Learning Management System (LMS) technical training necessary but not sufficient

Solomon Negash, Peter N. Meso, and Tamara Powell

***Abstract*—**This research is an exploratory study to develop research models to understand the impact of technical and pedagogical LMS training. We develop a research instrument, validate it through empirical study, and propose a model delineating technical and pedagogical LMS training impact. The LMS market is projected to reach $7.8 billion in 2018; it has been growing at a 25% annual rate since 2013. Despite the fast adoption, about 25% of LMS users report dissatisfaction with the technology. Many faculty members undergo LMS training to assist them in using the software more effectively. Most of this training focuses on imparting technical competencies pertaining to features, functions, and navigational capabilities of the LMS with little thought to higher level outcomes such as designing or developing LMS-based assignments that foster critical thinking. This exploratory research found training on features, functions, and navigation as necessary but not sufficient to assist faculty in teaching effectively using the LMS. Technical training is found to achieve only first level outcomes like trainee satisfaction and self-competence. The study finds that LMS pedagogical training produces higher level (second level) outcomes that impact student engagement and innovative use of the LMS by instructors. We provide empirical evidence from our pilot study with a proposed theoretical model to increase second-level outcomes.

***Keywords*—**innovative use, learning management systems, LMS, pedagogical training, technical training, training.

I. Introduction

THE Learning Management System (LMS) market is projected to reach $7.8 billion in 2018 from $2.65 billion in 2013; it is growing at a 25% annual rate (Pappas, 2015; Docebo, 2014; Markets and Markets, 2013; Medved, 2015; Software Advice, 2015). This projected sales figure does not include Moodle, the open source LMS with the largest number of users. Moodle has 14% of the market share with over seventy-three million users (Medved, 2015; Capterra, n/a). The commercial products Edmodo and Blackboard have 8% and 7% market share, respectively (Medved, 2015; Capterra, n/a).

An LMS, sometimes called a CMS or content management system or course management system, is used in many industry sectors. The education sector is the largest user accounting for 21% of the total LMS market. Breakdowns by other industries are 12% technology, 9% manufacturing, 7% healthcare, 7% consulting, 4% software developers, 3% non-profit, 3% real estate, 3% event management, 2% government, and the remaining sectors account for 29% (Medved, 2015).

Whereas a growing uptake of LMS is visible, in 2015 25% of users report dissatisfaction with their LMS. A significant proportion of the faculty also report resistance to using their LMS (owing to lack of or ineffective training) or discontentment with the LMS training that they had received.

It is interesting to note that while most faculty members report being satisfied with the perceived usability of LMS (Orfanou, Tselios, and Katsanos, 2015), several studies conclude that there is a need for faculty to receive further training on LMS. For example, Fathema and Sutton (2013) found faculty underutilize LMS and recommended more training. Gary (2013), while enumerating the student's likes and dislikes about instructor use of LMS, also recommended more training for faculty. While our focus here is on LMS in general, it was interesting to note that Derakhshan (2012) found students had higher levels of interest in mobile LMS than faculty and subsequently proposed that considerations be given to training faculty in a mobile LMS or mobile aspects of LMS-based education delivery.

Therefore, this is an exploratory study to understand if and how LMS training impacts faculty perceptions about the value of an LMS.

Our findings indicate that there are two kinds of training: technical training and pedagogical training. We also find two types of outcomes: first-level and second-level outcomes. Technical training is found to have a significant value, but its value is limited to first-level outcomes. On the other hand pedagogical training is found to impact both first and second-level outcomes. Our study indicates that technical LMS training is a necessary but insufficient type of training. Further, it serves as a pre-requisite for pedagogical LMS training.

II. Theoretical Background

IN this study we delineate between technical and pedagogical training. We define technical training as training on features, functions, and navigation of the technology. This definition is consistent with Diaz and Bontenbal (2000), who define traditional technical-based training as focused on "familiarizing the trainee with the mechanics of how a particular software or hardware works."

Our definition of pedagogical LMS training is also in line with the definition of pedagogical-based training provided by Diaz and Bontenbal (2000): "preparing the trainee to

The 2016 International Conference on Electronics and Communication Systems. ECS 2016. Riga, Latvia, May 28-30, 2016

implement technology skills and aquired knowledge in an instructional setting." We define pedagogical LMS training as mapping and implementing the LMS technology within the context of the subject matter, i.e., mapping and implementing the LMS within the teacher's course content.

When evaluating information systems' success, prior studies delineate between individual and organizational impact. Organizational impact is often realized as a result of individual impact, i.e., a satisfied person may help the organization increase market share. In this study we identify first-level outcomes and second-level outcomes to show the different levels of training impact, see Figure 1.

First-level outcomes: first-levle outcomes are related to the instructor and include the instructor's (a) satisfaction with LMS and (b) competence in LMS. Competency outcomes include enhanced teaching, effectiveness in using the LMS for teaching, confidence in using the LMS for teaching, and success in using the LMS for course content design. Satisfaction includes perceived quality and content of the training to the extent of sharing with and promoting the training to others. These two constructs form the the two mediating variables in our model—satisfaction with the LMS and competence in use of the LMS.

Second-level outcomes: second-level outcomes are those that (a) translate to innovative use of LMS and (b) transfer to the target audience—students (i.e the benefits that students derive from an instructor's use of LMS). These outcomes include enhancement in student engagement activities, improved content delivery, improved communication with or among students, better course expectation management, better management of course assessments, effective performance of administrative requirements, and application of innovative teaching methods. These two constructs form the dependent variables in our model—innovative use and LMS benefits to students.

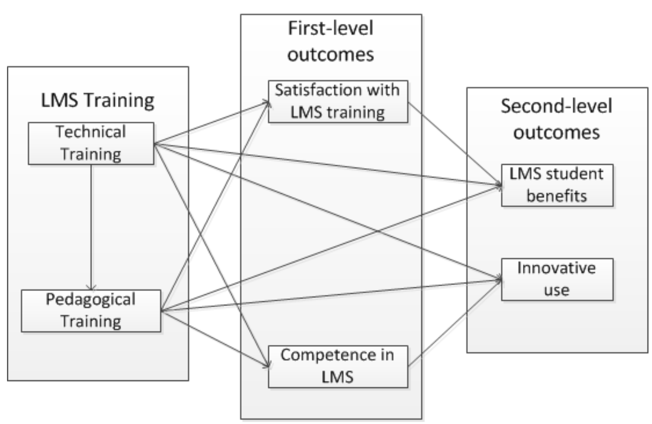

Figure 1: theoretical model

The independent variables are technical training and pedagogical training. Technical training focuses on the features, functionality, and navigation of the LMS whereas pedagogical training focuses on applying the LMS to the trainee's subject matter, which is course content.

III. Methods

This study is conducted at a large public university where Brightspace (formerly Desire2Learn) learning management system is used. Over the last fifteen years the university has switched the LMS it uses three times. The LMS is used throughout the university.

In this study we employed the quantitative survey method. We developed our survey questionnaire from prior literature on LMS use, training, and technology adoption. The survey questionnaire was reviewed by five experts for content validity. The expert feedback was used to refine the instrument through two rounds of review. All experts agreed on the final version of the questionnaire. We then randomized the questions on the instrument to mitigate common method bias. The resultant questionnaire was then administered as a paper-pencil-based survey to ninety (90) participants at an online teaching conference. We received twenty-nine (29) completed surveys indicating a thirty percent (30%) response rate.

IV. Instrument validation

Smart PLS was used for instrument validation (Ringle et al., 2005). We tested the instrument for (a) scale reliability (Cronbach's alpha), (b) composite reliability, (c) convergent validity (Average Variance Extracted--AVE), (d) discriminant validity (cross loading), and (e) indicator reliability (loading of items on their constructs).

Table-1 shows Cronbach's alpha, composite reliability, and AVE scores for the model's constructs. All constructs satisfied the Cronbach's alpha threshold of 0.7, therefore confirming the instruments scale reliability. Our instrument also statified composite reliability since all constructs scored above the recommended threshold of 0.7. Convergent validity is established when a constructs AVE score is above 0.5. This was confirmed as shown in Table 1 (Gefen and Straub, 2005).

Table 1: Instrument Reliability

	Cronbach's Alpha	Composite Reliability	AVE
Benefits of LMS	0.954	0.962	0.785
Innovative Use	0.982	0.988	0.966
Satisfaction with Training	0.993	0.995	0.981
Competence in LMS	0.989	0.992	0.969
Pedagogical Training	0.979	0.986	0.961
Technical Training	0.993	0.995	0.981

As shown in Table 2 our instrument satisfied discriminant validity since indicators load better on their primary constructs than they do on alternative constructs. The relatively high loading of indicators on alternative constructs is an observed limitation of this study. While we presume this is because of the small data set used in this study, we have no conclusive way of confirming this limitation. Further analysis with a larger data set is needed to determine this issue (Gefen and

Straub, 2005).

Reliability indicators for items loading was above the recommended 0.7 for all constructs. Therefore, indicator reliability for our instrument is confirmed (Gefen and Straub, 2005).

Table-2: Cross loadings of indicators on constructs

	Student Benefits	Innovative Use	Satisfaction	LMS Competence	PED Training	Tech Training
Benefits-1	0.9251	0.5839	0.6174	0.5723	0.6242	0.5923
Benefits-2	0.8715	0.4217	0.4448	0.4563	0.4587	0.4582
Benefits-3	0.8289	0.5887	0.5708	0.5742	0.5737	0.5674
Benefits-4	0.9275	0.3410	0.3493	0.3504	0.3548	0.3592
Benefits-5	0.8777	0.2752	0.2988	0.2909	0.3049	0.2841
Benefits-6	0.8519	0.5464	0.4867	0.4911	0.4788	0.4749
Benefits-7	0.9174	0.5034	0.5430	0.5275	0.5404	0.5410
Innovate-1	0.5458	0.9801	0.9623	0.9723	0.9516	0.9687
Innovate-2	0.5365	0.9802	0.9347	0.9315	0.9555	0.9169
Innovate-3	0.5522	0.9890	0.9582	0.9476	0.9660	0.9483
Satisfaction -1	0.5613	0.9649	0.9937	0.9881	0.9807	0.9903
Satisfaction -2	0.5467	0.9489	0.9879	0.9811	0.9564	0.9775
Satisfaction -3	0.5629	0.9704	0.9976	0.9859	0.9886	0.9877
Satisfaction -4	0.5568	0.9522	0.9840	0.9540	0.9784	0.9643
Competence -1	0.5230	0.9413	0.9782	0.9805	0.9433	0.9736
Competence -2	0.5454	0.9552	0.9811	0.9901	0.9682	0.9799
Competence -3	0.5379	0.9383	0.9651	0.9835	0.9559	0.9667
Competence -4	0.5194	0.9551	0.9505	0.9711	0.9252	0.9528
Pedagogy-1	0.5344	0.9136	0.9202	0.8932	0.9606	0.9118
Pedagogy-2	0.5585	0.9569	0.9652	0.9442	0.9857	0.9553
Pedagogy-3	0.5622	0.9688	0.9866	0.9758	0.9874	0.9830
Technical-1	0.5488	0.9499	0.9742	0.9785	0.9627	0.9896
Technical-2	0.5559	0.9397	0.9713	0.9756	0.9622	0.9897
Technical-3	0.5516	0.9529	0.9870	0.9850	0.9692	0.9885
Technical-4	0.5455	0.9654	0.9874	0.9909	0.9736	0.9954

V. Results and Discussion

SMART PLS was used for data analysis (Ringle et al., 2005). Some quesionnaire items were removed due to cross loading. The refined instrument was used to run the model.

The resulting model indicated a distinction between technical and pedagogical training.

Technical training had a strong (R2=0.940) and positive impact on pedagogical training, see Table 3. This positive impact indicated technical training as a pre-requisite for pedagogical training. Without knowledge of the technical aspects of the LMS, applying the LMS to the pedagogical outcomes is less possible. However, technical training did not have a direct impact on the benefits and innovative use that would be expected to impact learning. The impact of technical training on benefits and innovation was indirect through satisfaction and competence. Satisfaction and competence from technical training helped trainees apply their knowledge to achieve second-level outcomes, see Table 3.

Table-3: Model path coefficients

	Path Coefficients	T Statistics
Satisfaction with Training -> LMS Student Benefits	0.3243	1.2803
Competence in LMS -> Innovative Use	0.5821	2.9678
Pedagogical training -> LMS Student Benefits	0.3100	2.1507
Pedagogical training -> Innovative Use	0.5969	6.8554
Pedagogical training -> Satisfaction with Training	0.3003	2.5864
Pedagogical training -> Competence in LMS	-0.0475	0.5095
Technical training -> LMS Student Benefits	-0.0656	0.2372
Technical training -> Innovative Use	-0.1903	0.8761
Technical training -> Satisfaction with Training	0.6979	6.0599
Technical training -> Competence in LMS	1.0296	11.2090
Technical training -> Pedagogical training	0.9696	122.5759

Pedagogical training had a direct impact on second-level outcomes. Pedagogical training was also found to impact trainee satisfaction. We did not find pedagogical impact on competence, see Table 3.

This exploratory research delineates the role of technical and pedagogical training. Whereas typical training is focused on technical aspects of the LMS, our findings show such training is limited to first-level outcomes. To achieve second-level outcomes our findings indicate the necessity of pedagogical LMS training.

Further study is needed to understand student benefits. Malm and Defranco (2012) recommend student-centered approaches like average number of student logins for assessing LMS benefits.

While training seems to be widely provided by most institutions, the type-of-training and/or its efficacy is often not reported or discussed. Gautreau (2011) recommended individual consultation with faculty after training and faculty involvement in the development of training content and level of instruction. Those recommendations, if adopted, may assist in providing more effective LMS training to faculty. In addition to Gautreau's (2011) recommendations, we recommend more studies on the role and impact of peer collaboration. While a study by Jones (2015) found that encouragement from peers and adminstrators did not have any affect on LMS use, it may be that deeper and meaningful collaboration among peers on both technical and pedagogocal aspects of LMS use may spur greater adoption of the LMS as well as satisfaction with the LMS.

We also recommend further study on how LMS training can enhance innovative use. A study by Al-Busaidi and Al-Shihi (2012) seems to suggest so, too. It finds that instructors were satified with LMS's support for personal innovativeness. As Lochner, Conrad, and Graham (2015) found, faculty are concerned about managing innovation.

In conclusion, applying the training findings of this paper to an individual instructor's needs is important. Instructors are seeking more information on how use of LMS impacts their practice of the trade (Lochner, Conrad, and Graham, 2015). Our findings suggest that structured training that first enhances an instructor's technical competence in LMS and then goes beyond that to foster pedagogical-based competencies of LMS use contributes sigificantly in leveraging the efficacy of the instructor as an educator.

References

[1] Pappas, C. (May 26, 2015). The Top LMS Statistics and Facts For 2015 You Need To Know. Retrieved from http://elearningindustry.com/top-lms-statistics-and-facts-for-2015.

[2] Docebo Report (March 2014). E-Learning Market Trends & Forecast 2014 - 2016 Report. Retrieved from https://www.docebo.com/landing/contactform/elearning-market-trends-and-forecast-2014-2016-docebo-report.pdf

[3] Markets and Markets (October 29, 2013). Learning Management Systems (LMS) Market Worth $7.83 Billion by 2018 Forecasted in MarketsandMarkets Recent Report. Retrieved from http://www.marketwired.com/press-release/learning-management-systems-lms-market-worth-783-billion-2018-forecasted-marketsandmarkets-1845977.htm

[4] Medved, J. P. (April 8 2015). LMS Industry User Research Report. Retrieved from http://www.capterra.com/learning-management-system-software/user-research

[5] Software Advice (2015). Learning Management Systems User View 2015. Retrieved from http://www.softwareadvice.com/hr/userview/lms-report-2015/

[6] Capterra, Retrieved from http://www.capterra.com/learning-management-system-software/#infographic

[7] Fathema, N., & Sutton, K. L. (2013). Factors influencing faculty members' Learning Management Systems adoption behavior: An analysis using the Technology Acceptance Model. *International Journal of Trends in Economics Management & Technology*, *2*.

[8] Gary, C. Y. (2013). Students' perceptions of faculty usage of learning management systems. *Review of Management Innovation & Creativity*, *6*(20).

[9] Orfanou, K., Tselios, N., & Katsanos, C. (2015). Perceived usability evaluation of learning management systems: Empirical evaluation of the System Usability Scale. *The International Review of Research in Open and Distributed Learning*, *16*(2).

[10] Derakhshan, N. (2012). *Student and faculty perceptions of the features of mobile learning management systems in the context of higher Education*(Doctoral dissertation, Oklahoma State University).

[11] Diaz, D. P. and Bontenbal, K. F. (2000). Pedagogy based technology training in Teaching and Learning in a Network World, P. Hoffman and D. Lemke (Eds.), pp 50-54. (https://books.google.com/books?hl=en&lr=&id=oM-1Oah4m_wC&oi=fnd&pg=PA50&dq=technology+training+types&ots=J1jEvlAl5A&sig=YGdoA2wcUpT5poMpMTI69KsZtVk#v=onepage&q&f=false).

[12] Ringle, Christian M., Wende, Sven, Will, Alexander. *(2005). SmartPLS 2.0.M3.* Hamburg: SmartPLS. Retrieved from http://www.smartpls.com

[13] Gefen, David and Straub, Detmar (2005) "A Practical Guide To Factorial Validity Using PLS-Graph: Tutorial And Annotated Example," *Communications of the Association for Information Systems*: Vol. 16, Article 5. Available at: http://aisel.aisnet.org/cais/vol16/iss1/5

[14] Malm, E., & Defranco, J. F. (2012). Toward a student-centered measure of learning management system utilization. *Journal of Educational Technology Systems*, *40*(4), 401-413.

[15] Gautreau, C. (2011). Motivational Factors Affecting the Integration of a Learning Management System by Faculty. *Journal of Educators Online*, *8*(1), n1.

[16] Jones, D. S. (2015). *Analysis of Factors That Influence Use of Learning Management Systems by Pennsylvania Rural School Districts* (Doctoral dissertation, Indiana University of Pennsylvania).

[17] Al-Busaidi, K. A., & Al-Shihi, H. (2012). Key factors to instructors' satisfaction of learning management systems in blended learning. *Journal of Computing in Higher Education*, *24*(1), 18-39.

[18] Lochner, B., Conrad, R. M., & Graham, E. (2015). Secondary Teachers' Concerns in Adopting Learning Management Systems: A US Perspective. *TechTrends*, *59*(5), 62-70.