Digital Literacy and Effective Learning in a Blended Learning Environment

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Abstract: Leveraging the capabilities of the web, which has become hugely popular among university students since its inception in the 90s, blended learning has been promoted as an alternative to classroom learning. A hybrid of classroom learning and online learning, blended learning offers flexibility in the way students learn – when, what, where, and how to learn. The easy availability of mobile devices (e.g. smartphones, tablets, etc.), coupled with web-based services (e.g. digital library, learning management systems, etc.), has further fuelled blended learning. Universities see online learning as complementary to classroom learning so as to give students a better learning experience, and students like the learning flexibility. As blended learning expects students to know how to use digital technology to access the web, to search for and to use information from different sources both online and offline, as well as to be an independent learner, it seems reasonable to presume that to be an effective learner in a blended learning environment, students need to have a certain level of digital literacy. Thus, there remains a question: Do students require digital literacy to be effective in learning in a blended learning environment? Answering this question helps universities to understand if high digital literacy is a prerequisite to more effective learning in a blended learning environment. If it is, universities can provide students with workshops to help raise digital literacy among them. Following a quantitative approach, this study conducted an online questionnaire survey to answer the question by examining the relationships between four digital literacy constructs; i.e. underpinnings, background knowledge, central competencies, and attitudes and perspectives; as conceptualised by David Bawden in his 2008 book chapter entitled "Origins and Concepts of Digital Literacy," and effective learning. This study developed a 5-item scale to operationalise each of the four digital literacy constructs and, using the revised Bloom's taxonomy as a point of departure, a 6-item scale for the effective learning construct. To collect responses from the students who were taking subjects in a blended learning environment at a local university, the students were invited to fill in an online questionnaire. Responses were then analyzed using partial least squares. Exploratory factor analysis resulted in the four digital literacy constructs being reduced to three. Subsequent confirmatory factor analysis proved that the three digital literacy constructs each had a statistically significant relationship with the effective learning construct.

Keywords: blended learning, online learning, digital literacy, effective learning, higher education, partial least squares

1. Introduction

Educational institutions are taking advantage of advances in digital technology such as web applications, mobile devices, and telecommunications to engage their students with various teaching and learning modes. One such mode is blended learning (Porter et al., 2014) which integrates technologies into the learning delivery process, and hopefully overcomes some limitations of face-to-face classroom learning (Akkoyunlu and Yılmaz-Soylu, 2008).

In this digital age, blended learning allows students to learn anytime, anywhere, and in the way they want to. However, adopting blended learning does not necessarily improve the student learning experience (Cortizo et al., 2010). Joy and Garcia (2000) caution educators against assuming that students would learn better from technology-based learning delivery systems. As digital technology plays a key role in blended learning, it is expected that students need a certain level of digital literacy for them to learn effectively (Eshet, 2004). Hence, it is essential for educators to ask the question: Do students require digital literacy to be effective in learning in a blended learning environment? This study aims to answer this question.

The following sections provide an overview of blended learning, review the concept of digital literacy and its components, explain the measurement of effective learning, describe the research design and method, present the data analyses and results, and conclude the paper.

2. Research background

2.1 Blended learning

A learning delivery approach which blends face-to-face classroom learning and online learning, blended learning provides such flexibility as anytime and anywhere access to learning management systems (LMS) for online learning resources, tools, assessments, etc. (Glogowska et al., 2011). The basic premise is to complement face-to-face classroom learning by giving students the learning flexibility as enabled by digital technology. However, Kember et al. (2010) highlight that blended learning is not just about using LMS as an online repository of learning materials. Instead, educators should incorporate learning activities that engage students to foster active learning.

Given limited classroom space and increasing student number, blended learning seems to be a feasible solution (Garrison and Vaugha, 2013) which meets the needs of students, educators, and universities (Moskal, Dziuban and Hartman, 2013). However, blended learning can have different configurations of face-to-face classroom learning and online learning in different learning contexts (Garrison and Kanuka, 2004) and a good integration is always a challenge (McKenzie et al., 2013).

There are different blended learning models. Staker and Horn (2012) identifies four blended learning models for primary and secondary education: Rotation, Flex, Self-Blend, and Enriched-Virtual. D2L (2014), a company that specialises in developing integrated learning platforms, proposes five blended learning models: Face-to-Face Driver, Rotation, Flex, Online Lab, and Online Driver. Moskal, Dziuban and Hartman (2013) suggest that there is no one best blended learning model. Instead, there are a set of critical success factors, such as institutional goals and objectives; alignment between goals of administrators and faculty members; organizational capacity; faculty development and course development support; support for online students and faculty; robust and reliable infrastructure; longitudinal data collection and assessment; policy development; and funding model.

2.2 Digital literacy

Today's students are familiar with digital technology and generally know how to access, create, and share digital information (Ting, 2015). Gilster (1997) supports the notion that to be digitally literate, one does not just know how to find information from the web, but also has the ability to understand and assemble information from different print or digital sources. Digital literacy involves the mastery of ideas, and is not just about using the technology itself. Greene, Yu and Copeland (2014) agree that digital literacy requires one to search, manage, evaluate and integrate digital information well.

Ng (2012) proposes that there are three dimensions of digital literacy: (1) technical - IT skills; (2) cognitive - critical thinking in searching, evaluating and creating digital information, and (3) social-emotional - communicating, socializing and learning skills. Jisc (2014) emphasises that digital literacy is context-dependent and suggests a seven-element digital literacy model: media literacy, information literacy, digital scholarship, learning skills, communications and collaboration, career and identify management, and ICT literacy. Bawden (2008) highlights that the concept of digital literacy is very broad and can include very specific skills and competencies to general awareness and perspectives. He suggests four components of digital literacy: (1) underpinnings - the ability to read and write as well as to use software packages and computers; (2) background knowledge - an understanding of how digital and non-digital information is created from various forms of resources and communicated; (3) central competencies - the ability to assemble knowledge from multiple sources; and (4) attitudes and perspectives - the ability to learn independently as well as to exhibit good behaviour in a digital environment.

2.3 Effective learning

To assess how effective learning is as a result of adopting blended learning, the revised Bloom's taxonomy provides some good pointers. Commonly used as a reference framework when designing learning activities, objectives and outcomes (Blooma et al., 2013), the original Bloom's taxonomy was first published in 1956 (Bloom et al., 1956). The taxonomy was revised in 2001 with changes to its category names: remembering, understanding, applying, analysing, evaluating, and creating (Krathwohl, 2002).

2.4 Research model

Using the four digital literacy constructs; i.e. underpinnings, background knowledge, central competencies, and attitudes and perspectives, as conceptualised by Bawden (2008) and the revised Bloom's taxonomy as a point of departure, this study proposed a research model (Figure 1). Another of our study adopted Jisc's digital literacy model; this study included only Bawden's digital literacy components.

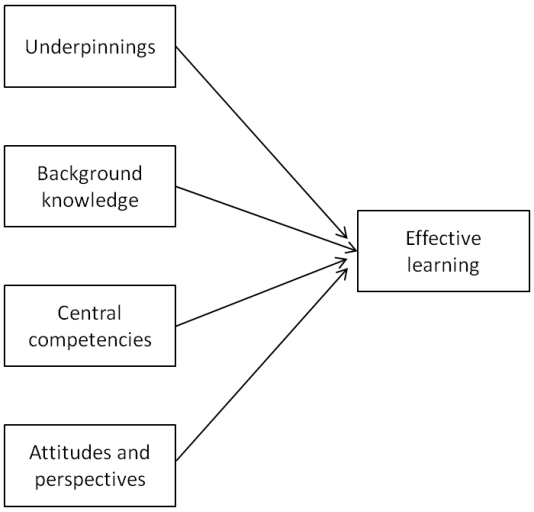

Figure 1: Research model

3. Research method

3.1 Construct operationalisation

To develop a scale for a construct, the construct must first be conceptualised theoretically (Segars, 1997). Following that, a group of scale items can then be developed based on the conceptual domain of the construct (MacKenzie et al., 2005). After a review of past literature and a questionnaire pretest, this study developed a 5-item scale for each of the four digital literacy constructs and a 6-item scale for the effective learning construct.

3.2 Data collection

An online questionnaire was used to collect data from the students of a university that had adopted blended learning. An invitation, with a link to the questionnaire, for the students to fill in the questionnaire was made on the LMS commonly accessed by them. The questionnaire consisted of four sections. Section A asked two questions about learning delivery. Section B consisted of two questions. One question was about the four digital literacy constructs (a total of 20 scale items, coded as D1 to D20, in random order) and the other the effective learning construct. All items were measured using a 5-point Likert-type scale, 5 being "strongly agree" and 1 being "strongly disagree." Section C asked four questions about usage of LMS. Section D asked two demographic questions. A total of 176 respondents provided the responses. 15 responses were removed as outliners in subsequent analyses. Thus, there were only 161 valid responses. Of the 161 respondents, 87 were male students (54%) and 74 female (46%).

4. Data analysis and results

4.1 Learning delivery and LMS usage

Table 1 provides a summary of the respondents' preference for different learning delivery modes. In order of preference ("prefer" and "strongly prefer"), a higher percentage of the respondents preferred classroom learning (74.5%), as compared to blended learning (64%) or online learning (63.9%).

Table 1: Preference for individual learning delivery modes

	Classroom learning		Online learning		Blended learning	
	N	%	N	%	N	%
Strongly not prefer	2	1.2	2	1.2	0	0.0
Not prefer	2	1.2	12	7.5	8	5.0

	Classroom learning		Online learning		Blended learning	
	N	%	N	%	N	%
Maybe	37	23.0	44	27.3	50	31.1
Prefer	72	44.7	82	50.9	60	37.3
Strongly prefer	48	29.8	21	13.0	43	26.7
Total	161	100.0	161	100.0	161	100.0

Table 2 provides a summary of what the respondents thought about the effectiveness of different learning activities or resources. In order of effectiveness ("effective" and "very effective"), a higher percentage of the respondents thought that face-to-face meetings (82%) were more effective than online interactions (45.9%); and online resources (70.2%) were more effective than physical resources (63.4%).

Table 2: Effectiveness of delivery methods

	Face-to-face meetings (e.g. in-class lecture, consultation with lecturer, group discussion)		Online interaction (e.g. blog, forum, chat, email)		Physical resources (e.g. print book, school library)		Online resources (e.g. ebook, digital database, audio or video webcast)	
	N	%	N	%	N	%	N	%
Not very effective	2	1.2	3	1.9	2	1.2	0	0.0
Not effective	1	0.6	15	9.3	14	8.7	9	5.6
Maybe	26	16.1	69	42.9	43	26.7	39	24.2
Effective	67	41.6	63	39.1	80	49.7	83	51.6
Very effective	65	40.4	11	6.8	22	13.7	30	18.6
Total	161	100.0	161	100.0	161	100.0	161	100.0

Table 3 provides a summary of the features the respondents liked the most about LMS (they could choose more than one feature). In order of frequency, the three largest percentages were online resources (78.5%), online course announcements (52.1%), and online assignment submission (47.9%).

Table 3: LMS features

LMS features	N	%
Online resources (e.g. lecture notes, PowerPoint slides, tutorial questions)	128	78.5
Online course announcements	85	52.1
Online assignment submission	78	47.9
Online assessment (e.g. quiz)	73	44.8
Online grade centre	59	36.2
Online discussion (e.g. blog, forum, chat)	34	20.9

Table 4 provides a summary of the usage of LMS.

Table 4: Usage of LMS

Demographic information		N	%
Semesters using the LMS	1 semester	50	31.1
	2 semesters	69	42.9
	3 semesters	28	17.4
	4 semesters	5	3.1
	5 semesters	2	1.2
	More than 5 semesters	7	4.3
Hours using the LMS per day	Less than 1 hour	93	57.8
	Between 1 to 2 hours	48	29.8
	Between 2 to 3 hours	16	9.9
	Between 3 to 4 hours	2	1.2
	More than 4 hours	2	1.2
Primary device accessing the LMS	Desktop computer	57	35.4
	Notebook	45	28.0
	Smartphone	47	29.2
	Tablet	12	7.5

4.2 Exploratory factor analysis

An exploratory factor analysis (EFA) is necessary to examine dimensionality of a scale before a confirmatory factor analysis (CFA) (Gerbing and Anderson, 1988). The analysis attempts to examine loadings of individual scale items across factors, identifying scale items that load strongly on a particular factor (Gefen and Straub, 2005). In this study, a factor analysis assessed the four digital literacy constructs using the principal axis factoring extraction method. A separate factor analysis assessed the effective learning construct. Straub, Boudreau and Gefen (2004) advise against mixing independent and dependent constructs in EFA but instead, suggest examining the constructs separately. Assuming that there were correlations among the constructs, the Promax rotation method was used (Hair et al., 2005).

Before a factor analysis of the four digital literacy constructs, a check for multivariate outliers was performed. Following the rule that a case is considered a multivariate outlier if the probability of its squared Mahalanobis distance is equal or less than 0.001 (Tabachnick and Fidell, 2007), of the 176 cases, 10 cases were removed. KMO (> 0.5) and Barlett's test ($p < 0.05$) were checked first for appropriateness for factor analysis (Hair et al., 2005). Both KMO and Barlett's tests satisfied the criteria. Two criteria were used to decide deletion of scale items: (1) scale items loaded < 0.5 on any one of the factors, or (2) scale items cross-loaded > 0.5 on two or more factors (Hair et al., 2005). Iteration 1 showed scale item D10 cross-loaded on two factors. Thus, it was removed from further analysis. In iteration 2, a simple structure was obtained. Factor scores were then calculated to check for outliers. Those scale items that had a factor score of larger than +/- 3.0 were considered as outliners (Deneshkumar et al., 2014). Of the 166 cases, 5 cases were removed. Thus, the remaining 161 cases were kept for further analysis. Subsequent 7 iterations deleted 7 scale items (D14, D19, D6, D3, D7, D9, and D11) and obtained a simple structure. Table 5 provides a summary of the factors.

Table 5: EFA results

Scale item	Mean	SD	1	2	3
(D17) I am motivated in learning new information both online and offline.	3.84	.821	.803		
(D16) I am comfortable with sharing information with others in discussion.	3.84	.757	.792		
(D18) I can critically evaluate the information that I gather for its usefulness.	3.69	.785	.642		
(D5) I know where to find information from different sources (e.g. school library, online database, web).	3.78	.724	.592		
(D13) I am confident in using application software (e.g. email, office suite, web browser).	3.93	.826		.788	
(D20) I have the skills to use digital technology (e.g. computer, tablet, smartphone) effectively.	3.90	.768		.722	
(D12) I use digital technology (e.g. computer, tablet, smartphone) often both at home and at school.	4.12	.839		.670	
(D8) I am familiar with the web.	3.82	.843		.586	
(D2) I can distinguish the differences between print and online resources.	3.77	.744			.730
(D1) I know how and where to search for useful information both online and offline.	3.74	.763			.663
(D4) I am one of the members in the learning community.	3.57	.992			.623
(D15) I can integrate information that comes from different sources (e.g. school library, online database, web).	3.73	.748			.533
% of variance explained			45.236	6.595	5.090
Eigenvalue			5.841	1.228	1.068
Cronbach's alpha			.827	.846	.782

EFA revealed that the four digital literacy constructs proposed originally had been reduced to three. While the construct underpinnings retained its original scale items, scale items of the other three digital literacy constructs loaded on just two factors. With reference to the concepts of organisational learning (Huber, 1991) and to better reflect the meaning of the scale items of each, these two newly-identified factors were labelled as *experiential learning* and *searching* respectively. In factor analysis, it is common to find the number of constructs

originally proposed in a research model to change as a result of factor analysis; that is, the number of constructs may be reduced (Gable, Sedera and Chan, 2003) or added (Cohen, Thiraios and Kandilorou, 2008). After deciding on the number of factors to be retained, it is then necessary to interpret and label the factors based on the meaning of the scale items loaded on the respective factors (Hair et al., 2005).

A factor analysis of the effective learning construct showed a one-factor simple structure (L1 to L6, Eigenvalue = 4.526, % of variance explained = 70.590, Cronbach's alpha = .935).

4.3 Confirmatory factor analysis

Unlike EFA, in confirmatory factor analysis (CFA), the relationships between a construct and its scale items are prescribed before the statistical analysis (Gefen and Straub, 2005). This study performed a CFA with the partial least squares (PLS) approach. PLS approach aims to examine variances and significance of relationships, and is appropriate for making predictions (Fornell and Bookstein, 1982; Gefen, Straub and Boudreau, 2000).

Gerbing and Anderson (1988) propose a two-step modelling approach to PLS analysis. They contend that a two-step approach that examines both the measurement model and structural model makes a complete confirmatory assessment of construct validity. The first step examines the measurement model, and the second step examines both the measurement and structural models simultaneously. Following Gerbing and Anderson (1988), in this study, the measurement model was tested first for internal consistency reliability, convergent validity, and discriminant validity (Dunn, Seaker and Waller, 1994). Next, by estimating the path coefficients and R^2, the structural model was examined for the relationships between the exogenous and endogenous constructs (Gerbing and Anderson, 1988). To perform the PLS analysis, this study used the SmartPLS software.

4.3.1 Measurement model

First, the loadings of individual items were examined. Those that did not load more than 0.7 on the intended construct were deleted to establish unidimensionality (Chin, 1998). Scale item D4 of the construct central competencies did not meet the threshold value (0.599). Thus, it was removed from further analyses. After D4 was removed, loadings of all scale items on their intended constructs were above 0.7.

Having established that all scale items had satisfactory loading, subsequent analyses checked for internal consistency reliability, convergent validity, and discriminant validity.

Internal consistency reliability - For satisfactory internal consistency reliability, composite reliability of a construct should exceed 0.7 (Chin, 1998, Fornell and Larcker, 1981). As depicted in Table 6, composite reliability of all constructs was above 0.7. Thus, internal consistency reliability of individual constructs was satisfactory.

Table 6: CR, AVE, and construct correlations

Constructs	CR	AVE	Experiential learning	Searching	Effective learning	Under-pinnings
Experiential learning	0.885	0.658	0.811			
Searching	0.883	0.716	0.643	0.846		
Effective learning	0.948	0.754	0.688	0.657	0.868	
Underpinnings	0.897	0.685	0.592	0.642	0.572	0.828

Note: CR: composite reliability; AVE: average variance extracted; square roots of average variances extracted (AVE) are shown on diagonal; correlations between constructs are shown on off-diagonal.

Convergent validity - For satisfactory convergent validity, three criteria should be met: (1) composite reliability of a construct should exceed 0.7 (Chin, 1998; Fornell and Larcker, 1981); (2) average variance extracted (AVE) of a construct should exceed 0.5 (Chin, 1998; Fornell and Larcker, 1981); and (3) loading of scale items should exceed 0.7 on the intended construct (Barclay, Higgins and Thompson, 1995; Chin, 1998). When AVE is more than 0.5, the variance of individual constructs is larger than that contributed by the measurement error (Segars, 1997). As depicted in Table 6, composite reliability of all constructs was above 0.7. In addition, AVEs of all constructs were above 0.5. As depicted in Table 7, loadings of all scale items on the intended constructs were above 0.7. Thus, it was evident that all constructs had satisfactory convergent validity.

Table 7: Factor loadings and cross loadings

Scale items	Experiential learning	Searching	Effective learning	Under-pinnings
(D5) I know where to find information from different sources (e.g. school library, online database, web).	0.758	0.558	0.504	0.418
(D16) I am comfortable with sharing information with others in discussion.	0.828	0.537	0.541	0.480
(D17) I am motivated in learning new information both online and offline.	0.813	0.423	0.514	0.434
(D18) I can critically evaluate the information that I gather for its usefulness.	0.843	0.561	0.653	0.569
(D2) I can distinguish the differences between print and online resources.	0.415	0.777	0.449	0.512
(D15) I can integrate information that comes from different sources (e.g. school library, online database, web).	0.572	0.879	0.635	0.600
(D1) I know how and where to search for useful information both online and offline.	0.624	0.879	0.562	0.512
(L1) I am able to recall the material that I have learned.	0.570	0.532	0.874	0.419
(L2) I am able to explain the material that I have learned.	0.557	0.588	0.878	0.531
(L3) I am able to apply the material that I have learned.	0.644	0.610	0.893	0.539
(L4) I am able to critically analyse a problem situation to suggest solutions.	0.617	0.514	0.851	0.409
(L5) I am able to evaluate the quality of information that I receive.	0.642	0.564	0.889	0.522
(L6) I am able to integrate material from different resources to create useful information.	0.548	0.610	0.824	0.547
(D8) I am familiar with the web.	0.466	0.591	0.413	0.813
(D12) I use digital technology (e.g. computer, tablet, smartphone) often both at home and at school.	0.472	0.486	0.434	0.799
(D13) I am confident in using application software (e.g. email, office suite, web browser).	0.504	0.602	0.529	0.883
(D20) I have the skills to use digital technology (e.g. computer, tablet, smartphone) effectively.	0.514	0.449	0.501	0.813

Discriminant Validity - For satisfactory discriminant validity, two criteria should be met: (1) scale items should load > 0.50 on the intended construct, but lower or weakly on the other unintended constructs (Straub, Boudreau and Gefen, 2004); and (2) the square root of AVE of a latent construct should be larger than the correlation between that particular construct and any other constructs in the model (Chin, 1998; Fornell and Larcker, 1981; Gefen and Straub, 2005). As depicted in Table 6, it was evident that individual scale items loaded > 0.50 on their intended constructs and significantly lower on any other constructs. Table 6 provides evidence that the square root of AVE of individual constructs was higher than the correlation between it and any other constructs in the model.

4.3.2 Structural model

The structural model was examined next. A bootstrapping procedure of 500 sub-samples was used to calculate t-statistics of path coefficients between the exogenous and endogenous constructs (Gefen, Straub and Boudreau, 2000). As depicted in Figure 2, two-tailed t-statistics showed all path coefficients between the constructs were significant at $p < 0.01$ (t-statistics > 2.57 were significant at $p < 0.01$). It was evident that the constructs of underpinnings, experiential learning, and searching explained about 56% of the variance in the effective learning construct ($R^2 = 0.561$).

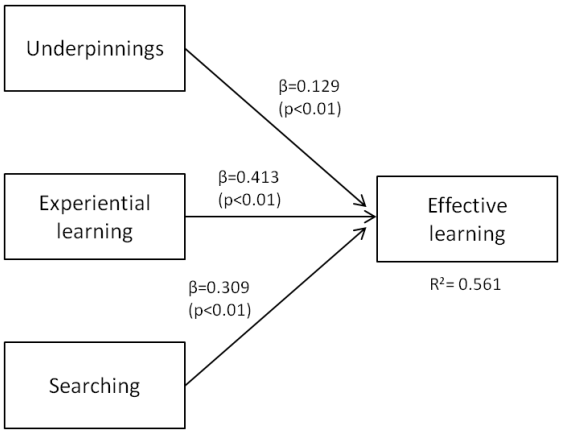

Figure 2: Structural model

5. Discussion and conclusions

This study set off to answer the question: Do students require digital literacy to be effective in learning in a blended learning environment? Analyses show that the four digital literacy constructs conceptualized by Bawden (2008) can be reduced to three. These three constructs are: underpinnings, experiential learning, and searching, and together they account for more than half of the learning effectiveness of respondents in a blended learning environment at the local university. The results provide evidence that for blended learning to be successful, there is a need for students to be digitally literate.

Given that today's young university students (most respondents are below 25 years old at the university this study was conducted) generally have good knowledge of using digital technology, it is not a surprise that a higher percentage (70.2% vs. 63.4%) of the respondents find online resources (e.g. ebooks, digital databases, audio or video webcasts) more effective than physical resources (e.g. print books, school libraries). However, as highlighted by Bawden (2009), it is equally important that the students possess skills to analyse, evaluate, and synthesise information to prevent information overload. The same view is supported by the revised Bloom's taxonomy (Krathwohl, 2002), which identifies lower-order to higher-order skills as remembering, understanding, applying, analysing, evaluating, and creating.

This study also highlights another notable observation. A higher percentage (74.5% vs. 63.9%) of the respondents prefer classroom learning as compared to online learning. Despite the convenience brought by digital technology, the respondents still find the need to meet in classrooms. This might be due to the urge for some physical community connection with other students as well as lecturers amid the virtual world enabled by digital technology. Related to this observation, it is interesting to note that a higher percentage (82% vs. 45.9%) of the respondents find that face-to-face meetings (e.g. in-class lectures, consultations with lecturers, group discussions) are more effective than online interactions (e.g. blogs, forums, chats, emails). In relation to the features of LMS, only 20.9% of the respondents like online discussions (e.g. blogs, forums, chats). It is quite clear that blended learning can be effective in learning delivery if a good balance is maintained between face-to-face classroom learning and online learning.

However, the respondents in this study had different LMS usage experience. The majority of them (60.3%) had used the LMS for two or three semesters, but about a third for only one semester. How familiar they were with the LMS could influence their views of how useful the LMS was in their learning process. In addition, the respondents were from different courses. The types and levels of digital literacy capabilities required of them could be diverse across subject matter areas.

The study context was a local university that had adopted blended learning. Future studies can examine the original research model in different contexts, e.g. primary or secondary schools, professional courses, working adults, full-time young students, etc. Also, the factors, i.e. underpinnings, experiential learning, and searching, explained slightly more than 50% of the variance in effective learning. There are other factors that could contribute to effective learning, e.g. environmental factors. Future studies can consider new factors, investigate interactions among the factors, and introduce moderators.

References

Akkoyunlu, B. and Yılmaz-Soylu, M. (2008) "Development of a Scale on Learners' Views on Blended Learning and its Implementation Process" *Internet and Higher Education*, Vol. 11, pp. 26-32.

Barclay, D., Higgins, C. and Thompson, R. (1995) "The Partial Least Squares (PLS) Approach to Causal Modeling: Personal Computer Adoption and Use as an Illustration", *Technology Studies*, Vol. 2, No. 2, pp. 285-309.

Bawden, D. (2008) Origins and Concepts of Digital Literacy. In: Lankshear, C. and Knobel, M. (eds). *Digital Literacies: Concepts, Policies and Practices*, Peter Lang, New York.

Bawden, D. and Robinson, L. (2009) "The Dark Side of Information: Overload, Anxiety and Other Paradoxes and Pathologies", *Journal of Information Science*, Vol. 35, No. 2, pp. 180-191.

Bloom, B., Engelhart, M.D., Furst, E.J., Hill, W.H. and Krathwohl, D.R. (1956). *Taxonomy of Educational Objectives: The Classification of Educational Goals*, Longman, New York.

Blooma, M.J., Kurian, J.C., Chua, A.Y.K, Goh, D.H.L. and Lien, N.H. (2013) "Social question answering: Analyzing knowledge, cognitive processes and social dimensions of micro-collaborations", *Computers & Education*, Vol. 69, pp. 109-120.

Brown, S.L. and Eisenhardt, K.M. (1998) *Competing on the Edge: Strategy as Structured Chaos*, Harvard Business School Press, Boston.

Chin, W.W. (1998) "Issues and Opinion on Structure Equation Modelling", *MIS Quarterly*, Vol. 22, No.1, pp. vii-xvi.

Cohen, S., Thiraios, D. and Kandilorou, M. (2008) "Performance Parameters Interrelations from a Balanced Scorecard Perspective: An Analysis of Greek Companies", *Managerial Auditing Journal*, Vol. 23, No. 5, pp. 485-503.

Cortizo, J.L., Rodríguez, E., Vijande, R., Sierra, J.M. and Noriega, A. (2010) "Blended Learning Applied to the Study of Mechanical Couplings in Engineering", *Computers & Education*, Vol. 54, pp. 1006-1019.

D2L. (2014) Blended Learning: Where Teaching Meets Technology. [Online] Available at: <http://content.brightspace.com/wp-content/uploads/Blended_Learning_Where_Teaching_Meets_Technology.pdf> [Accessed: 30 April 2015].

Deneshkumar, V., Senthamaraikannan, K. and Manikandan, M. (2014) "Identification of Outliers in Medical Diagnostic System Using Data Mining Techniques", *International Journal of Statistics and Applications*, Vol. 4, No. 6, pp. 241-248.

Dunn, S.C., Seaker R.F. and Waller, M.A. (1994) "Latent Variables in Business Logistics Research: Scale Development and Validation", *Journal of Business Logistics*, Vol. 15, No. 2, pp. 145-172.

Eshet, Y. (2004). "Digital Literacy: A Conceptual Framework for Survival Skills in the Digital Era", *Journal of Educational Multimedia and Hypermedia*, Vol. 13, No. 1, pp. 93-106.

Fornell, C. and Bookstein, F.L. (1982) "Two Structural Equation Models: LISREL and PLS Applied to Consumer Exit-Voice Theory", *Journal of Marketing Research*, Vol. 19, No. 4, pp. 440-452.

Fornell, C. and Larcker, D.F. (1981) "Structural Equation Models with Unobservable Variables and Measurement Error: Algebra and Statistics", *Journal of Marketing Research*, Vol. 18, No. 3, pp. 382-388.

Gable, G.G., Sedera, D. and Chan, T. (2003) "Enterprise Systems Success: A Measurement Model", *Proceedings of the 24th International Conference on Information Systems*, pp. 576-591.

Garrison, D.R. and Kanuka, H. (2004) "Blended learning: Uncovering its Transformative Potential in Higher Education", *Internet and Higher Education*, Vol. 7, pp. 95-105.

Garrison, D.R. and Vaughan, N.D. (2013) "Institutional Change and Leadership Associated with Blended Learning Innovation: Two Case Studies", *Internet and Higher Education*, Vol. 18, pp. 24-28.

Gefen, D. and Straub, D. (2005) "A Practical Guide to Factorial Validity Using PLS-Graph: Tutorial and Annotated Example", *Communications of the Association for Information Systems*, Vol. 16, No. 5, pp. 91-109.

Gefen, D., Straub, D.W. and Boudreau, M. (2000) "Structural Equation Modeling and Regression: Guidelines for Research Practice", *Communications of the Association for Information Systems*, Vol. 4, No. 7, pp. 1-77.

Gerbing, D.W. and Anderson, J.C.B. (1988) "An Updated Paradigm for Scale Development Incorporating Unidimensionality and Its Assessment", *Journal of Marketing Research*, Vol. 25, No. 2, pp. 186-192.

Gilster, P. (1997) *Digital literacy*, Wiley, New York.

Glogowska, M., Young, P., Lockyer, L. and Moule, P. (2011) "How 'Blended' is Blended Learning?: Students' Perceptions of Issues around the Integration of Online and Face-To-Face Learning in a Continuing Professional Development (CPD) Health Care Context", *Nurse Education Today*, Vol. 31, pp. 887-891.

Greene, J.A., Yu, S.B. and Copeland, D.Z. (2014) "Measuring Critical Components of Digital Literacy and their Relationships with Learning", *Computers & Education*, Vol. 76, pp. 55-69.

Hair, J.F., Black, B., Babin, B., Anderson, R.E. and Tatham, R.L. (2005) *Multivariate Data Analysis* (6th ed.), Pearson, Upper Saddle River.

Huber, G. P. (1991) "Organizational Learning: The Contributing Processes and the Literatures", *Organization Science*, Vol. 2, No. 1, pp. 88-115.

Jisc. (2014) Developing digital literacies. [Online] Available at: <https://jisc.ac.uk/guides/developing-digital-literacies> [Accessed: 30 April 2015].

Joy, E. and Garcia, F. (2000) "Measuring Learning Effectiveness: A New Look at No-Significant-Difference Findings", *Journal of Asynchronous Learning Networks*, Vol. 4, No. 1, pp. 3-39.

Kember, D., McNaught, C., Chong, F.C.Y., Lam, P. and Cheng, K.F. (2010) "Understanding the Ways in Which Design Features of Educational Websites Impact upon Student Learning Outcomes in Blended Learning Environments", *Computers & Education*, Vol. 55, pp. 1183-1192.

Krathwohl, D.R. (2002) "A Revision of Bloom's Taxonomy: An Overview", *Theory Into Practice*, Vol. 41, No. 4, pp. 212-218.

MacKenzie, S.B., Podsakoff, P.M. and Jarvis, C.B. (2005) "The Problem of Measurement Model Misspecification in Behavioral and Organisational Research and Some Recommended Solutions", *Journal of Applied Psychology*, Vol. 90, No. 4, pp. 710-730.

McKenzie, W.A., Perini, E., Rohlf, V., Toukhsati, S., Conduit, R. and Sanson, G. (2013) "A Blended Learning Lecture Delivery Model for Large and Diverse Undergraduate Cohorts", *Computers & Education*, Vol. 64, pp. 116-126.

Moskal, P., Dziuban, C. and Hartman, J. (2013) "Blended Learning: A Dangerous Idea?", *Internet and Higher Education*, Vol. 18, pp. 15-23.

Ng, W. (2012) "Can we teach digital natives digital literacy?", *Computers & Education*, Vol. 59, pp. 1065-1078.

Porter, W.W., Graham, C.R., Spring, K.A. and Welch, K.R. (2014) "Blended Learning in Higher Education: Institutional Adoption and Implementation", *Computers & Education*, Vol. 75, pp. 185-195.

Segars, A.H. (1997) "Assessing the Unidimensionality of Measurement: A Paradigm and Illustration within the Context of Information Systems Research", *Omega*, Vol. 25, No. 1, pp. 107-121.

Staker, H. and Horn, M.B. (2012) Classifying K–12 Blended Learning, Innosight Institute, Lexington.

Straub, D., Boudreau, M. and Gefen, D. (2004) "Validation guidelines for IS positivist research", *Communications of AIS*, Vol. 13, pp. 380-427.

Tabachnick, B.G. and Fidell, L.S. (2006) *Using Multivariate Statistics* (5th ed.), Pearson, Boston.

Ting, Y. (2015) "Tapping into Students' Digital Literacy and Designing Negotiated Learning to Promote Learner Autonomy", *Internet and Higher Education*, Vol. 26, pp. 25-32.