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Unraveling e-Learning: An Investigation of Critical Constructs

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Abstract

E-learning and the traditional learning models share many challenges, but some e-learning challenges—e.g., resource utilization—are particular. This study examines the effects that e-learning challenges have on its success in terms of the learner's expectations, experiences, satisfaction, and performance. Seven hundred and forty-two students in a small Midwestern university constituted the sample; the data from those with e-learning experiences (412) were analyzed for their relevance to this study (close to 13% of the theoretical population). Several levels of analysis examined the effects that e-learning constructs (i.e., course structure and contents, experience with e-learning, expectations, and satisfaction) have on performance of e-learners. Although the bivariate tests and multiple regression analysis supported the theoretical model in this study, "course structure and content quality" appeared to be the most important factor affecting learner's performance.

Keywords: e-learning, teaching model, distance education, e-learner's perceptions, performance

1. INTRODUCTION

Practices in educating are evolving; e-learning is no exception. However, e-learning's effectiveness has had its share of skepticism. This is evident in the number of published research that compared e-learning and the traditional classroom teaching models. The concern is partly because of its newness and the end users'—particularly the educators—unfamiliarity with the specifics of this teaching/learning environment. The mystery also stems from whether e-learning can inspire in learners the motivation to move themselves beyond the collective knowledge, and they can develop skills for independent investigation in their respective fields.

E-learning shares with the traditional face-to-face teaching/learning models several challenges. For example, both aim to create teaching database information, and swaying toward information generation and expanding skills by inspiring learners to acquire knowledge independently; both assume that the learner can expound on the subject matter and apply what is learned. However, paramount among e-learning challenges are motivation, time management, cognitive development, and learning how to learn in a virtual environment. The unprecedented challenge specific to the nature of e-learning (or that of information technology) includes resource utilization—e.g., preparation, texts, handouts, assessments, and interactive engagements in cyberspace.

To meet these challenges has become synonymous with aiding learners to generate knowledge and interpret information, to think critically, and develop skills demanded in the employment market. Consequently, learning is not merely thinking critically; it is the ability to

plan and execute independently—i.e., the ability to use and apply the information learned to a specific context, be it software development, experimentation, completing a project, writing a term project, etc. While "good teaching is always good teaching" (Driscoll, Jicha, Hunt, Tichavsky et al., 2012), is e-learning "good" learning?

The business environment has accepted e-learning as an effective tool (Wong & Huang, 2011), but higher education is still preoccupied with such questions that put to the test e-learning's credibility as a viable platform for knowledge creation. This is a paradoxical because of the existing wide Web-based education in higher education, which legitimizes e-learning vis-à-vis the traditional pedagogical approaches. Because resisting e-learning is widespread, it reinforces the need for more empirical research in this area. Given this, the current study tests the relevance of a number of key pedagogical factors to a successful e-learning environment. The hope is to add to the body of information that aims to improve e-leaning demands for a set of desired competency in higher education.

Given the above, this study assessed e-learning effectiveness in relation to the quality and students' achievement. It attempted to address a series of research questions reflecting how students benefit from e-learning uniformly: What are the students' expectations of e-learning? What type of experiences do the students have with e-learning? How are the students' experiences with e-learning affecting their performances?

2. LITERATURE REVIEW

The scholarship on e-learning focuses predominantly on the perceptions of the end-users and usefulness of e-learning; the set of empirical studies comparing e-learning outcomes with the traditional format of classroom management is also expansive. The literature affirms the usefulness of e-learning, and supports that there is no significant difference between e-learning and the traditional classroom environment (York, 2008). The best practices in e-leaning share with other pedagogical methods the provision of quality training with substance (Sanders & Lafferty, 2010).

The common threads in the literature on a workable e-learning platform are ease of navigation, accessibility, and consistency (Sanders & Lafferty, 2010). If present, these qualities allude to the mechanical structuration of e-learning modules. Paramount to this structure is the aesthetic habitual concern of the end user—e.g., the "user-centered" quality of the product. However, the most ambitious features in the literature on best e-learning practices are course design, quality, contents, engagement, knowledge generation, and independent learning. A robust e-learning environment also rests heavily on solid pedagogy and technology (Garrison & Anderson, 2003).

The challenges of delivering "quality" e-learning are unique in their own rights (Suarez, Grice, Turner, & Hankins, 2012), but "quality" is a broad term with a broad spectrum that ranges from solid teaching to high expectations to substantive learning of skills; these characteristics are not mutually exclusive. For this reason, the range of conceptual definitions of "quality e-learning" lends itself to expansive and overlapping areas of investigation. For example, Hill, Lomas, and MacGregor (2003) explored the idea—i.e., quality—by surveying a focused group comprised of students from different disciplines in higher education in England. They found that quality of the lecturer, students' engagement with the materials, resources, and the support systems from family and friends were the most important factors affecting quality in an e-learning environment. These researchers conceptualized "Quality" in terms of the facilitator's abilities, sources of encouragement or inspiration, and the technical support. Although these aspects are important in delivering information in an e-learning environment, the literature suggests ensuring quality through maintaining compliance with the curriculum requirement of a course (Hay, Kehoe, Miquel, Hatzipanagos, Kinchin, et. al., 2008; Stross, 2011).

Given the above, the challenge of maintaining quality e-learning is embedded in the course design—e.g., user friendliness and the seamless flow of information (Huryk, 2005). These are highly important and relevant observations, but they undermine several fundamental issues. The success of e-learning relates to: 1) availability and accessibility of technology, 2) the end users' skills and competence in navigating the course and their technical and mechanical knowledge), and 3) the ability to fulfill the course's objective by masterfully and independently demonstrating

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the learning outcome. The first two points relate to the learning environment in terms of the experiences with e-learning and technology use. Related to these factors are the extent to which the product development focuses on the least competent end-users while designing and developing e-learning course products, and the concern for disabled users. Furthermore, as Chapelle (1999) argued, any new educational tool must deal with the literacy challenges posed by the intersections of the socio-cultural factors such as class, race/ethnicity, and gender—all of which require the designers/educators to search ways to enhance the potentials for success. Thus, e-learning must provide an interface that can accommodate different teaching modules for different learning skills in a self-regulated and independent process of knowledge creation.

Another issue points to meeting the challenges of delivering quality e-learning. Educators have developed many designs and incorporated activities to enhance quality, facilitate learning, and measure effectiveness. For example, Lin, Tseng, Weng, & Su (2008) introduced adopting a mechanism of learning activities that incorporated "navigation and content presentation" according to the "learners' knowledge" of the course contents. They have suggested "Object Oriented Learning Activity" or "Learning Sequencing Graph" that requires content selection based on explicating a sequence of different learning units. Similarly, Mor and Minguillon (2004) looked at the usefulness of designing a "usage mining tool" to analyze the navigation behavior of e-learners and its relationship with "optimal scheduling" and "user profile." The intent in these efforts is that mapping e-learning is reflective of the learner's characteristics, and that sequencing can improve learning and understanding the course concepts. These studies suggest selectivity in learning: learning the contents most suited to the specificities of a learner. Here, the assumption is to customize learning so that it fits the characteristics of the learner because each comes from a diverse background and strength.

Streamlining the content according to the learners' knowledge of the course or their characteristics contradicts the suggestion by the researchers who advocate effective earning through strong pedagogical structures and content (Derntl, 2005; Garrison, 2001; Salmon, 2005). These researchers suggest that the structural environment within which e-learning is implemented requires certain skills; the success of any type of e-learning activities depends on the system's readiness, the platform's quality, and the ease for navigation. Although this point is missing in the "content driven" approaches, the structural approach is overlooking the learners' abilities to adjusting to information technology. Another issue with this type of constructivist approach to pedagogy on e-learning is the ambivalence regarding their effectiveness when compared with other instructional methods. The search for new and varied methods has contributed to the growth of e-learning and to the development of new skills, but these skills are limited to what Gray, Ryan, and Coulon (2013) perceived as ways of "exploiting the new technology." They also indicated that "e-learning constructs" often demonstrate a commonsense approach. For this reason, any newly suggested method of teaching may seem appropriate or effective.

Whether the contents or the structure, the point is that contents and technology are inseparable. This assertion may be misconstrued as if technology dictates the contents. Technology may provide the tools, but its usefulness is limited to enhancing the learning process; Technology is useful only if it enhances the learning process (O'Neill, Singh, & O'Donoghue, 2004).

Other prevailing notions in the literature on e-learning, although not mutually exclusive, are advocating a hybrid of the two—i.e., a blended pedagogical model (e.g., Verkroost, Meijerink, Lintsen, & Veen, 2008), collaborative learning (Mason, 2011), the mining technique (Khribi, Jemni, & Nasraoui, 2009), or interactive learning (Anderson & Hatakka, 2010). They also suggest that a strong e-learning pedagogy requires a structured format where rules and regularities with either explicit or implicit formula convert abstract ideas into knowledge and knowledge into actions. When juxtaposed, this short list gives the impression that e-learning is not an aggregate of separate random activities—thus, emphasizing teaching skills regardless of the structural modalities; Yet the assessment data in this category of research reflects mostly test scores. Although the designs of the course seem elaborate, it makes sense to assume their effectiveness; but e-learning constructs often demonstrate a common-sense approach—a point warned by Gray, et al., (2013).

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In essence, effective e-learning means providing a reliable interface—i.e., maintaining interactions (both among the students and between the instructor and the students), creating a supportive online community, and a focus on resources are among the factors (Boettcher, 2011; Driscoll et al., 2013; Center for Teaching and Learning at the University of Maryland University College, 2013). Research in this area correlates learning with frequent formal and informal conferences (i.e., covering specific course contents, Cyber Café, or Open Forum) set forth by the instructor. These efforts demonstrate that one-on-one (i.e., facilitator-learner) communication is expected in an effective e-learning. The available communication modes can range from a simple e-mail through asynchronous learning networks or threaded message boards (Aksomitis, 2006). Although students may express satisfaction with online interactions amongst themselves (Driscoll et al., 2013), they seem more inclined toward face-to-face interactions with the facilitator. In general, any form of open, "one-on-one" communication is essential to learning (Rovai & Barnum, 2003), and that e-learners are more comfortable with the learning environment if they do not feel isolated. This line of analysis seems to equate "learning" with "consumer's satisfaction" instead of "quality control."

In summation, research on e-learning's effectiveness is predominantly perceptional: the faculty's perception of the effectiveness and success of e-learning; or the students' satisfaction with the e-learning environment (Kamali, 2013). However, studies reviewed here suggest enhancing the contents, incorporating structured patterns of delivery, and requiring connectivity in conjunction with collaborative and customized learning strategies with a set of clear expectations for e-learning. The current scholarship on e-learning also suggests the importance of creating a comfortable learning environment. However, it is unclear if the notion that technology enhances learning is application driven.

3. THEORETICAL MODEL

Given the above, constructing a unified theory of e-learning may seem inappropriate due to the diversity in approaches to pedagogy. However, measuring successful e-learning is doable by relating its constructs to a host of structural variables that can measure the appropriateness of its contents. This way, e-learning is reflected in a content driven and structurally patterned environment, which is mirrored in the manifestation of a context within which knowledge is generated, gathered, and disseminated. Within this framework is the perceived usefulness of the e-learning environment. In other words, a successful e-learning environment is mirrored in the e-learners' satisfaction with its contents and quality, and their achievements. These may be justified based on self-efficacy—i.e., the self-paced, self-regulated skills for studying (Appendix A, Figure 1).

Hence, this study tested the following hypotheses their relevance to e-learning's efficacy:

Hypothesis 1. E-learning's experiences depends on the architectonic of a course and the quality of its contents.

Hypothesis 2. Learners with more positive experiences are more likely to express satisfaction with the e-learning environment.

Hypothesis 3. The more satisfied e-learners are more likely to perform better.

The linearity assumption among the constructs was tested and supported by creating a scatter plot matrix (Mertler & Vannetta, 2002). Collectively, these hypotheses imply that a successful e-learning environment is reflective of its structure and contents, and aims to meet the learners' expectations and their sense of achievements. Although there exist various combinations of the relationships among the e-learning constructs examined here, they appeared redundant if hypothesized. However, if the constructs mandated in the above hypotheses are available in an e-learning environment, then we would assume that there is no difference in learning and performing between e-learning and the traditional classroom environment.

4. METHODS

Sample and Data

A random sample of the entire student population (slightly over 6,000) in a Midwestern university in 2011-2012 was the source of the data for this study. The data was collected via self-administered questionnaires that were

distributed in only Monday face-to-face classes at 10:00 a.m.. This avoided duplications of participants. The sample size (n=742) was slightly below 13% of the theoretical population, which sufficiently ensures consistency in reliability (Monette, Sullivan, & DeJong, 2010; Neuman, 2011), but only those with e-learning experiences (a total of 412) were included in the analysis. The sample included a representative distribution of the respondents in terms of the academic background and status (75% traditional students (i.e., typically 18-24 years of age who enters the university with no delay from high school, may work part-time, is financially dependent on other sources (Deil-Amen, 2011)) and sex (41% males and 59% females). Of those surveyed, 57% had taken at least one class that utilized e-learning, and 74% of the sample expressed willingness to take more online classes.

Variables and Measures

This study employed a self-administered questionnaire for data collection, which contained both qualitative and quantitative measures of e-learning effectiveness. The questionnaire assessed the course structure and content quality, students' perception and expectations of e-learning, their experiences with and preference for online classes, and their performance. The questionnaire was piloted to ensure validity. Problematic questions were rephrased or simplified. Collectively, they measured the following constructs: 1) "Structure and Content Quality" measured the organization of the course, delivery, demand and the rigor of the course. 2) Student's Expectations reflected meeting the course objectives, the course level, and flexibility. 3) "Experiences With E-learning" covered ease of navigation, availability of the instructor, participation, and technical issues. 4) "Satisfaction with the course" indicated the overall perceptions regarding the course, the instructor's ability to meet the objectives of the course, help received, and ease of access and navigation. "Performance" was also measured by a set of self-reported questions regarding successful completion of at least one course that utilized e-learning, the ability to meet the deadlines and completing the course requirements. A 5-point Likert scale measured the variables, which was transformed into three categories ranging from High/strongly agree through medium/neutral to low/strongly disagree. Items in each scale were cross-checked for internal consistency—all were statistically significant at $p < .01$. Spearman's Rho measured the bivariate correlations between pairs of the constructs because of the ordinal nature of the additive scales. Regression analysis as a preliminary test of the validity of the instrument examined the efficacy of the questionnaire (Cohen, 1988).

5. INDINGS

The preliminary analysis of the data indicated that 29.2% of those with no e-learning experiences were uncomfortable with e-learning; they were unwilling to take classes that incorporated e-learning. However, those with e-learning experiences have shown more favorable attitude toward e-learning ($r=39$, $p=.000$). There is a degree of resistance toward e-learning among those with no prior experiences with this pedagogical tool. Paramount among the reason for the averting learners was their perceived lack of ability to perform well in an e-learning environment. From a marketing perspective, the institutional strategic planning must include priority plans that target and attract this group of students.

Descriptive statistics and correlation values were calculated for each possible pair of the constructs (Appendix B, Table 1). The mean distribution data in Table 1 shows a positively skewed pattern of responses with regard to the e-learning scales (constructs) in this study. The mean scores indicate that a structured course content were highly valued among the respondents; their expectations of the course also leaned toward the higher end. Although most seemed to have expressed a relatively positive experience with e-learning, their satisfaction with the course seemed almost unanimously high. The small standard deviation values also support these finding, indicating uniformity in the responses expressed by the participants. These finding agree with the literature in terms of e-learning's acceptance.

Moreover, the bivariate analyses showed statistically significant correlations between a course structure and the students' expectations of a course ($r=.24$), as well as with their satisfaction ($r=.22$) and performance ($r=.52$) in a course (these correlations were significant at $p=.000$ level). Since "success" is measured according to the students' satisfaction with the course and performance, the data supported

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Hypothesis 1—i.e., e-learning's success is dependent on the architectonic of a course, its contents, and the ways in which e-learning is utilized.

However, one's expectations showed no statistically significant correlation with one's e-learning experiences (r=.09); e-learning experiences did not correlate with perceived satisfaction with e-learning (r=-.06). Having e-learning experiences was negatively correlation with performance; the correlation was also weak (=-.05). Therefore, the data did not support Hypothesis 2—i.e., having e-learning experience is immaterial to the learner's perceived satisfaction with e-learning. Therefore, the relevance of a successful e-learning environment to the learner's expectations and experiences is highly questionable.

The data in Table 1 also shows that both "satisfaction" and "performance" were highly correlated with the students' expectation of the course (r=.33 and r=.24, respectively, p=.000). A highly significant and positive correlation is also present between satisfaction with a course and performance (r=.24, p=.000); therefore, supporting Hypothesis 3—i.e., the more satisfied e-learners are more likely to perform better. Moreover, the data indicates that students with more e-learning experiences are less prone to a highly structured course content (r=-.10, p=.04). Although this is curious, one reason for this anomaly is the notion that e-learning should permit flexibility and independent study habits.

In addition to testing the existing empirical research, these findings are also contributing to the body of the literature. Although seven of the nine bivariate correlation coefficients are statistically significant, six of them are weak coefficients. The bivariate coefficients do not show the most important, predictive e-learning constructs; the linear grouping of the constructs does not truly show their relationships with performance.

Since this study seeks to ascertain which e-learning constructs (i.e., structure and content quality, expectation, e-learning experiences, and satisfaction) are most influential in predicting students' performance, a stepwise multiple regression analysis was utilized as test statistics. However, several tests were conducted prior to the regression analysis that determined the relevance of the data in this study. Box's test of equality of covariance was significant at p<.001), which is lower than p=.02 suggested by Mertler and Vannetta (2002), indicating unequal group sample size or unequal covariance. Because multicolinearity could be an issue, the tolerance levels for all e-learning constructs were calculated, which were above .90. This means that the variance in each construct was mainly independent of other predictors. Thus, multicolinearity was absent among these measures.

Regression results in Table 2 indicate that the overall four predictors of e-learning model in this study significantly predict performance (F=27.52, p=.000). The model is accountable for 21% of the variance in performance. These findings are compatible with the bivariate coefficients. However, the model's test statistics indicate that the structure and content quality of an e-learning environment is the most significant predictor of performance (β=.43, p=.000). This is also evident in the t score (t=9.58) for this construct, which is greater than 1.96--allowing for more than 95% confidence interval.

The data in Table 2 also suggests that the standard regression coefficient is consistent with the hypothesized model. Although the bivariate coefficients between performance and each of the constructs of e-learning were statistically significant (Table 1), the regression model indicates that expectations, experiences, and satisfaction do not play major roles in predicting performance. This pattern is also evident when testing for partial correlations (statistics not shown). We can assume that some degree of variance in performance may be due to the unexplained portion of the predictors, but the major contributor to performance is the structural integrity of the course and its quality.

6. DISCUSSIONS AND CONCLUSIONS

Studies of e-learning effectiveness abound in the literature. These studies help us develop a sense of urgency regarding the appropriateness and relevance of e-learning in contemporary higher education. However, a major limitation in these types of research is that the contrasts are often perceptual instead of a focus on contents, quality, and performance. While the current study tries to avoid such voids, it missed an emphasis on coverage, its significance and importance to the learner's educational achievement, and the instructor's commitment to the course for quality control purposes.

Subsequent research may benefit by paying attention to these points (See also Discussions and Conclusions below).

Nonetheless, the current study corresponds with prior research findings that point to a positive correlation between performance and satisfaction with a course or with the instructor. The findings verified the assumption that students familiar with e-learning often perform well in this environment. However, these findings are limited only to independent bivariate analyses. Further analysis by juxtaposing the e-learning constructs indicated that the degree of variance in performance that is accounted for by the set of combined predictors is not uniformly distributed. The course structure and content quality seemed to be the most important predictor of performance. This latter finding contradicts prior research findings that emphasized satisfaction with a course or with the instructor as important correlates of performance. The findings in this research also question the accuracy of assuming that performance is dependent on e-learning experiences, expectations, and satisfaction with the e-learning.

Learner's satisfaction with the course structure and content quality requires maintaining an effective and engaging role in e-learning delivery, which needs a robust platform. Although the current research supported the need for a robust and well-structured learning environment, it is not clear if such an environment is also a measure of the end user's acceptance of e-learning. A concern here is that many learners refuse to accept online classes and e-learning's usefulness in teaching and learning as a viable option vis-à-vis the traditional lecture classes. This is more prevalent among those who have no prior e-learning experiences with e-learning. Administrators should target this population if their interest is to integrate diverse learners. Training workshops and advisement into hybrid courses may ease the fear of the unknown. Most learners fear neglecting the course requirements, procrastinating, and being forgetful. Research in this area also suggests a stronger communication and presence by the facilitator for improving these issues and enhancing the end users' acceptance of the system. However, e-learning instructors must develop strategies for motivating e-learners. Further research in this area will shed more light on these issues since research findings are inconclusive (Kim, 2009).

If positive experiences with the course contents (and system quality) in the e-learning environment contribute to performance, it can be extrapolated that the stability of the course environment is a significant factor in determining the success of e-learning. Although the literature has paid scant attention to the end user's interfaces, it is unclear if a high volume of interaction in e-learning has a significant effect on the learner's performance level.

Last, the current research delineated "structure and content quality" as a strong predictor of the end user's performance. This study measured "structure" based on the course set up, accessibility and availability of the materials, and comprehending the instructional materials. These issues are also relevant to service quality, support staff, and the stability of the platform. Perhaps an empirical measure of "content quality" should focus on the richness of the contents, how current and appropriate the contents are for the course level. Future research in this area may focus on an in-depth content analysis of the e-learning environment instead of measuring perceptions.

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APPENDIX A

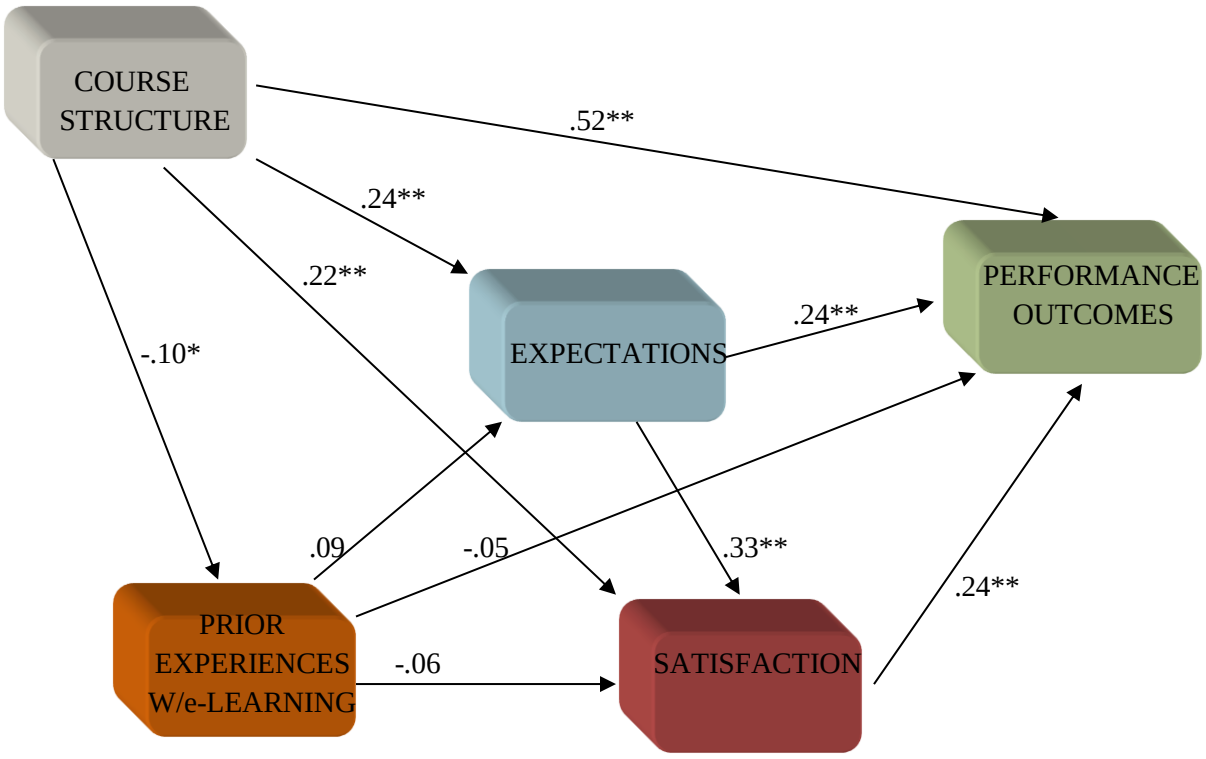

Figure 1. The Study Model and the Bivariate Correlation Coefficients

** Correlation is significant at p < 0.000 level (2-tailed)
* Correlation is significant at p ≤ 0.05 level (2-tailed)

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APPENDIX B

Table 1. Descriptive Statistics and Bivariate Correlation Values (Spearman's Rho)

Constructs	Mean	Range	SD	1	2	3	4	5
1. Structure & Content	2.24	1-3	0.84	#				
2. Expectation	2.81	1-3	0.53	.24**	#			
3. Experience W/e-Learning	2.35	1-3	0.49	-.10*	.09	#		
4. Satisfaction	2.93	1-3	0.30	.22**	.33**	-.06	#	
5. Performance	2.44	1-3	0.74	.52**	.24**	-.05	.24**	#

** Correlation is significant at $p < 0.000$ level (2-tailed)
* Correlation is significant at $p \leq 0.05$ level (2-tailed)

Table 2. Regression Coefficients for E-learning Construct Measurements [a]

Constructs	B	SE	β	t	Sig.
(Constant)	1.14	.356	.365	3.21	.001
Structure & Contents	.39	.04	.43	9.58	.000
Expectations	.09	.07	.07	1.43	.15
Experiences W/e-Learning	-.03	.07	-.02	- .45	.65
Satisfaction	.09	.11	.04	.78	.43

R = .56 R^2 = .21 Adjusted R^2 = .20 F = 27.52 Sig. = .000

a. Dependent Variable = Performance
Selecting only cases when at least one e-learning class is taken.