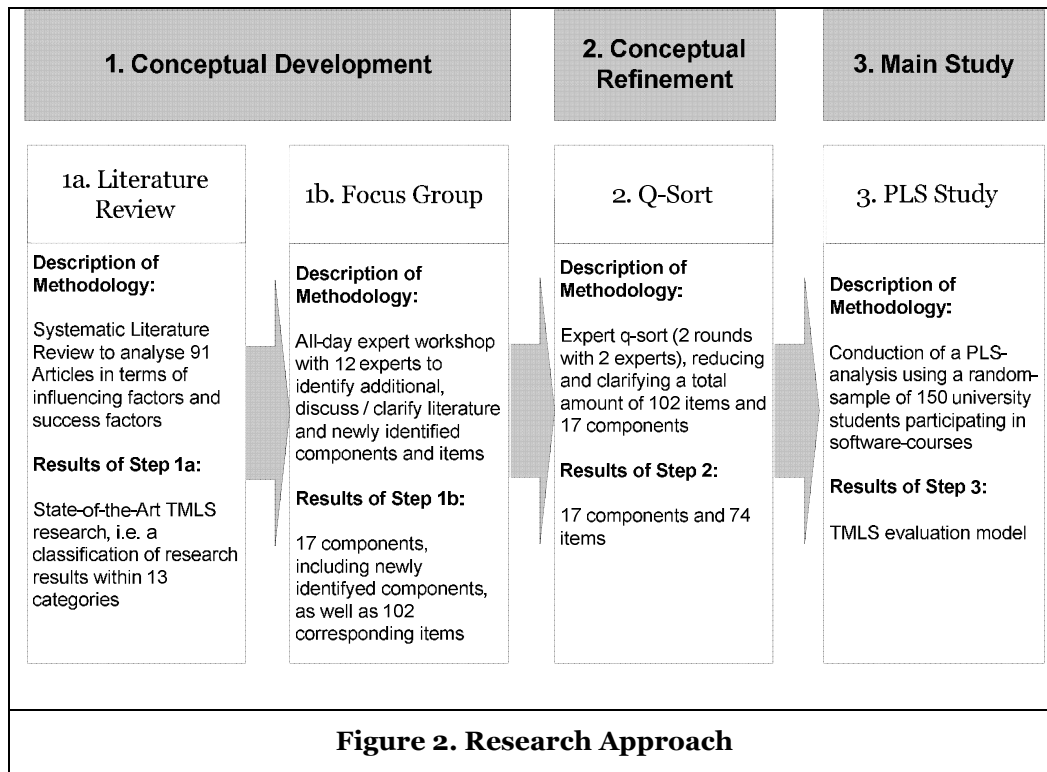
So far, not much research can be found which focuses specifically on the TMLS process. To the best of our knowledge, interactivity is the only, process specific component which has under research for several decades. Interactivity, such as participant interaction, recipient-lecturer-interaction and recipient-IT-interaction (Evans and Gibbons 2007; Sims 2003; Smith and Woody 2000; Thurmond and Wambach 2004), have been widely examined and can be considered as an important determinant of TMLS success.

Finally, plenty of research results focusing on the service results quality dimension exist. Kirkpatrick (2005) suggested the use of four learning dimensions: (1) reaction, describes the emotional reaction to the course, (2) learning, describes the learning success, (3) application of knowledge, describes the actual usage of the knowledge in the real world, and (4) company success, describes effects within the company caused by the knowledge of the course participant. The most common measure for (1) reaction is satisfaction, one of the frequent measures for TMLS evaluation (Alonso et al. 2011; Arbaugh 2001; Johnson et al. 2009). Another frequent measure which is examined is (2) learning success, often called course performance (Arbaugh 2001; Benbunan-Fich and Arbaugh 2006; Hiltz et al. 2000; Santhanam et al. 2008). Several authors include (3) application of knowledge (Hansen 2008; Sousa et al. 2010) while only a few consider (4) business effects of training (Aragon-Sanchez et al. 2003; Reber and Wallin 1984).

To sum up, the TMLS process dimension has hardly received attention in most studies in that research area. Especially transfer efficiency, in terms of a faster and efficient way of working, and effects on retention seems to be highly relevant for measuring the productivity of TMLS. User satisfaction, even with the use of IT systems and system usability, is a pivotal factor for the IS success (Wang et al. 2007); but the discussion in recent relevant literature is rare and not substantial enough for TMLS process evaluation.

Evaluating TMLS Quality

Analogous to established scale development and validity guidelines (Churchill Jr 1979; Hinkin 1998; Straub 1989) we conducted a three-step process: (1) conceptual development, (2) conceptual refinement and (3) main study. Thereby, we employ the plurality of methods, such as (1a) literature review and (1b) focus group research for the conceptual development of our model. Next we completed a conceptual refinement, applying the (2) q-sort method. Last, we carried a (3) PLS-study. The research approach is shown in Figure 2.



Step 1: Conceptual Development and Initial Item Pool Generation

In a first step, we identified articles and according results regarding influencing factors of non-IT -related and IT -related learning scenarios for the four service dimensions structure, predisposition, potential and results . In preparation for the latter quantitative study, we began with an extensive literature review (anonymous) examining articles from various disciplines, i.e. information systems, psychology, pedagogy and service science, all published from 2001 to 2011. To avoid a restriction of our results solely to IT -related studies, we considered studies of IT- and non-IT -supported learning scenarios of varying contents such as business, engineering, informatics or mathematics. Based on a total of 91 articles published in academic journals, we identified influencing and success factors for the four before mentioned dimensions in 13 categories. Some examples include media and infrastructure, learning methods and service quality, recipients' motivation or cognition. The results showed that most studies analyze the impact of a certain type of educational service empirically by means of surveys and structural equation modeling. No predominant theoretical basis of the reviewed studies could be identified. Therefore, we decided to develop a comprehensive TMLS evaluation approach from the start, including a systematic approach to evaluate the TMLS High predisposition quality. We then included the initial set of results into a focus group workshop to consolidate and validate the corresponding results.

In a next step, a subject-matter expert focus group workshop was conducted, within an eight hour setting with twelve subject-matter experts. The recipients were lecturers with an educational background with a minimum of eight years of working experience. Following the focus-group design approach by Frey and Fontana (1991) we designed the focus group, while taking data-related design requirements, interviewer, and group characteristics into account. Returning to the results of the literature review presented before, a conceptual model for TMLS evaluation was derived, including a set of possible items and categories. The focus group findings are the exploratory groundwork to add upon literature findings for the quantitative evaluation and improvement (Miles and Huberman 1994)

In accordance with Kolfshoten et al. (2006) experts were invited to brainstorm influencing factors and output factors in an initial brainstorming session, which was followed by an organizational activity based

on the expert and the literature results that aimed, to clarify the existing influencing factors and finally organize the results in according dimensions. Thereby, an initial conceptual model could be developed, comprising a total of 17 construct and a total of 102 corresponding items. In the following table, the identified, components are presented and defined.

Table 1. Structural Quality			
No.	Component	Description	Source
1	Trainer Characteristics	Trainer characteristics such as professional competence, didactical competence and social competence	(Arbaugh 2001; Kim et al. 2011; Parasuraman et al. 1988)
2	Learning Environment	Describe the offline and online environment of the TMLS	(Ma et al. 2005; Parasuraman et al. 1988)
3	IT –System Quality	The quality of the provided IT-systems	(Delone and McLean 2003)
4	Learning Materials	The information quality of the learning materials	(Delone and McLean 2003)

Table 1 shows the resulting components for the structural quality . The components were published in literature and were accepted by the experts. The component “trainer characteristics” comprises aspects such as didactical competence, professional competence and social competence.

Table 2. Service Recipient			
No.	Component	Description	Source
5	(Previous-) Knowledge	Knowledge regarding the course content	Focus Group
6	Motivation	Motivation of the recipients	(Colquitt et al. 2000)
7	Technology Readiness	Attitude towards technology of the recipients	(Parasuraman 2000)
8	Self-regulated learning	Recipients’ capability to organize their own learning activities	(Colquitt et al. 2000)
9	Expectations	Recipients’ expectation towards the course	Focus Group

Table 2 shows the resulting components for the service recipients. In the literature we formerly identified cognition as a component. Within the focus group setting, the component was changed into “(Pre-) Knowledge”, since the recipients expected it to be a more relevant aspect of the service recipient . Moreover, the recipients’ expectations were identified as an important factor for the TMLS evaluation.

Table 3. Service Process Quality			
No.	Component	Description	Source
10	Interactivity	Interactivity during the course, online and offline	(Siau et al. 2006)
11	IT-Process Support	Helpfulness of the applied IT-tools in terms of communication- and learning-support during the	Focus Group

		process	
12	Learning Group	Characteristics of the learning group such as homogeneity of knowledge, expectations or mutual support	Focus Group
13	Quality of Exercises	Quality of the exercises in terms of helpfulness, didactical appropriateness and understandability	Focus Group
14	Transparency of the Training Process	Traceability of the course procedure, upcoming process activities and corresponding learning goals	Focus Group
15	Fit	Overall fit of the course design for the recipients characteristics and expectations	Focus Group

Table 3 shows the resulting components for the service process quality. As outlined in the Related Work section, little research could be found to evaluate the TMLS process. Therefore, five additional components were identified and defined, grounded on the preliminary conceptual work of Gupta and Bostrom (2009).

Table 4. Service Results Quality			
No.	Component	Description	Source
16	Satisfaction	Service recipient satisfaction	(Arbaugh 2001)
17	Learning Success	Service recipient knowledge gain	(Arbaugh 2001)

Table 4 shows the resulting components for the service results quality. In this case, no changes were suggested during the focus group workshop.

Step 2: Conceptual Refinement and Item Modification

Next, we applied the Q-sort-method to ensure reliability and construct validity of the questionnaire items (Nahm et al. 2002). Thereby, four judges with more than 4 years of experience in TMLS were asked to sort every item into the identified components, in order to improve the items and components comprehensibility and clearness. Each judge was presented with the components, corresponding definitions and a bucket of randomly sorted items printed on small notes. The judges had to assign each note individually to one of the components; alternatively, in case of doubt, notes were sorted into an “unclear” bucket. The judges were interviewed as to why they were unsure about certain items and the feedback was collected. First, two judges were asked to sort the items, collecting their feedback and improving the questionnaire. Next, another two judges were asked to conduct the q-sort. After this procedure was completed, Cohen’s Kappa, a measure of agreement, exceeded 0.76, representing an excellent degree of agreement beyond chance (Landis and Koch, 1977). Moreover, the total hit ratio was used to identify potential problem component areas (Moore and Benbasat, 1991). Finally, we were able to eliminate a total of 28 items that at least 3 of the judges claimed to be irrelevant or unclear. Moreover, we clarified another 9 items in terms of wording precision. As a consequence, the 17 components comprised a total amount of 74 items.

Step 3: Main Study and Validity Testing

The results from Step1 and Step2 served as a fundament for the model testing (cp. Fig 2) that was carried out, in accordance with the PLS approach. To operationalize the results of the first two steps in terms of empirical measurement, we decided to rely on reflective first-order, formative second-order measurement models for the structural and process dimension of TMLS quality, and on reflective measurement models for the two TMLS results, satisfaction and learning success. In order to evaluate our research model (cp

Figure 1), we conducted a web-based questionnaire among students who recently participated in at least one software training. By means of a web-based questionnaire, we account for the fact that participants of software training are usually faced with several questionnaires, e.g., regarding their satisfaction with the trainer, the course, and so on. Consequently, the willingness to complete another questionnaire during the course is comparably low, and an ex-post assessment using a web-based approach seems to be a better approach in terms of response rate and data quality. It took the participants about 20 minutes to complete the questionnaire. Responses were recorded on a bipolar 5-point Likert response format, with the endpoints labeled as “extremely disagree” and “extremely agree”. Further, the participants could choose “I do not know” when they did not want to rate a statement. To achieve high quality results, we implemented several reverse coded items, and checked all cases regarding the consistency of answers given to the items relevant for our data analysis and the reverse coded control items. In total, we gathered 163 complete data sets that could be used for our evaluation. The participants were on average 24.67 years of age, 52 of them were females and more than 100 of them were business students. We decided to use the PLS approach (Chin 1998a) to analyze our data, since the PLS algorithm is better suited to analyze models including formative indicators (Chin and Newsted 1999; Ringle et al. 2012). We used SmartPLS 2.0 (Ringle et al. 2005) and SPSS 20 as the tools for our analysis. To model the reflective first-order, formative second-order measurement models in the SmartPLS software, we followed the approach of Wang et al. (2005), and computed the factor scores of each reflective first-order construct, and used the factor scores as formative indicators for the second-order constructs. We then built common formative measurement models in PLS using the mean scores of each dimension as formative indicators.

Recently, a number of researchers have brought up the problem of common method variance in behavioral research (Podsakoff et al. 2003; Sharma et al. 2009). These publications point out that a significant amount of variance explained in a model is attributed to the measurement method rather than to the constructs the measures represent ((Podsakoff et al. 2003). In extreme cases, even more than 50% of the explained variance can result from common method variance (Sharma et al. 2009). Due to the fact that we used only one data source and gathered the data for the exogenous and endogenous constructs from the same participants, our study could have been affected by common method variance (Podsakoff et al. 2003). To account for this problem, we followed the guidelines of Podsakoff et al. (2003), and used procedural as well as statistical remedies to reduce and assess the probability that the common method variance impacts our results. Regarding the procedural remedies, we first assured anonymity to the participants by explicitly stating in the introduction of the questionnaire that all answers would be anonymous, and no relationship between any answers and a participant would be established. Second, the introduction also stated that there are no right or wrong answers, emphasizing that we were interested in the participants' honest opinion. Third, we provided verbal labels for the extreme points and the midpoints of the scales. Fourth, we developed a cover story for the questionnaire, in order to make it appear to the participants that the exogenous and endogenous constructs were not connected. Regarding the statistical remedies, we conducted the Harman' single factor test, and extracted four factors with an eigenvalue greater than 1. In this test, all indicators are included in an exploratory factor analysis, and the result is crucial regarding the existence of common method variance, if only a single factor emerges or if one general factor emerges accounting for the majority of covariance among the indicators. According to this test, due to the fact that three factors with an Eigenvalue higher than 1 could be extracted in our analysis, according to this test, common method variance is not a problem in our study (Podsakoff et al. 2003).

Results

Due to the fact that we used reflective and formative measurement models, and that both need to be evaluated using different quality criteria (Chin 1998b), we separately assess the quality of the reflective and formative measurement models. Beginning with the evaluation of the reflective measurement models, we first checked the composite reliability (ρ_c) and the cross-loadings for the single indicators of the reflective measurement models. The results regarding these two quality criteria show that all loadings are higher than 0.78 (should be above 0.707), and every indicator has the highest loading on its desired construct (the highest cross-loading value is 0.5873 and thus below the lowest indicator loading). The composite reliability for all constructs is higher than 0.85 (should be above 0.707). Therefore, the reflective measurement models fulfill these two quality criteria (Chin 1998b). Next, we evaluated the

Average Variance Extracted (AVE) for each construct, and the correlation among all reflective constructs. Since the AVE for all constructs is higher than 0.66 (should be above 0.5), and the AVE for each construct is higher than any correlation with another construct (the correlation between learning success and satisfaction is 0.6038, and, thus, below the lowest AVE), the reflective measurement models also fulfill these two quality criteria (Chin 1998b).

After having shown that the reflective measurement models fulfill the desired quality criteria, we shift our focus to the evaluation of the formative measurement models. For this evaluation, we rely on the six guidelines for evaluating formative measurement models presented by Cenfetelli and Bassellier (2009); a summary of the key indicators is presented in Table 5.

Table 5. VIF, Factor Weights, p-value and Factor Loadings for the Indicators of the Formative Measurement Model.					
Construct	Indicator	VIF	Factor Weights	p-value	Factor Loadings
Provider Characteristics	Trainer Characteristics	1.992	0.486	< 0.001	
	Learning Environment Quality	1.571	0.053	n.s.	0.4319
	IT System Quality	2.310	0.134	n.s.	0.4997
	Learning materials quality	2.962	0.577	< 0.001	
Recipient Predisposition	(Previous-) Knowledge	1.065	-0.151	n.s.	0.2047
	Motivation	1.374	0.784	< 0.001	
	Technology Readiness	1.418	0.182	n.s.	0.6250
	Self-regulated Learning	1.228	0.203	< 0.05	
	Expectations	1.156	0.042	n.s.	0.3608
Process Quality	Interactivity	1.980	0.042	n.s.	0.3708
	IT Process Support	1.407	0.195	< 0.001	
	Learning Group	1.322	0.169	< 0.01	
	Quality of Exercises	3.289	0.281	< 0.001	
	Transparency	2.724	0.377	< 0.001	
	Fit	1.493	0.296	< 0.001	

According to the first guideline, we checked for multicollinearity by computing the Variance Inflation Factor (VIF). The results indicate that multicollinearity is not a problem in our study because the highest VIF value (3.289) is below the limit of 3.33 (Diamantopoulos and Siguaaw 2006).

In their second guideline, Cenfetelli and Bassellier (2009) state that a large number of indicators will cause many non-significant weights. We observed some non-significant weights (at the level of 0.05, marked with "n.s." in Table 5). However, their inclusion is based upon theory and expert suggestions, and we decided not to drop any indicators. This decision is based on the argument that this is the first study aiming to comprehensively assess TMLS quality, and it should be checked whether this lack of significance was observed in different studies before questioning the relevance of these indicators (Cenfetelli and Bassellier 2009).

The third guideline deals with the co-occurrence of positive and negative weights. Due to the fact that the only indicator with a negative weight was not found to be significant, there was no need to worry about this point in our study (Cenfetelli and Bassellier 2009).

Guideline four suggests that researchers should check the indicator loadings when observing indicators that have a low indicator weight. As a reason, Cenfetelli and Bassellier (2009) point out that the indicator could have only a small formative impact on the construct (shown by a low weight), but it still could be an important part of the construct (shown by a high loading). If this is the case, the indicator is important and should be included in the measurement model (Cenfetelli and Bassellier 2009). Chin (1998b) stipulates that a loading of 0.5 is weak but still acceptable. Checking the results presented in Table 5, we can see that most loadings of the indicators with non-significant weights are below this threshold. The indicator *Technology Readiness* is the only one showing a loading above the threshold ($0.6250 > 0.5$), the indicator *IT System Quality* shows a loading comparably high as that of the threshold (0.4997). The remaining four, non-significant indicator all show loadings below the threshold with (0.4319 is the highest loading among the four indicators). Nevertheless, since this is the first study of this kind, and the inclusion of all indicators is based on a solid theoretical basis and expert suggestions, we follow Cenfetelli and Bassellier's (2009) advice and choose to not drop the indicator. However, the observation that four indicators show a non-significant weight and a low loading challenges the theoretical basis, and, if similar results can be observed in future studies, the indicator should be dropped. Moreover, the suitability of the theoretical basis suggesting this particular relationship should be investigated.

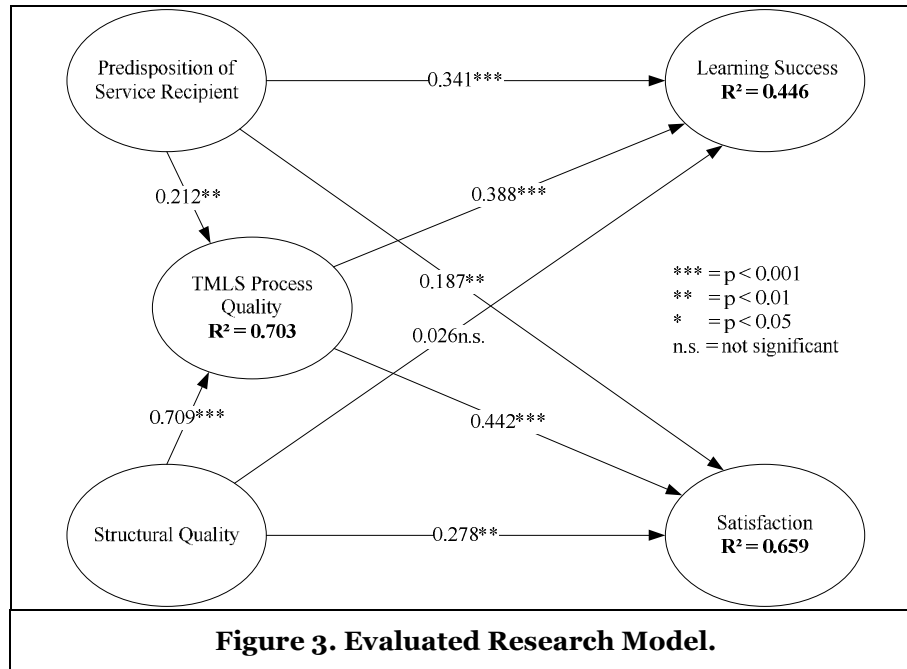
In the fifth guideline, Cenfetelli and Bassellier (2009) recommend testing for nomological network effects and construct portability. They suggest comparing the factor weights of the indicators across different studies. Due to the fact that, to the best of our knowledge, ours is the first study following a comprehensible approach to evaluate TMLS quality, a comparison of factor weights across different studies is not possible.

The sixth guideline cautions that the indicator weights can be slightly inflated when using the PLS technique (Cenfetelli and Bassellier 2009). We used the PLS technique, and it therefore represents a limitation in our study.

In sum, the evaluation of our formative measurement models shows that the formative measurement models fulfill the requirements posed by the guidelines of Cenfetelli and Bassellier (2009). Thus, we can now confidently move on to the evaluation of our hypotheses (see Table 6 for a structured evaluation).

Table 6. Evaluation of the Hypotheses.					
	Hypotheses	Supported / not supported	Path coefficient	t-value	p-value
H1	High predisposition quality has a positive impact on the quality of the TMLS process.	Supported	0.212	3.269	< 0.01
H2	The structural quality has a positive impact on the quality of the TMLS process.	Supported	0.709	12.752	< 0.001
H3	High predisposition quality has a positive impact on the learning success.	Supported	0.341	3.821	< 0.001
H4	High predisposition quality has a positive impact on the satisfaction.	Supported	0.187	2.992	< 0.01
H5	The structural quality has a positive impact on the learning success.	Not supported	0.026	0.256	n.s.
H6	The structural quality has a positive impact on the satisfaction.	Supported	0.278	2.978	< 0.01
H7	The TMLS process quality has a positive impact on the learning success of the TMLS service recipient.	Supported	0.388	3.092	< 0.01
H8	The TMLS process quality has a positive impact on the satisfaction of the TMLS service recipient.	Supported	0.442	4.631	< 0.001

The results in Table 6 show that all but one of our hypotheses could be supported by our data. Only H6 could not be supported by our data, since we did not observe a significant impact of the service provider's structural quality on the learning success of the service recipients. The overall results regarding the structural model are provided in Figure 3. The R^2 values for our dependent variables learning success and satisfaction are on the moderate level (above 0.33 and below 0.67) and on a substantial level for TMLS process quality (above 0.67).



Discussion

Our paper makes several contributions to the existing body of literature. When answering our first research questions, we successfully identify a set of constructs and components, which are suitable to evaluate TMLS quality. Thereby, we could contribute to service science research and TMLS research in particular, by providing a TMLS specific evaluation approach as requested by several researchers (Gupta and Bostrom 2009; Van Dyke et al. 1997). Using the theoretical foundation provided by Gupta and Bostrom (2009) we could identify and adapt 17 components for four identified constructs by means of a focus group workshop and the application of the q-sort method.

In accordance with the before mentioned researchers, we conclude, that some of the current research approaches lacked TMLS specific determinants, e.g. SERVQUAL, respectively overemphasizing and respectively misinterpreting effects due to a sole focus on a specific aspect of TMLS, missing the greater picture. Hence, we created a necessary fundament for a systematic TMLS evaluation, empowering researchers to evaluate TMLS scenarios comprehensively, while learning more about the causal effects and their strength from a holistic perspective.

To the best of our knowledge, we were the first who systematically examined the TMLS process dimension, identifying components and corresponding items to examine effects of structural quality characteristics and service recipients' predisposition via the mediating process dimension. More precisely, we were able to newly identify components such as the overall fit (path coefficient = 0.296, $p < 0.001$), IT-process support (path-coefficient = 0.195), transparency of the learning process (path-coefficient = 0.377, $p < 0.001$), the learning group (path-coefficient = 0.169, $p < 0.01$) and the quality of the exercises (path-coefficient = 0.281, $p < 0.001$). Thereby, we could extend existing service evaluation approaches such as SERVQUAL, with TMLS specific components. By means of these components we enable TMLS researchers and practitioners to identify more specific weaknesses within TMLS scenarios, which go beyond classical, high-level dimensions of service quality evaluation, e.g. assurance (competence and

courtesy) which now can be described more specifically by e.g. quality of exercises (path-coefficient = 0.281, $p < 0.001$) or transparency of the learning process (path-coefficient = 0.377, $p < 0.001$).

In addition, we observed a high and significant impact of the quality of the learning material (path-coefficient = 0.577, $p < 0.001$) and trainer characteristics (path-coefficient = 0.486, $p < 0.001$). They were of a higher relevance than components such as learning environment (path-coefficient = 0.661, n.s.) and IT-systems quality (path-coefficient = 1.395, n.s.). This seems surprising since many studies suggested a high impact of the IT -systems-quality (e.g. (Lin 2007a) and learning environment (Ladhari 2009). In an increasingly computerized world, IT -systems -quality might be a minimum requirement, considered as mandatory and which does not support the learning process significantly. Since the study was conducted within a university, the effects of the learning environment could have been underestimated, since most students are used to the learning environment after having been in it for a long time, thus, blocking the potential effect of the learning environment.

Since the second research question dealt with the relationship of the various dimensions of TMLS quality, we argued that four service dimensions have to be considered for a comprehensive TMLS quality evaluation. Therefore, we included the four dimensions (1) TMLS structure, (2) recipients predisposition, (3) TMLS process and (4) TMLS results in accordance with Donabedian (1980) and Fitzsimmons and Fitzsimmons (2006). In our research model, we showed that the service process quality could help to explain the inconclusive results which were observed in former research results (Gupta and Bostrom 2009). We were able to show that both, structural quality as well as predisposition quality has a significant influence on the process dimension. This can be considered a contribution to TMLS research, providing causal relationships for the four dimensions as requested by Seth (2005). Furthermore, we observed that the TMLS process quality is especially important to determine the impact of the structural quality on the TMLS results. We could, e.g., not observe a direct effect of the structural quality on the learning success (path coefficient = 0.026; n.s.) but observed a significant and high indirect impact via the TMLS process quality ($0.709 * 0.388 = 0.275$). Despite the fact that the existence of an indirect effect is especially important in this particular case, we observed significant indirect effects for both independent variables – structural quality and predisposition quality – on both service results – learning success and satisfaction. Combining these indirect effects with the direct effects from TMLS process quality on the learning success (0.388, $p < 0.001$) and satisfaction (0.442, $p < 0.001$), the results of our study empirically validate the central role of the TMLS process quality as highlighted in previous conceptual TMLS research.

To sum up, we provided a comprehensive, theoretical model, which corresponds with Gregor (2006) and explains and predicts factor effects within TMLS. We were able to answer our research questions by presenting a TMLS evaluation approach based on a comprehensive model for four dimensions, i.e. structural quality, predisposition quality, process quality and results quality. Thereby, for the first time, a holistic model has been developed which considers the specific requirements of a holistic TMLS evaluation. In addition, we were able to demonstrate relations between the four dimensions, providing insight into causal effects of the various constructs and delivering evidence on the mechanisms of TMLS processes.

Furthermore, our results help TMLS providers and trainers evaluate the TMLS quality more adequately, hereby considering comprehensive TMLS quality related components. The effects of various treatments can be observed and take antecedents, such as predisposition and structural quality into consideration. Moreover, the simultaneous evaluation of four related dimensions empowers researchers and practitioners to derive and survey multi-dimensional measures, supporting an efficient and effective TMSL delivery. Furthermore, a continuous improvement process is encouraged, deriving improvement measures for the TMLS process quality while considering structure and predisposition quality.

Limitations and Future Research

This study is not without limitations, which also provide opportunities for future research. TMLS are used for a broad variety of contents and we focused on end user trainings for software. Consequently, the results are limited to software-trainings for end-users, since e.g. soft-skill trainings differ strongly from hard-fact trainings. Thus, further research should empirically investigate if the identified TMLS quality model holds true for other content areas than end-user software-training. Furthermore, we relied on

participants of end-user software trainings at universities. We are aware of the fact that answers of students may vary from vocational training participants. As a results future research should investigate whether our results apply for other groups of participants, e.g., of soft-skill training participants. Therefore, we are currently collecting data from vocational software trainings, extending and validating the current model.

To the best of our knowledge, this study is the first to provide results on a comprehensive TMLS quality evaluation. Even though, we followed a rigorous research approach and our indicators are based upon theory and expert suggestions, the empirical evaluation questioned some of our foundations. Consequently, future research should investigate these inconsistencies between the theoretical foundations and our results.

Furthermore, numerous contributions on TMLS have shown that factors like gender and age affect the TMLS results (see e.g. (Arbaugh 2000; Heuer and Hegele 2008; Seidler 2006; Vigliocco et al. 2005)) Since we did not control for gender or age effects, this is a definite limitation of our study and should be investigated in future research.

Additionally, some portion of the indicator weights should be expected to vary due to the structural model the construct is embedded in (Diamantopoulos and Sigauw 2006; Howell et al. 2007). As Cenfetelli and Bassellier (2009) point out, large changes would indicate a lack of portability of the construct and thus threaten the generalizability of the formative measurement models. Since our study is the first aiming at a comprehensive evaluation of TMLS quality, we cannot test our formative measurement models for construct portability. Consequently, future research should embed the formative measurement models in different structural models to test for construct portability and generalizability.

We are aware of the fact that this R^2 value is high, compared to R^2 values reported in other studies throughout the IS discipline. Consequently, we addressed the common method variance issue raised by Podsakoff et al. (2003), and Sharma et al. (2009), and used procedural remedies prior to data collection to prevent the occurrence of common method variance. We also used the Harman' single factor test afterwards to check for common method variance. The results of the test indicate that common method variance is not a serious issue in our study. Although it is hardly possible to ensure that common method variance is no problem at all in a study, we argue that common method variance is not a significant problem in ours.

Conclusion

In this paper, we aimed to broaden the body of knowledge in the context of TMLS quality. Based on the body of literature, referring mainly to results from service science and TMLS research, we identified four, well-known dimensions for the evaluation of services: (1) structural dimension, (2) recipients predisposition, (3) process dimension and (4) result dimension. Based on these findings, we collected components for the evaluation of TMLS, thereby, identifying new components which have not been considered so far, mainly for the service process dimension. In this process dimension, we could, apart from interactivity which is widely known as an influencing component in learning services (Thurmond and Wambach 2004), add to the body of literature by identifying components such as transparency of the learning process, quality of exercises, characteristics of the learning group or IT-process support. Thereby, for the first time, the foundation for comprehensive TMLS quality evaluation was build, including extensive information about the TMLS process quality. Second, we could show a relationship between the four mentioned dimensions, providing arguments that a TMLS quality evaluation seems better suited when not only input-output studies are conducted, but rather a holistic approach, which considers multiple TMLS dimensions and components, is used. Thereby, in accordance with Gupta and Bostrom (2009) an empirically validated explanation for inconclusive results of the past could be presented, providing arguments for a holistic evaluation on TMLS. With the consideration of the TMLS process quality dimension, a comprehensive evaluation of TMLS quality is feasible, and possesses the potential to cure existing short-comings regarding the examination and evaluation of TMLS scenarios.

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References

- Alavi, M., and Leidner, D.E. 2001. "Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues," *MIS quarterly*, pp. 107-136.
- Alonso, F., Manrique, D., Martínez, L., and Viñes, J.M. 2011. "How Blended Learning Reduces Underachievement in Higher Education: An Experience in Teaching Computer Sciences," *Education, IEEE Transactions on* (54:3), pp. 471-478.
- Antonis, K., Daradoumis, T., Papadakis, S., and Simos, C. 2011. "Evaluation of the Effectiveness of a Web-Based Learning Design for Adult Computer Science Courses," *Education, IEEE Transactions on* (54:3), pp. 374-380.
- Apte, U.M., and Mason, R.O. 1995. "Global Disaggregation of Information-Intensive Services," *Manage. Sci.* (41), pp. 1250-1262.
- Aragon-Sanchez, A., Barba-Aragón, I., and Sanz-Valle, R. 2003. "Effects of Training on Business Results1," *The International Journal of Human Resource Management* (14:6), pp. 956-980.
- Arbaugh, J. 2000. "An Exploratory Study of the Effects of Gender on Student Learning and Class Participation in an Internet-Based Mba Course," *Management Learning* (31:4), pp. 503-519.
- Arbaugh, J.B. 2001. "How Instructor Immediacy Behaviors Affect Student Satisfaction and Learning in Web-Based Courses," *Business Communication Quarterly* (64:4), pp. 42-54.
- Arthur, W.J., Bennett, W.J., Edens, P.S., and Bell, S.T. 2003. "Effectiveness of Training in Organizations: A Meta-Analysis of Design and Evaluation Features," *Journal of Applied Psychology* (88:2), p. 234.
- Baehr, C. 2012. "Incorporating User Appropriation, Media Richness, and Collaborative Knowledge Sharing into Blended E-Learning Training Tutorial," *Professional Communication, IEEE Transactions on* (55:2), pp. 175-184.
- Benbunan-Fich, R., and Arbaugh, J. 2006. "Separating the Effects of Knowledge Construction and Group Collaboration in Learning Outcomes of Web-Based Courses," *Information & Management* (43:6), pp. 778-793.
- Benlian, A., Koufaris, M., and Hess, T. 2011. "Service Quality in Software-as-a-Service: Developing the Saas-Qual Measure and Examining Its Role in Usage Continuance," *Journal of management information systems* (28:3), pp. 85-126.
- Bolton, R.N., and Drew, J.H. 1991. "A Multistage Model of Customers' Assessments of Service Quality and Value," *Journal of consumer research*, pp. 375-384.
- Broderick, A.J., and Vachirapornpuk, S. 2002. "Service Quality in Internet Banking: The Importance of Customer Role," *Marketing Intelligence & Planning* (20:6), pp. 327-335.
- Celik, V., and Yesilyurt, E. 2013. "Attitudes to Technology, Perceived Computer Self-Efficacy and Computer Anxiety as Predictors of Computer Supported Education," *Computers & Education* (60:1), pp. 148-158.
- Cenfetelli, R.T., and Bassellier, G. 2009. "Interpretation of Formative Measurement in Informations Systems Research," *MIS Quarterly* (33:4), December, pp. 689-707..
- Chin, W.W. 1998. "The Partial Least Squares Approach to Structural Equation Modeling," in *Modern Methods for Business Research*, G.A. Marcoulides (eds.). London: LEA.
- Chin, W.W., and Newsted, P.R. 1999. "Structural Equation Modeling Analysis with Small Samples Using Partial Least Squares," *Statistical strategies for small sample research*, pp. 307-341.
- Choi, D.H., Kim, J., and Kim, S.H. 2007. "Erp Training with a Web-Based Electronic Learning System: The Flow Theory Perspective," *International Journal of Human-Computer Studies* (65:3), pp. 223-243.
- Churchill Jr, G.A. 1979. "A Paradigm for Developing Better Measures of Marketing Constructs," *Journal of marketing research*, pp. 64-73.
- Colquitt, J.A., LePine, J.A., and Noe, R.A. 2000. "Toward an Integrative Theory of Training Motivation: A Meta-Analytic Path Analysis of 20 Years of Research," *Journal of Applied Psychology* (85:5), pp. 678-707.

- Cranton, P. 1994. *Understanding and Promoting Transformative Learning: A Guide for Educators of Adults*. Jossey-Bass Higher and Adult Education Series. ERIC.
- Cuthbert, P.F. 1996. "Managing Service Quality in He: Is Servqual the Answer? Part 1," *Managing service quality* (6:2), pp. 11-16.
- DeLone, W.H., and McLean, E.R. 1992. "Information Systems Success: The Quest for the Dependent Variable," *Information Systems Research* (3:1), pp. 60-95.
- Delone, W.H., and McLean, E.R. 2003. "The Delone and Mclean Model of Information Systems Success: A Ten-Year Update," *Journal of management information systems* (19:4), pp. 9-30.
- Diamantopoulos, A., and Siguaw, J.A. 2006. "Formative Versus Reflective Indicators in Organizational Measure Development: A Comparison and Empirical Illustration," *British Journal of Management* (17:4), December, pp. 263-282.
- Donabedian, A. 1980. "Explorations in Quality Assessment and Monitoring Vol I, the Definition of Quality and Approaches to Its Assessment Health Administration." Press Michigan.
- Evans, C., and Gibbons, N.J. 2007. "The Interactivity Effect in Multimedia Learning," *Computers & Education* (49:4), pp. 1147-1160.
- Exadaktylos, F., Espin, A.M., and Branas-Garza, P. 2013. "Experimental Subjects Are Not Different."
- Fitzsimmons, J.A., and Fitzsimmons, M.J. 2006. *Service Management: Operations, Strategy, and Information Technology*. McGraw-Hill New York.
- Frost, F.A., and Kumar, M. 2000. "Intservqual—an Internal Adaptation of the Gap Model in a Large Service Organisation," *Journal of Services Marketing* (14:5), pp. 358-377.
- Garrison, D.R., and Kanuka, H. 2004. "Blended Learning: Uncovering Its Transformative Potential in Higher Education," *The Internet and Higher Education* (7:2), pp. 95-105.
- Gregor, S. 2006. "The Nature of Theory in Information Systems," *Mis Quarterly* (30:3), pp. 611-642.
- Grönroos, C. 1984. "A Service Quality Model and Its Marketing Implications," *European Journal of marketing* (18:4), pp. 36-44.
- Grönroos, C., and Ojasalo, K. 2004. "Service Productivity: Towards a Conceptualization of the Transformation of Inputs into Economic Results in Services," *Journal of Business Research* (57:4), pp. 414-423.
- Gupta, S., and Bostrom, R.P. 2009. "Technology-Mediated Learning: A Comprehensive Theoretical Model," *Journal of the Association for Information Systems* (10:9), pp. 686-714.
- Gupta, S., Bostrom, R.P., and Huber, M. 2008. "End-User Training Methods: What We Know, Need to Know," *ACM SIGMIS Database* (41:4), pp. 9-39.
- Hansen, D.E. 2008. "Knowledge Transfer in Online Learning Environments," *Journal of Marketing Education* (30:2), pp. 93-105.
- Haywood-Farmer, J. 1988. "A Conceptual Model of Service Quality," *International Journal of Operations & Production Management* (8:6), pp. 19-29.
- Heuer, H., and Hegele, M. 2008. "Adaptation to Visuomotor Rotations in Younger and Older Adults," *Psychology and aging* (23:1), p. 190.
- Hiltz, S.R., Coppola, N., Rotter, N., Toroff, M., and Benbunan-Fich, R. 2000. "Measuring the Importance of Collaborative Learning for the Effectiveness of Aln: A Multi-Measure," *Olin College-Sloan-C*, p. 101.
- Hinkin, T.R. 1998. "A Brief Tutorial on the Development of Measures for Use in Survey Questionnaires," *Organizational research methods* (1:1), pp. 104-121.
- Jacobs, S.C., Huprich, S.K., Grus, C.L., Cage, E.A., Elman, N.S., Forrest, L., Schwartz-Mette, R., Shen-Miller, D.S., Van Sickle, K.S., and Kaslow, N.J. 2011. "Trainees with Professional Competency Problems: Preparing Trainers for Difficult but Necessary Conversations," *Training and Education in Professional Psychology* (5:3), p. 175.
- Jiang, J.J., Klein, G., and Carr, C.L. 2002. "Measuring Information System Service Quality: Servqual from the Other Side," *Mis Quarterly*, pp. 145-166.
- Johnson, R.D., Gueutal, H., and Falbe, C.M. 2009. "Technology, Trainees, Metacognitive Activity and E-Learning Effectiveness," *Journal of managerial psychology* (24:6), pp. 545-566.
- Keramati, A., Afshari-Mofrad, M., and Kamrani, A. 2011. "The Role of Readiness Factors in E-Learning Outcomes: An Empirical Study," *Computers & Education* (57:3), pp. 1919-1929.
- Kettinger, W.J., and Lee, C.C. 1997. "Perspectives on the Measurement of Information Systems Service Quality," *Mis Quarterly*, p. 223.
- Kim, J., Kwon, Y., and Cho, D. 2011. "Investigating Factors That Influence Social Presence and Learning Outcomes in Distance Higher Education," *Computers & Education* (57:2), pp. 1512-1520.

- Kirkpatrick, D.L., and Kirkpatrick, J.D. 2005. *Transferring Learning to Behavior: Using the Four Levels to Improve Performance*. Berrett-Koehler.
- Kolfschoten, G.L., Briggs, R.O., De Vreede, G.-J., Jacobs, P.H., and Appelman, J.H. 2006. "A Conceptual Foundation of the Thinklet Concept for Collaboration Engineering," *International Journal of Human-Computer Studies* (64:7), pp. 611-621.
- Ladhari, R. 2009. "A Review of Twenty Years of Servqual Research," *International Journal of Quality and Service Sciences* (1:2), pp. 172-198.
- Lehtinen, E., Hakkarainen, K., Lipponen, L., Rahikainen, M., and Muukkonen, H. 1999. "Computer Supported Collaborative Learning: A Review," *The JHGI Giesbers reports on education* (10).
- Lewis, R.C., and Booms, B.H. 1983. "The Marketing Aspects of Service Quality," *Emerging perspectives on services marketing* (65:4), pp. 99-107.
- Lin, H.F. 2007. "Measuring Online Learning Systems Success: Applying the Updated Delone and Mclean Model," *CyberPsychology & Behavior* (10:6), pp. 817-820.
- López-Pérez, M., Pérez-López, M.C., and Rodríguez-Ariza, L. 2011. "Blended Learning in Higher Education: Students' Perceptions and Their Relation to Outcomes," *Computers & Education* (56:3), pp. 818-826.
- Ma, Q., Pearson, J.M., and Tadisina, S. 2005. "An Exploratory Study into Factors of Service Quality for Application Service Providers," *Information & Management* (42:8), pp. 1067-1080.
- MBB. 2011. "Weiterbildung Und Digitales Lernen Heute Und in Drei Jahren: Mobile Und Vernetzte Szenarien Im Aufwind,".
- McLaughlin, C.P., and Coffey, S. 1990. "Measuring Productivity in Services," *International Journal of Service Industry Management* (1:1), pp. 46-64.
- Menschner, P., Peters, C., and Leimeister, J.M. 2011. "Engineering Knowledge-Intense, Personoriented Services—a State of the Art Analysis,".
- Miles, M.B., and Huberman, A.M. 1994. *Qualitative Data Analysis: An Expanded Sourcebook*. SAGE publications, Inc.
- Nahm, A.Y., Solís-Galván, L.E., Rao, S.S., and Ragu-Nathan, T. 2002. "The Q-Sort Method: Assessing Reliability and Construct Validity of Questionnaire Items at a Pre-Testing Stage," *Journal of Modern Applied Statistical Methods* (1:1), pp. 114-125.
- Ozkan, S., and Koseler, R. 2009. "Multi-Dimensional Students' Evaluation of E-Learning Systems in the Higher Education Context: An Empirical Investigation," *Computers & Education* (53:4), pp. 1285-1296.
- Parasuraman, A. 2000. "Technology Readiness Index (Tri) a Multiple-Item Scale to Measure Readiness to Embrace New Technologies," *Journal of Service Research* (2:4), pp. 307-320.
- Parasuraman, A. 2002. "Service Quality and Productivity: A Synergistic Perspective," *Managing Service Quality* (12:1), pp. 6-9.
- Parasuraman, A., Zeithaml, V.A., and Berry, L.L. 1985. "A Conceptual Model of Service Quality and Its Implications for Future Research," *The Journal of Marketing*, pp. 41-50.
- Parasuraman, A., Zeithaml, V.A., and Berry, L.L. 1988. "Servqual," *Journal of retailing* (64:1), pp. 12-37.
- Petter, S., DeLone, W., and McLean, E. 2008. "Measuring Information Systems Success: Models, Dimensions, Measures, and Interrelationships," *European journal of information systems* (17:3), pp. 236-263.
- Pintrich, P.R., and De Groot, E.V. 1990. "Motivational and Self-Regulated Learning Components of Classroom Academic Performance," *Journal of Educational Psychology* (82:1), p. 33.
- Pitt, L.F., Watson, R.T., and Kavan, C.B. 1995. "Service Quality: A Measure of Information Systems Effectiveness," *MIS quarterly*, pp. 173-187.
- Podsakoff, P.M., MacKenzie, S.B., Jeong-Yeon, L., and Podsakoff, N.P. 2003. "Common Method Biases in Behavioral Research: A Critical Review of the Literature and Recommended Remedies," *Journal of Applied Psychology* (88:5), p. 879.
- Rasch, T., and Schnotz, W. 2009. "Interactive and Non-Interactive Pictures in Multimedia Learning Environments: Effects on Learning Outcomes and Learning Efficiency," *Learning and Instruction* (19:5), pp. 411-422.
- Reber, R.A., and Wallin, J.A. 1984. "The Effects of Training, Goal Setting, and Knowledge of Results on Safe Behavior: A Component Analysis," *Academy of Management Journal* (27:3), pp. 544-560.
- Ringle, C., Sarstedt, M., and Straub, D. 2012. "A Critical Look at the Use of PLS-Sem in MIS Quarterly," *MIS Quarterly (MISQ)* (36:1).
- Ringle, C.M., Wende, S., and Will, S. 2005. "Smartpls 2.0 (M3) Beta, Hamburg," Available in <http://www.smartpls.de>.
- Santhanam, R., Sasidharan, S., and Webster, J. 2008. "Using Self-Regulatory Learning to Enhance E-Learning-Based Information Technology Training," *Information Systems Research* (19:1), pp. 26-47.

- Santos, J. 2003. "E-Service Quality: A Model of Virtual Service Quality Dimensions," *Managing service quality* (13:3), pp. 233-246.
- Sasidharan, S., and Santhanam, R. 2006. "Technology-Based Training," *Human-computer interaction and management information systems: applications* (6), p. 247.
- Schank, R.C. 2005. *Lessons in Learning, E-Learning, and Training: Perspectives and Guidance for the Enlightened Trainer*. San Francisco, CA.: Pfeiffer
- Seidler, R.D. 2006. "Differential Effects of Age on Sequence Learning and Sensorimotor Adaptation," *Brain research bulletin* (70:4), pp. 337-346.
- Seth, N., Deshmukh, S., and Vrat, P. 2005. "Service Quality Models: A Review," *International Journal of Quality & Reliability Management* (22:9), pp. 913-949.
- Sharma, R., Yetton, P., and Crawford, J. 2009. "Estimating the Effect of Common Method Variance: The Method-Method Pair Technique with an Illustration from Tam Research," *MIS Quarterly* (33:3), pp. 473-A413.
- Shostack, G.L. 1987. "Service Positioning through Structural Change," *Journal of Marketing* (51:1), pp. 34-43.
- Siau, K., Sheng, H., and Nah, F.-H. 2006. "Use of a Classroom Response System to Enhance Classroom Interactivity," *Education, IEEE Transactions on* (49:3), pp. 398-403.
- Sims, R. 2003. "Promises of Interactivity: Aligning Learner Perceptions and Expectations with Strategies for Flexible and Online Learning," *Distance Education* (24:1), pp. 87-103.
- Smith, S.M., and Woody, P.C. 2000. "Interactive Effect of Multimedia Instruction and Learning Styles," *Teaching of Psychology* (27:3), pp. 220-223.
- Sousa, N., Alves, G.R., and Gericota, M.G. 2010. "An Integrated Reusable Remote Laboratory to Complement Electronics Teaching," *Learning Technologies, IEEE Transactions on* (3:3), pp. 265-271.
- Spreng, R.A., and Mackoy, R.D. 1996. "An Empirical Examination of a Model of Perceived Service Quality and Satisfaction," *Journal of retailing* (72:2), pp. 201-214.
- Straub, D.W. 1989. "Validating Instruments in Mis Research," *Mis Quarterly*, pp. 147-169.
- Tannenbaum, S.I., Mathieu, J.E., Salas, E., and Cannon-Bowers, J.A. 1991. "Meeting Trainees' Expectations: The Influence of Training Fulfillment on the Development of Commitment, Self-Efficacy, and Motivation," *Journal of Applied Psychology* (76:6), pp. 759-769.
- Thurmond, V., and Wambach, K. 2004. "Understanding Interactions in Distance Education: A Review of the Literature," *International Journal of Instructional Technology and Distance Learning* (1:1).
- Van Der Rhee, B., Verma, R., Plaschka, G.R., and Kickul, J.R. 2007. "Technology Readiness, Learning Goals, and Elearning: Searching for Synergy," *Decision Sciences Journal of Innovative Education* (5:1), pp. 127-149.
- Van Dyke, T.P., Kappelman, L.A., and Prybutok, V.R. 1997. "Measuring Information Systems Service Quality: Concerns on the Use of the Servqual Questionnaire," *Mis Quarterly*, pp. 195-208.
- Vigliocco, G., Vinson, D.P., Paganelli, F., and Dworzynski, K. 2005. "Grammatical Gender Effects on Cognition: Implications for Language Learning and Language Use," *JOURNAL OF EXPERIMENTAL PSYCHOLOGY GENERAL* (134:4), p. 501.
- Wainhouse, R. 2007. "The Distance Education and E-Learning Landscape—Volume 1: Learning Management Platforms, Software and Tools." Retrieved 25.09.2012, from <http://www.wainhouse.com/images/reports/wrdistedelearnv1.pdf>
- Wang, W., and Benbasat, I. 2005. "Trust in and Adoption of Online Recommendation Agents," *Journal of the Association for Information Systems* (6:3), pp. 72-101.
- Wang, Y.-S., Wang, H.-Y., and Shee, D.Y. 2007. "Measuring E-Learning Systems Success in an Organizational Context: Scale Development and Validation," *Computers in Human Behavior* (23:4), pp. 1792-1808.
- Willingham, D.B. 1998. "A Neuropsychological Theory of Motor Skill Learning," *Psychological review* (105:3), p. 558.
- Xilong, T., and Huiling, W. 2011. "Information Technology in Teacher's Professional Skill Training Application," *Computer Science & Education (ICCSE), 2011 6th International Conference on*, pp. 365-369.
- Zeithaml, V.A., Berry, L.L., and Parasuraman, A. 1988. "Communication and Control Processes in the Delivery of Service Quality," *The Journal of Marketing*, pp. 35-48.
- Zeithaml, V.A., Berry, L.L., and Parasuraman, A. 1991. "Understanding Customer Expectations of Service," *Sloan Management Review* (32:3), p. 42.
- Zhu, F.X., Wymer, W., and Chen, I. 2002. "It-Based Services and Service Quality in Consumer Banking," *International Journal of Service Industry Management* (13:1), pp. 69-90.