12-21-2020

A SYSTEM'S VIEW OF E-LEARNING SUCCESS MODEL AND ITS IMPLICATIONS TO E-LEARNING EMPIRICAL RESEARCH

Sean Eom
Department of Management, Southeast Missouri State University, sbeom@semo.edu

A SYSTEM'S VIEW OF E-LEARNING SUCCESS MODEL AND ITS IMPLICATIONS TO E-LEARNING EMPIRICAL RESEARCH

Sean Eom
Department of Management
Southeast Missouri State University
sbeom@semo.edu

Abstract:

A stream of empirical research over the past decade that identified predictors of e-learning success suggests that there are several critical success factors (CSFs) that must be managed effectively to fully realize promise for e-learning. A problem with empirical distance learning research comes with modeling methods. Especially, there are two approaches of modeling, with or without mediating variables. This paper argues that the simple cause-effect relationship modelling approach in some cases may lead to misleading and false conclusions. As a basis of theoretical foundation to justify our approach, we introduce a system's view of e-learning success model. Then, we present two examples from previous published papers that may mislead the effect of a CSF on the outcomes of e-learning systems. We conclude that the simple cause-effect relationship model approach in some cases may lead to misleading and false conclusions. Future e-learning empirical research should avoid the simple complex cause-effect relationship model.

Keywords: e-learning success model; a system's view; simple cause-effect relationship model; complex cause-effect relationship model; critical success factor; self-regulated learning; partial least squares structural equation modeling.

I. INTRODUCTION

A series of recent surveys tracking distance learning in the United States by the Babson Survey Research Group revealed the following: e-learning has become a mainstream delivery medium; distance education enrollments have increased continually at a greater rate than those of overall higher education; a large proportion (63.3%) of chief academic leaders believe that e-learning is a critical component of their long-term growth strategies; and a substantial proportion (71.4%) of chief academic leaders rated the learning outcomes of e-learning as comparable or superior to those in face-to-face instruction (Eom & Arbaugh, 2011; Allen, Seaman, Poulin, & Straut, 2016). Some meta-analytical studies (Sitzmann, Kraiger, Stewart, & Wisher, 2006; Means, Toyama, Murphy, Bakia, & Jones, 2009) suggest that e-learning outcomes are equal to or in some cases, better than those of face-to-face learning.

Given the growing importance of distance learning as an effective delivery medium, identification and management of e-learning critical success factors (CSFs) have been an important subject of e-learning research (Eom, Ashill, & Arbaugh, 2016). A stream of research over the past decades that identified predictors of e-learning success suggests that there are several CSFs that must be managed effectively to fully realize promise for e-learning.

The purpose of this paper is to argue that the simple cause-effect relationship model approach in some cases may lead to misleading and false conclusions. When applying the complex cause-effect relationship model as shown in Fig. 3, a theoretical assumptions or underlying theories that underpinned the development of hypotheses must be discussed. As such, we introduce a system's view of e-learning success model (Eom & Ashill, 2018). Then, we present an example from previous published papers that misleads the effect of a CSF, self-regulated learning, on the learning outcomes of e-learning systems. Finally, we discuss the implications of this study for future e-learning empirical studies.

II. A SYSTEM'S VIEW OF E-LEARNING SUCCESS MODEL

Two issues hamper progress toward building an e-learning success model: (1) the proliferation of measures of dependent and independent variables and (2) the need for a holistic success model with multiple dimensions (constructs). Eom and Ashill (2016; 2018) attempt to overcome these issues and present a learning theory-based, integrative, and holistic e-learning success model at the university level with empirical testing of the validity of the model. The model they present depicts the important relationships among a set of interdependent pivotal factors of e-learning systems working together. Using the identical data, their two studies apply partial least squares structural equation modeling (PLS-SEM) to examine the determinants of students' satisfaction and their perceived learning outcomes in the context of university online courses. Two studies used different PLS-SEM path models: the simple cause-effect relationship model (Fig. 2) and the complex cause-effect relationship model (Fig. 3). The components of a systemic model consist of inputs, processes, and outputs (Figure 1). The system's view of e-learning depicts the important relationships among a set of interdependent pivotal factors of e-learning systems dynamically working together. It provides a theoretically-grounded conceptualization and incorporated more fully developed e-learning success measures to revisit the question of key predictor of perceived learning outcomes, derived from three constructivist models (constructivism, collaborativism, and cognitive information processing model) (Eom et al., 2016).

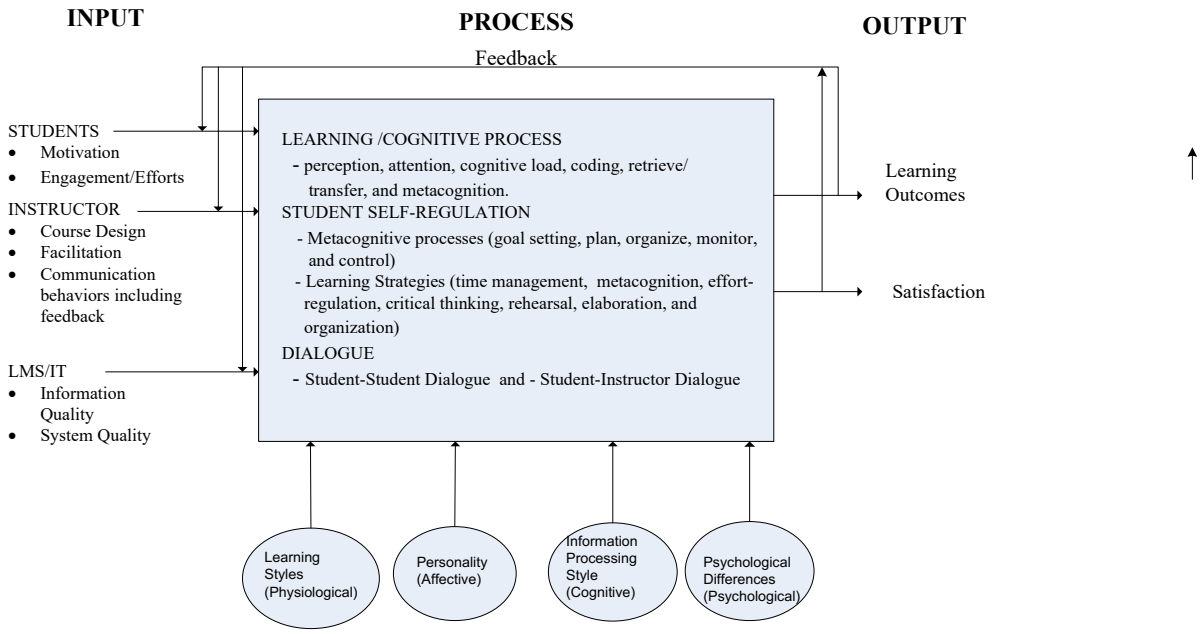

Figure 1: System's view of e-learning systems (Source: (Eom & Ashill, 2018, p.189)

Inputs

The theoretical foundation of the system's view of e-learning success model is based on the constructivist learning theories as discussed in Eom & Ashill (2016). This model is in part derived from the virtual learning environment (VLE) effectiveness model of Piccoli et al. (2001). The VLE model postulates that two antecedents (human dimension and design dimension) determine the effectiveness of e-learning systems. The human dimension is concerned with two human entities (students and instructor) and their various attributes, and the design dimension includes LMS(Eom Sean, 2012; Eom, 2014), self-regulated learning (SRL) and learner control, course design quality,

and interaction among human entities. All design dimension elements belong to the processes of e-learning systems except course design quality.

Processes

There are three distinct types of processes to produce learning outcomes.

The students' learning/cognitive process

The cognitive process is composed of a series of phases (perception, attention, cognitive load, coding, retrieval/transfer, and metacognition) supported by the different types of memories (sensory memory, working memory, long-term memory) (Alonso, López, Manrique, & Viñes, 2005).

The students' self-regulated learning process

According to Zimmerman, self-regulated students are the ones who are "'meta-cognitively,' motivationally, and behaviorally active participants in their own learning process" (Zimmerman, 1986) and they are characterized by three inseparable features: their use of SRL strategies, their responsiveness to self-oriented feedback about learning effectiveness, and their interdependent motivational processes (Zimmerman, 1990).

Self-regulated learners are the ones who motivate themselves and put forth strenuous effort, even studying materials that are uninteresting. They also self-manage the learning process of planning, monitoring, organizing and controlling. The planning includes setting their goals, selecting the appropriate learning strategies (time management, meta-cognition, effort-regulation, and organization), and controlling (evaluating their own progress and dynamically responding to it).

Dialogue

One thing that sets e-learning apart from traditional face-to-face learning is the psychological and communication space (transactional distance) between the instructor and students (Moore, 1993). The transactional distance in e-learning can be reduced by many types of interactions: learner-content, learner-instructor, learner-learner, and learner-technology interaction (Moore, 1989; Hillman, Willis, & Gunawardena, 1994). Learner-technology (learner-interface) interaction permits a learner to interact with content, the instructor, and other learners.

Of these four types of interactions, the constructivist model of learning views the interaction and dialogue between students (SS Dialog) and between students and the instructor (SI Dialog) as being critical ingredients to the success of e-learning. Therefore, the model of Eom and Ashill (2018) included only interaction between human entities. Unlike many empirical studies that measured the effects of all types of interaction (negative, neutral, and positive) on learning outcomes, their model incorporated only purposeful, constructive, meaningful interaction valued by each party (dialogue). Dialogue promotes learning through active participation and enables deep cognitive engagement for developing higher-order knowledge (Moore, 1993; Muirhead & Juwah, 2004).

Outputs

Learning outcomes and satisfaction used in e-learning empirical research are based on the taxonomy of educational objectives in the domains of cognitive behaviors (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956), affective behaviors (Krathwohl, Bloom, & Masia, 1964) , and psychomotor behaviors (Simpson, 1966). The cognitive domain learning outcomes measure intellectual learning in terms of theories, comprehension, and application of course materials to problem solving. The affective domain learning includes appreciation, feeling, satisfaction, and attitude changes.

III. TWO APPROACHES OF E-LEARNING EMPIRICAL STUDY

Data Collection

To analyze the data, Eom and Ashill (2016, 2018) utilized the following two research models utilizing the same dataset. A sample of 382 valid, unduplicated responses were received (11.63% response rate) from of 3,285 students were identified from student data files associated with every online course delivered through the online program of a university in the Midwestern United States (Eom & Ashill, 2016; 2018).

The Simple Cause-Effect Relationship Model Approach

This approach deals with the direct relationships between each CSF and learning outcomes as shown in Fig. 2. Many e-learning empirical studies totally ignored synergistic effects of CSFs interacting together (Peltier, Drago, & Schibrowsky, 2003; Arbaugh, 2005; Eom, Ashill, & Wen, 2006; Johnson, Hornik, & Salas, 2008; Sun, Tsai, Finger, Chen, & Yeh, 2008; Kim, Kwon, & Cho, 2011; Mashaw, 2012; Barbera, Clara, & Linder-Vanberschot, 2013; Eom & Ashill, 2016).

The Complex Cause-Effect Relationship Model Or Mediation Model Approaches

These approaches consider one or more mediator variables between the independent/exogeneous variable and the dependent/endogenous variable (LaPointe & Gunawardena, 2004; Young, 2005; Peltier, Schibrowsky, & Drago, 2007; Wilson, 2007; Wan, Wang, & Haggerty, 2008; Wan, 2010; Eom & Ashill, 2018). These approaches allow several CSFs that are interdependent. Unlike Fig. 2, Fig. 3 exhibits the complex cause-effect relationship model in which all three mediator variables (SI Dialog, SS Dialog, and SRL) connect the independent variables and the dependent variables.

All these empirical studies using the complex cause-effect relationship model have advanced our understanding of the effective management of CSFs of e-learning. Nevertheless, the same data processed by each of two approaches could produce misleading results and therefore hamper progress toward building reliable distance learning theories.

IV. AN EXAMPLE OF MISLEADING EMPIRICAL STUDIES

Different research models (Eom & Ashill, 2016; 2018) using the same data could produce two different conflicting outcomes. In this example, our discussion focused on students' SRL efforts. The same hypothesis, "Students with a higher level of SRL in online courses will report higher perceived learning outcomes" is tested using two different models and resulted in different outcomes. The first model failed to support the hypothesis (H3b in Table 1), while the second approach support it (H11 in Table 2).

The results of the first model (Table 1) show that the structural model explains 65% of the variance in learning outcomes. Table 1 indicates that students' SRL efforts have no impact on perceived learning outcomes, while the second research model's findings (Table 2) demonstrate the importance of SS dialog, SI dialog, and SRL as mediating variables. All three variables play a partial or full mediating role in relationships between e-learning inputs (course design quality, instructor involvement, and student motivation) and learning outcomes.

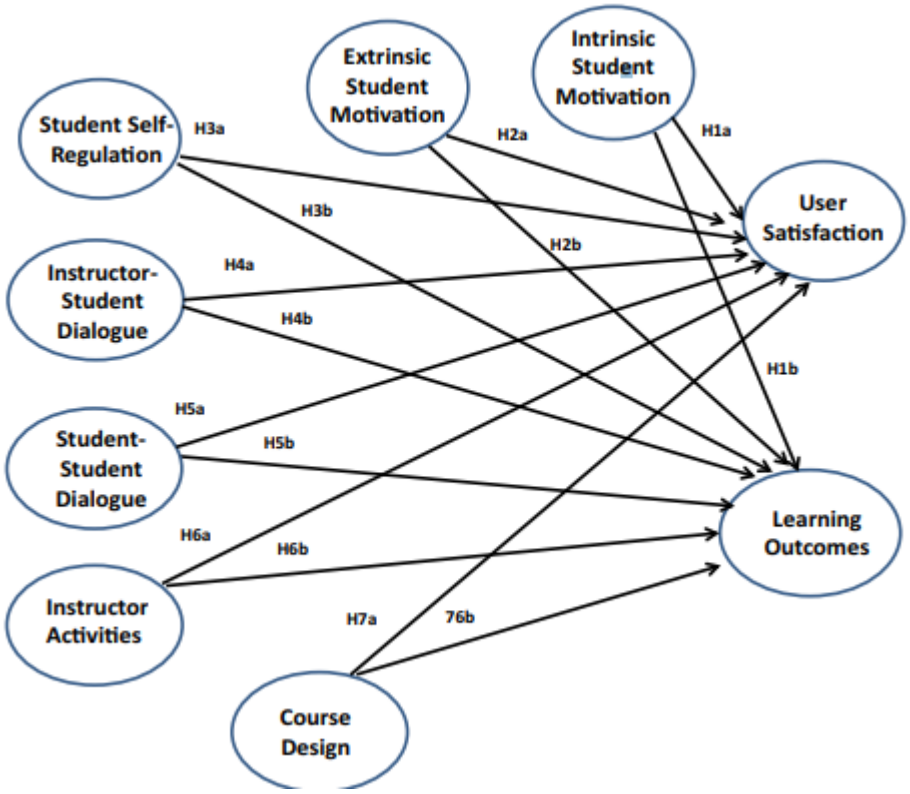

Figure 2: Research model A (The simple cause-effect relationship model)

Table 1: Structural (inner) model results

	Path Coefficient	*t* Value	Hypothesis Support
Effects on User Satisfaction	$R^2 = .71$		
Intrinsic Student Motivation (H1a)	+.05	1.44 n.s	No
Extrinsic Student Motivation (H2a)	−.01	.03 n.s	No
Student Self-Regulation (H3a)	+.01	.15 n.s	No
Instructor-Student Dialogue (H4a)	+.08	2.13^{**}	Yes
Student-Student Dialogue (H5a)	+.25	4.04^{***}	Yes
Instructor Activities (H6a)	+.27	4.07^{***}	Yes
Course Design (H7a)	+.34	6.28^{***}	Yes
Effects on Learning Outcomes	$R^2 = .65$		
Intrinsic Student Motivation (H1b)	+.10	2.68**	Yes
Extrinsic Student Motivation (H2b)	+.01	.08 n.s	No
Student Self-Regulation (H3b)	+.05	1.36 n.s	No
Instructor-Student Dialogue (H4b)	+.24	6.11^{***}	Yes
Student-Student Dialogue (H5b)	+.22	3.29^{***}	Yes
Instructor Activities (H6b)	+.17	2.36^{**}	Yes
Course Design (H7b)	+.25	4.67^{***}	Yes

n.s. not significant; $^{***}p < .001$; $^{**}p < .01$; $^{*}p < .05$

.

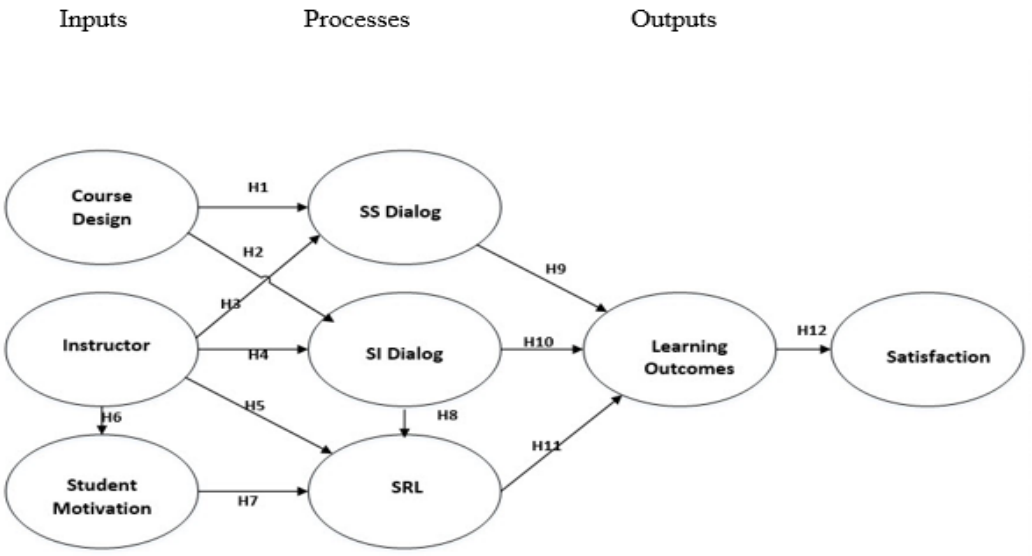

Figure 3: Research model of the complex cause-effect mediation relationship

Table 2: Structural (inner) model results

Hypothesized Relationships[a]	Standardized Coefficient	t-Value[b]	Test Result
H1. CD→ SS Dialog	.13***	2.94	Supported
H2. CD→ SI Dialog	.26****	4.11	Supported
H3. IA → SS Dialog	.76****	19.23	Supported
H4. IA → SI Dialog	.32****	5.29	Supported
H5. IA → SRL	−.09**	1.90	Not supported
H6. IA → Mot	.12**	2.17	Supported
H7. Mot → SRL	.58****	14.56	Supported
H8. SI Dialog → SRL	.20****	4.29	Supported
H9. SS Dialog → Out	.54****	13.37	Supported
H10. SI Dialog → Out	.29****	6.76	Supported
H11. SRL → Out	.09***	2.54	Supported
H12. Out → Sat	.81****	51.07	Supported

Main Effects Model Evaluation Statistics:

R^2 for: Mot = .02, SI Dialog = .30, SS Dialog = .74, SRL = .39, Out = .58 and Sat = .65

Communality Q-square values all above zero

The indirect effects of course design quality and instructor on learning outcomes are all significant beyond the .05 level. The indirect effect of motivation on learning outcomes is nonsignificant at the .05 level.

Notes: [a]CD = course design quality; IA = instructor activities; Mot = student motivation; SS Dialog = student-student dialog; SI Dialog = student-instructor dialog; SRL = self-regulatory learning strategies; Out = learning outcomes; Sat = user satisfaction.

[b]t-values corresponding to one-tail tests at: $t > 1.28$, $p < .10$; $t > 1.65$, $p < .05$; $t > 2.33$, $p < .01$; $t > 3.09$, $p < .001$. Significance levels: ****$p < .001$, ***$p < .01$, **$p < .05$, *$p < .10$, ns not significant.

V. DISCUSSION

The system's view of e-learning success model is presented to show a wide range of constructs derived from the constructivist model of learning (Jonassen, Davidson, Collins, & Haag, 1995) and its extended models (collaborativism, socioculturism, and the cognitive information processing model (Leidner & Jarvenpaa, 1995). More importantly it shows that some factors are inputs to the learning process, and other factors are mediators between inputs and Outputs (perceived learning outcomes). Therefore, it is not logical to only identify direct relationships between CSFs and dependent variables (learning outcomes).

The results of the simple cause-effect relationship model indicated that all CSFs excepts extrinsic student motivation and SRL positively contributed to learning outcomes. Therefore, student self-regulation had no significant relationship with perceived learning outcomes. On the other hand, the complex cause-effect relationship path model demonstrated positive and significant effects of SRL on learning outcomes, thus supporting our hypothesis, "Students with a higher level of SRL in online courses will report higher perceived learning outcomes." This is due to the mediating role of the process variables (SRL, SI dialogue, and SS dialogue). We first examined direct paths from course design quality, instructor activities, and motivation to learning outcomes, in addition to the indirect or mediated paths as shown in path model B (Fig. 3). These findings in Table 2 indicate that the indirect effect of instructor involvement on SRL was also significant ($\beta = .016$, $t = 3.47$). Further, the indirect effect of motivation on learning outcomes through SRL was significant ($\beta = .05$, $t = 2.21$), suggesting that SRL fully mediates the effect of motivation on learning outcomes. In summary, the above findings demonstrate the importance of SS dialog, SI dialog, and SRL as mediating variables in research model B.

Consequently, the results from the two approaches produced a contradictory conclusion and therefore they could hamper progress toward building reliable distance learning theories. Although the two models produced the same positive relationships between dialogues (SS dialogue and SI dialogue) and perceived learning outcomes with our sample, there are of course open possibilities for contradictory conclusions.

VI. CONCLUSION AND IMPLICATIONS

E-learning systems are an open system of human entities (students and instructor) and non-human entities (learning management systems and information systems) to maximize e-learning outcomes and student satisfaction (Figure 1). There exists a dynamic relationship among students' motivation, academic engagement, SRL efforts, course design quality, and instructor's roles. E-learning success is not easily explainable from characteristics of isolated sub-entities. The dynamic relationships among all constructs can be better modeled with higher order construct modeling. Theoretical developments in contemporary educational and psychological literatures (Butler & Winne, 1995) suggest that a simple cause-effect relationship model cannot adequately capture the relationship between feedback and self-regulated learning. According to Butler & Winne (1995), the instructor feedback delivered through SI dialogue as a prime determinant of the self-regulated learning process. Further, feedback and self-regulated learning are inseparable components in learning research.

Future e-learning empirical research should utilize the complex cause-effect relationship model to avoid reaching misleading and false conclusions. Research leading false conclusions has far-reaching implications in e-learning empirical research. This issue hampers progress toward building an e-learning success model and building a cumulative research tradition.

REFERENCES

Allen, I. E., Seaman, J., Poulin, R., & Straut, T. T. (2016). Online report card - tracking online education in the united states. Babson Survey Research Group and Quahog Research Group, LLC.

Alonso, F., López, G., Manrique, D., & Viñes, J. M. (2005). An instructional model for web-based e-learning education with a blended learning process approach. *British Journal of Educational Technology*, 36(2), 217-235.

Arbaugh, J. B. (2005). Is there an optimal design for on-line MBA courses? *Academy of Management Learning & Education*, 4(2), 135-149.

Barbera, E., Clara, M., & Linder-Vanberschot, J. A. (2013). Factors Influencing Student Satisfaction and Perceived Learning in Online Courses. *E-learning and Digital Media*, 10(3), 226-235.

Bloom, B. S., Engelhart, M. D., Furst, E. J., Hill, W. H., & Krathwohl, D. R. (1956). *Taxonomy of educational objectives: The classification of educational goals. Handbook 1: Cognitive domain*. New York: David McKay.

Butler, D. L., & Winne, P. H. (1995). Feedback and Self-Regulated Learning: A Theoretical Synthesis. *Review of Educational Research*, 65(3), 245-281.

Eom, S. B. (2014). Understanding e-Learners' Satisfaction with Learning Management Systems *Bulletin of the IEEE Technical Committee on Learning Technology*, 16 (2/3), 10-13.

Eom, S. B., & Arbaugh, J. B. (Eds.) (2011). *Student Satisfaction and Learning Outcomes in E-Learning: An Introduction to Empirical Research*. Hersey, PA: Information Science Reference.

Eom, S. B., & Ashill, N. (2016). The Determinants of Students' Perceived Learning Outcomes and Satisfaction in University Online Education: An Update. *Decision Sciences Journal of Innovative Education*, 14(2), 185-215.

Eom, S. B., & Ashill, N. (2018). A system's view of e-learning success model. *Decision Sciences Journal of Innovative Education*, 16(1), 42-76.

Eom, S. B., Ashill, N., & Wen, H. J. (2006). The Determinants of Students' Perceived Learning Outcome and Satisfaction in University Online Education: An Empirical Investigation. *Decision Sciences Journal of Innovative Education*, 4(2), 215-236.

Eom, S. B., Ashill, N. J., & Arbaugh, J. B. (2016). Guest Editors' Introduction to the Special Issue *Decision Sciences Journal of Innovative Education*, 14(2), 124-127.

Eom Sean, B. (2012). Effects of LMS, self-efficacy, and self-regulated learning on LMS effectiveness in business education. *Journal of International Education in Business*, 5(2), 129-144.

Hillman, D. C. A., Willis, D. J., & Gunawardena, C. N. (1994). Learner-interface interaction in distance education: An extension of contemporary models and strategies for practitioners. *American Journal of Distance Education*, 8(2), 30-42.

Johnson, R. D., Hornik, S., & Salas, E. (2008). An empirical examination of factors contributing to the creation of successful e-learning environments. *International Journal of Human–Computer Studies*, 66(5), 356-369.

Jonassen, D., Davidson, M., Collins, M. C., J., & Haag, B. B. (1995). Constructivism and computer-mediated communication in distance education. *The American Journal of Distance Education*, 9(2), 7-26.

Kim, J., Kwon, Y., & Cho, D. (2011). Investigating factors that influence social presence and learning outcomes in distance higher education. *Computers & Education* 57, 1512–1520.

Krathwohl, D. R., Bloom, B. S., & Masia, B. B. (1964). *Taxonomy of Educational Objectives: The Classification of Educational Goals. Handbook II: Affective Domain*. New York, NY: David McKay Co., Inc.

LaPointe, D. K., & Gunawardena, C. N. (2004). Developing, Testing and Refining of a Model to Understand the Relationship Between Peer Interaction and Learning Outcomes in Computer-Mediated Conferencing. *Distance Education*, 25(1), 83-106.

Leidner, D. E., & Jarvenpaa, S. L. (1995). The Use of Information Technology to Enhance Management School Education: A Theoretical View. *MIS Quarterly*, 19(3), 265-291.

Mashaw, B. (2012). A Model for Measuring Effectiveness of an online Course. *Decision Sciences Journal of Innovative Education*, 10(2), 189-221.

Means, B., Toyama, Y., Murphy, R., Bakia, M., & Jones, K. (2009). Evaluation of Evidence-based Practices in Online Learning: A Meta-Analysis and Review of Online Learning Studies. Washington, DC: U.S. Department of Education.

Moore, M. G. (1989). Three types of interaction. *The American Journal of Distance Education*, 3(2), 1-6.

Moore, M. G. (1993). Theory of transactional distance. In D. Keegan (Ed.), *Theoretical principles of distance education*. London, New York: Routledge, 22-38.

Muirhead, B., & Juwah, C. (2004). Interactivity in computer-mediated college and university education: A recent review of the literature. *Educational Technology & Society*, 7(1), 12−20.

Peltier, J. W., Drago, W., & Schibrowsky, J. A. (2003). Virtual communities and the assessment of online marketing education. *Journal of Marketing Education*, 25(3), 260-276.

Peltier, J. W., Schibrowsky, J. A., & Drago, W. (2007). The Interdependence of the Factors Influencing the Perceived Quality of the Online Learning Experience: A Causal Model. *Journal of Marketing Education*, 29(2), 40-153.

Piccoli, G., Ahmad, R., & Ives, B. (2001). Web-based Virtual Learning Environments: A Research Framework and A Preliminary Assessment of Effectiveness in Basic IT Skills Training. *MIS Quarterly*, 25(4), 401-426.

Simpson, E. (1966). The classification of educational objectives, psychomotor domain. Washington, D.C.: US Department of Education.

Sitzmann, T., Kraiger, K., Stewart, D., & Wisher, R. (2006). The comparative effectiveness of web-based and classroom instruction: A meta-analysis. *Personnel Psychology*, 59, 623-664.

Sun, P.-C., Tsai, R. J., Finger, G., Chen, Y.-Y., & Yeh, D. (2008). What drives a successful e-Learning? An empirical investigation of the critical factors influencing learner satisfaction. *Computers & Education*, 50(4), 1183–1202.

Wan, Z. (2010). *E-learning inputs, processes, and outcomes: theoretical development and empirical investigations*, The University of Western Ontario, London, Ontario, Canada.

Wan, Z., Wang, Y., & Haggerty, N. (2008). Why people benefit from e-learning differently: The effects of psychological processes on e-learning outcomes. *Information & Management*, 45, 513–521.

Wilson, J. (2007). *An examination of the relationships of interaction, learner styles, and course content on student satisfaction and outcomes in online learning*. Ph.D. Dissertation, University of Southern Queensland, Toowoomba, Queensland

Young, M. R. (2005). The Motivational Effects of the Classroom Environment in Facilitating Self-Regulated Learning. *Journal of Marketing Education*, 27(1), 25-40.

Zimmerman, B. J. (1986). Development of self-regulated learning: Which are the key subprocesses? . *Contemporary Educational Psychology*, 16, 307-313.

Zimmerman, B. J. (1990). Self-regulated learning and Academic achievement: An Overview. *Educational Psychologist*, 25(1), 3-17.

ABOUT THE AUTHOR

Sean B. Eom is Professor Emeritus of MIS at the Harrison College of Business of Southeast Missouri State University. He is the author/editor of 12 books, over 80 journal articles, and more than 130 articles in encyclopedias, book chapters, and conference proceedings. His research areas include distance learning, business intelligence, decision support systems, and bibliometrics.