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Dialogue between Students and the Instructor: A Missing Link in Assessing E-Learning Outcomes

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DIALOGUE BETWEEN STUDENTS AND THE INSTRUCTOR: A MISSING LINK IN ASSESSING E-LEARNING OUTCOMES

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Abstract:

Interaction is one of the controversial topics in e-learning literature. Overall body of knowledge that has accumulated over the past decade seemed inconclusive and needs critical analyses. To find an answer to the perplexing issue, this study presents a path analysis model to investigate the effects of interaction and dialog on e-learning outcomes and satisfaction. The path analysis model we present here differs from all existing studies in that the path model introduced a new variable, dialog. The concept of dialog is suggested by Moore, but it was not empirically test until now. Based on the review of related research, five hypotheses were developed. The structural equations also show that about forty two percent of e-learning satisfaction levels can be explained by three endogenous variables and one exogenous variable (learning outcomes). The level of student satisfaction in e-learning hinges on the facilitating role of the instructor, the interaction among students, and the dialogue between the instructor and students, in the order of the magnitude of path coefficients.

Keywords: e-learning; distance learning; empirical research; interaction; dialogue; satisfaction; learning outcome.

I. INTRODUCTION

Interaction is one of the controversial topics in e-learning literature. Overall body of knowledge that has accumulated over the past decade seemed inconclusive and needs critical analyses. The core of e-learning or distance education theory centers around overcoming transaction distance which is described by Moore [1997, p.22] as

> The transaction that we call distance education occurs between teachers and learners in an environment having the special characteristic of separation of teachers from learners. This separation leads to special patterns of learner and teacher behaviors. It is the separation of learners and teachers that profoundly affects both teaching and learning. With separation there is a psychological and communications space to be crossed, a space of potential misunderstanding between the inputs of instructor and those of the learner. It is this psychological and communications space that is the transactional distance.

According to transaction theory of Moore[1997], the transactional distance in distance education is a function of Dialogue, Structure, and Learner Autonomy. Many measures of learning outcomes have been used in e-learning research including overall perceived effectiveness [Peltier et al., 2003], satisfaction and learning outcome [Eom et al., 2006], grade received and satisfaction level [Abdous and Yoshimura, 2010]. Consensus seems to be forming among e-learning empirical researcher as to the dependent variables such as satisfaction and outcomes.

This study presents a path analysis model to investigate the effects of interaction and dialog on e-learning outcomes and satisfaction. First, we review previous e-learning empirical studies that have investigated the relationship between the interaction and students' perceived learning outcomes and satisfaction in university online education covering the period 2001-2010. Their conclusions seemed inconclusive. One study found no relationships between interactions and two dependent variables (satisfaction and learning outcomes). Five studies found positive

relationships between interactions and two dependent variables. Two studies concluded that interactions significantly affect e-learning satisfaction, but not learning outcomes. To find an answer to the perplexing issue, the path analysis model we present here differs from all existing studies in that the path model introduced a new variable, dialog. The concept of dialog is suggested by Moore, but it was not empirically test until now. The next section is devoted to the review of related research and hypothesis development. The following sections are concerned with the survey instruments and path analysis process (model specification, model identification, model estimation, model testing and modification). The conclusion section presents the findings of this study.

II. REVIEW OF LITERATURE

To highlight the major differences among the selected empirical studies, we compiled and contrasted nine empirical studies with particular attention to the four issues (the dependent constructs and their indicators, independent constructs and their indicators, research methods, participants' characteristics, and findings. As a first logical step to demystify these inconclusive findings, we cluster all these papers into three groups: (1) case study, (2) analysis of variance (ANOVA) and correlations analysis, and (3) structural equation modeling (SEM) and factor and regression analyses.

Case study

The Kellogg and Smith (2009) study is different from the rest of the studies in the review in terms of participant's attributes (working adult, part-time students) in addition to research method. This study concluded that student-to-student interaction had indifferent and often negative association with either perceived learning outcomes or satisfaction. Like all other studies in this review, the dependent variables in this study were measured by two single questions. The independent variable (interaction) was measured by the time spent per student for all online activities in a course. The conclusion is clearly distinguishable from the rest of the eight studies. Perceived e-learning outcomes and the level of satisfaction are the results of interplay of many psychological, socio-economic, cultural, and other variables. Therefore, the results of qualitative and quantitative investigations should not be mixed together and be interpreted differently.

Empirical studies with single indicator variable

The remaining 8 studies can be further analyzed by the variable types. Two studies [Swan, 2001, Wilson, 2007] used single indicator variables and 6 other studies used SEM and other multivariate statistical analyses. Findings of the two studies that employed ANOVA and inter-item correlations analyses are quite different. While Swan's study suggested a high correlation among satisfaction, learning outcomes, and interaction, Wilson found a small impact of interaction on satisfaction but no definite connection between learning outcome (grade received) and interaction.

Empirical studies with SEM, factor, or regression analyses

The majority of studies in the review use SEM, factor and/or regression analyses. The findings were inconclusive. Major issues in comparing the findings of these studies were the measurement of dependent constructs and their indicator variables. The dependent constructs were:

- Overall perceived effectiveness [Peltier et al., 2003] and self-reported learning outcomes [LaPointe and Gunawardena, 2004] – these two are a mix of satisfaction and learning outcome.
- Perceived learning/Course quality [Marks et al., 2005]

- Learner Satisfaction and learning outcome ([Eom, 2009, Eom et al., 2006]
- Perceived learning and satisfaction [Arbaugh and Rau, 2007] – this study had two dependent constructs but their indicators were mixed each other.

Table 1. Review of Literature (2001 – 2010)

References	Research methods	Findings
[Swan, 2001]	*ANOVA *Inter-item correlations	Perceived satisfaction, perceived learning the instructor, peers, and contents - were **highly interrelated with.**
[Wilson, 2007]	*Content analysis *ANOVA *Inter-item correlations (two tailed Pearson's correlation) analysis	Overall interaction had a small impact on satisfaction. **No significant differences** of satisfaction between low and high interaction groupings of participants measured by actual frequency and duration of interaction. No definite connection between learning outcome (grade) and interaction.
[Pettier et al., 2003]	*Factor Analysis *Regression analysis	Instructor-to-student and student-to-student interactions are the least important factors, but were **statistically significant predictors** of e -learning effectiveness**.** Two of three indicators are satisfaction measure.
[Arbaugh and Rau, 2007]	*Factor analysis *Correlations analysis *Regression analysis	All three interactions had **a positive effect** on student learning and satisfaction. Their research design did not separate learning outcome and satisfaction
[LaPointe and Gunawardena, 2004]	*SEM (AMOS 4.0) *Exploratory factor analysis	Strong relationship between perceived peer interaction & perceived learning outcomes, indicating **a large, direct effect** of self-reported peer interaction on self-reported learning outcomes, measured by self-reported learning and satisfaction.
[Marks et al., 2005]	*SEM (LISREL)	Student-to-student interaction had **a positive effect** on student learning and satisfaction. These two measures were not separated.
[Eom et al., 2006]	*SEM (PLS-Graph)	Interaction has **a significant effect on satisfaction** at $p < .01$, but **not on learning outcome**.
[Eom, 2009]	*SEM (PLS-Graph)	Interactions are affected by course Structure, self-motivation, and learning style. Interaction **significantly affects user satisfaction, but not learning outcomes**.
[Kellogg and Smith, 2009]	*Case study *Content analysis on open-ended question *Participation analysis	Student-to-student interactive modalities are not associated with either perceived learning outcome or satisfaction (**indifferent and often negative** regarding these learning activities)

Table 1. Review of Literature (2001 – 2010) continued

Source	Method	Independent variables (perceived)	Independent variable (perceived)	Dependent variables (perceived)	Relation-ships
[Swan, 2001]	*Anova *Correlation	Satisfaction/ outcome		Interaction I	Highly correlated
		Satisfaction/ outcome		Interaction II	Highly Correlated
[Peltier et al., 2003]	*Factor *Regression		effectiveness (mix of outcome & satisfaction)	Interactions I and II	positive
[Arbaugh and Rau, 2007]	*Factor *Regression		Mix of outcome & satisfaction	Interaction I	positive
				Interaction II	Negative
[Marks et al., 2005]	*SEM (LISREL)		Mix of outcome & satisfaction	Interaction I	positive
			Mix of outcome & satisfaction	Interaction II	positive
[LaPointe and Gunawardena, 2004]	*SEM (AMOS) *Exploratory factor		Mix of outcome & satisfaction	Interaction I	positive
[Eom et al., 2006]	*SEM (PLS)	Satisfaction		Mix of interactions I & II	positive
		Outcome		Mix of interactions I & II	negative

Interaction I = interaction with students, Interaction II = interaction with instructor

III. HYPOTHESIS DEVELOPMENT

Instructor facilitation and learning outcomes

Distance learning can easily break a major assumption of objectivism that the instructor houses all necessary knowledge. For this reason, distance learning systems can utilize many other

learning models such as constructivist, collaboratism, and socioculturism. Constructivism assumes that individuals learn better when they control the pace of learning. Therefore, the instructor supports learner-centered active learning. Under the model of collaboratism, student involvement is critical to learning. The basic premise of this model of collaboratism is that students learn through shared understanding of a group of learners. Therefore, instruction becomes communication-oriented and the instructor becomes a discussion leader. E-learning environments demand a transition of the roles of students and the instructor. The instructor's role is to become a facilitator who stimulates, guides, and challenges his/her students via empowering students with freedom and responsibility, rather than a lecturer who focuses on the delivery of instruction [Huynh, 2005]. We used a question to assess the roles of the instructor as the facilitator: "The instructor was actively involved in facilitating this course". We hypothesized:

H_1: A higher level of instructor facilitation will lead to higher levels of student agreement that the learning outcomes of online courses are equal to face-to-face courses.

Dialogue and e-learning outcome

According to Moore [1997], the term dialogue is similar to interaction but there are some critical distinctions between the two as explained below:

> The term 'dialogue' is used to describe an interaction or series of interactions having positive qualities that other interactions might not have. A dialogue is purposeful, constructive and valued by each party. Each party in a dialogue is a respected and active listener; each is a contributor, and builds on the contributions of the other party or parties. There can be negative or neutral interaction; the term 'dialogue' is reserved for positive interactions, with value placed on the synergistic nature of the relationship of the parties involved.

We have not found any previous empirical research that investigated the effect of dialogue on e-learning outcome other than between interaction and e-learning outcome. Prior research has reached mixed results on the effect of interaction on e-learning outcomes. Some reported a positive effect on both learning outcomes and satisfaction [Arbaugh and Rau, 2007, Marks et al., 2005] and positive effect on only satisfaction, but not on learning outcome [Eom et al., 2006]. With the absence of prior empirical studies, we hypothesize that

H_2: Dialog between students and instructor will lead to a higher level of student learning outcome.

Interaction with instructor and learning outcomes

There are clearly inconclusive relationships between the interaction between the instructor and students and learning outcomes. The dependent constructs used in this review include overall perceived effectiveness [Peltier et al., 2003], perceived quality [Peltier et al., 2007], self-reported learning outcomes [LaPointe and Gunawardena, 2004], perceived learning/course quality [Marks et al., 2005], learner satisfaction and learning outcome [Eom, 2009, Eom et al., 2006], and perceived learning and satisfaction [Arbaugh and Rau, 2007]. Even more startling fact is that no two dependent constructs share common indicator variables. Consequently, it may be an inevitable consequence to see the inconclusive findings from the previous research we reviewed. Therefore, we hypothesize the following.

H_3: Interaction between students and instructor will lead to a higher level of student learning outcome.

Interaction among students and learning outcomes

The majority of empirical studies reported statistically positive relationships between peer interaction and learning outcomes [Arbaugh and Rau, 2007, Marks et al., 2005, Peltier et al., 2003, Swan, 2001] except a few other studies, e.g., [Eom et al., 2006]. An important objective of the current study is to see the effects of two types of interaction (among students and between students and the instructor) on learning outcome. We hypothesize:

H_4: Interaction among students will lead to a higher level of student learning outcome.

Learning outcomes and student satisfaction

Prior e-learning empirical research has built either recursive models or non-recursive models to investigate the relationship between outcome and satisfaction. The research model (figure 1) is a recursive model that specifies direction of cause from learning outcomes to student satisfaction without reciprocal effects from satisfaction to learning outcome. Perceived level of learning outcome is the cause of user satisfaction variable represented by a future action of taking online courses again. Thus, we hypothesized:

H_5: A higher level of perceived e-learning outcome will lead to higher levels of student satisfaction.

IV. SURVEY INSTRUMENT AND DATA

After conducting an extensive literature review, we designed a list of questions. The survey questionnaire is in part adapted or selected from the commonly administered IDEA (Individual Development & Educational Assessment) student rating systems developed by Kansas State University.

In an effort to survey students using technology-enhanced e-learning systems, we focused on students enrolled in Web-based courses with no on campus meetings. We collected the e-mail addresses from the student data files achieved with every online course delivered through the online program of a university in the mid-western United States. From these addresses, we generated 1,854 valid e-mail addresses. We collected 397 valid unduplicated responses from the survey. Three responses with one or more blanks were deleted. Therefore 394 samples were used in this paper.

The model (figure 1) consists of four independent variables on the left (instructor facilitation, dialog between students and the instructor, interaction between students and the instructor, and interaction among students, and two dependent variables (e-learning outcome, and student satisfaction). Unlike the latent variables in structural equations, the six variables in figure 1 are all directly measurable. Each manifest variable below is measured from a corresponding question. The five point Likert scale was used as the rating scale in the questionnaire. The scale ranges from agree strongly, agree, neither agree nor disagree, disagree, and disagree strongly.

Instructor Facilitation: The instructor was actively involved in facilitating this course.
Dialogue: The instructor provided helpful timely feedback on assignments, exams, or projects.
Interaction between the instructor and students: I frequently interacted with the instructor in this online course.
Interaction among students: I frequently interacted with other students in this online course.

Learning Outcomes: I feel that I learned as much from this course as I might have from a face-to-face version of the course.
User Satisfaction: I would take an online course at this university again in the future.

V. RESEARCH MODEL AND DATA ANALYSIS

The research model (figure 1) was tested using path analysis. LISREL 8.70 was used to do path analysis. It is a technique to assess the causal contribution of directly an observable variable to other directly observable variables. Unlike structural equation modeling that is concerned with latent variables, path analysis examines the causal contribution of directly observable variables.

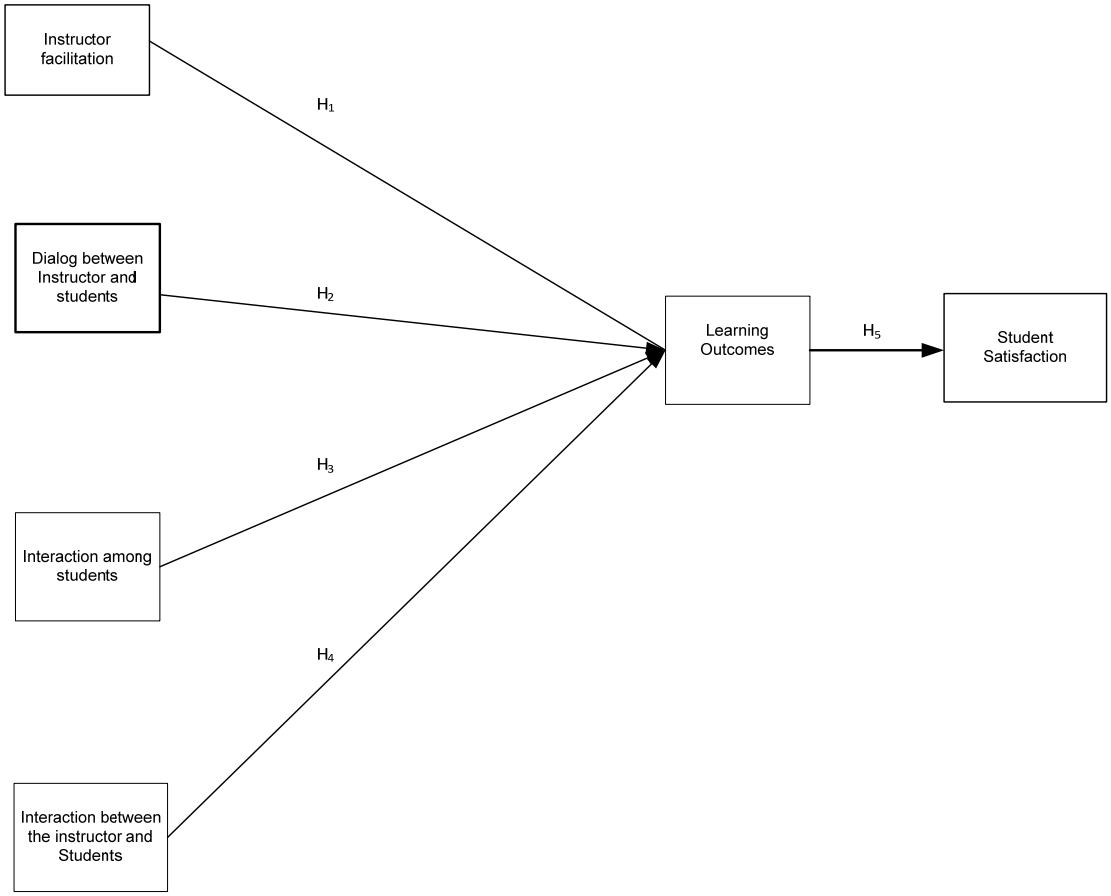

Figure 1 Research model

Model identification and estimation

After the specification of path model, the identifiability of a path model can be determined by comparing the number of the parameters to be estimated (unknowns) and the number of distinct values in the covariance matrix (knowns). If the number of the parameters to be estimated is less than the number of distinct values, the model is over identified and satisfies a necessary condition.

The number of distinct values (knowns) are (6*7)/2=21. The number of unknowns is 17. They consists of: the number of paths (5), the number of disturbance terms (equation error variances) (2), and independent variable variances (4), the number of correlations among the independent variables (6). The degrees of freedom, the number of knowns – the number of unknowns, in this model are 4 (21-17).

Model testing

Model testing is to test the fit of the correlation matrix of sample data against the theoretical causal model built by researchers based on the extant literature. Goodness of fit statistics includes an extensive array of fit indices that can be categorized into six different subgroups of statistics that may be used to determine model fit. For a very good overview of LISREL goodness- of-fit statistics, readers are referred to [Byrne, 1998, Hooper et al., 2008]. There seems to be an agreement among SEM researchers that it is not necessary to report every goodness of fit statistics from path analysis output. Although there are no golden rules that can be agreed upon, Figure 2 includes a set of indices that have been frequently reported and suggested to be reported in the literature [Boomsma, 2000, Crowley and Fan, 1997, Hayduk et al., 2007, Hooper et al., 2008, Kline, 2005, McDonald and Ho, 2002] [Hoyle and Panter, 1995]. Figure 2 includes our model fit statistics of various fit indices and corresponding acceptable threshold levels of each corresponding fit index. Considering all indices together, the specified model (figure 1) seems to be supported by the sample data. The modification indices suggest adding two paths (from interaction among students to satisfaction and from facilitation to satisfaction. These two paths added results in significant improvements in goodness-of-fit statistic (The last column of Table 2).

Table 2. Goodness-of-fit statistic

Fit index	Criterion	Results(initial)	Results(Revised)
χ^2		18.07(p=0.0012)	0.49 (p=0.78)
χ^2/df	< 5	4.52	0.245
RMSEA	< .08	0.097	0.0
GFI	>.9	0.98	1.0
AGFI	>.9	0.92	1.0
RMR		0.045	0.0048
SRMR	<.08	0.037	0.0038
NFI	>.95	.98	1.0
NNFI	>.95	.95	1.01
CFI	>.95	.99	1.0

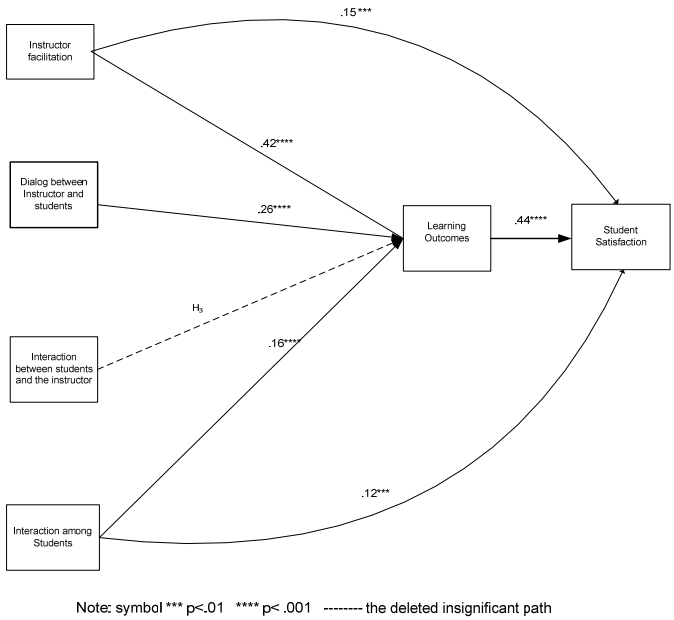

Figure 2. Respecified Model

Path model analysis results

The path analysis output shows two different outputs from structural equations and reduced form equations. The structural equations consist of all the equations including mediating variables (learning outcomes). The reduced form equations show only effects of exogenous (independent) variables on endogenous variables. The structural equations show that about forty percent of e-learning outcomes can be explained by the four exogenous variables (R^2 =.4). Specifically, we can reach the following conclusions. First, the role of the instructor in the e-learning process is pivotal. The facilitating roles of the instructor are the most important factor that affects perceived e-learning outcomes. E-learning environments demand a transition of the roles of students and the instructor. The instructor's role is to become a facilitator who stimulates, guides, and challenges his/her students via empowering students with freedom and responsibility, rather than a lecturer who focuses on the delivery of instruction [Huynh, 2005]. Second, the dialogue between the instructor and students are the next important factor toward e-learning outcomes. The dialogue is positive, purposeful, and constructive interactions among the parties involved. Third, the interaction among students is another factor that contributes to students e-learning outcomes. But the effects of the interaction between the instructor and students on learning ng outcomes are not statistically significant.

Table 3 Results of Path Analysis

Hypothesis	Predictor	Path Coeff.	T-value (sig. level)
H_1	Outcome	+0.42	5.72 ****
H_2	Outcome	+0.26	3.93 ***
H_3	Outcome	+0.16	3.39 ****
H_4	Outcome	+0.11	1.73 ns
H_5	Satisfaction	+0.44	10.52 ****

**** p<.001, *** p<.010

The structural equations also show that about forty two percent of e-learning satisfaction levels can be explained by three endogenous variables and one exogenous variable (learning outcomes) (R^2 =.42). Specifically, the reduced form equations show only effects of four exogenous variables (facilitation, dialogue, interaction between the instructor and students, and interactions among students on student satisfaction. The level of student satisfaction in e-learning hinges on the facilitating role of the instructor, the interaction among students, and the dialogue between the instructor and students, in the order of the magnitude of path coefficients.

VI. CONCLUSION

Abundant e-learning empirical research points out that superior e-learning outcomes are one of the critical objectives of e-learning research. Our path analytical model suggests that of these four variables we hypothesized, three of them are useful predictor of e-learning outcomes, except the interaction between instructor and students. A primary contribution of this study is that the dialogue between the instructor and students a missing link in assessing e-learning outcomes. This research shows that the dialogue is a stronger predictor of e-learning outcome than interaction. Dialogue and interaction in e-learning are two way communication to exchange data and information in the process of knowledge acquisition and transfer. Specifically, this research reveals that e-learning outcomes are primarily dependent on instructor's facilitation and dialogue between the instructor and students. However, the perceived level of interaction between the instructor and students is not positively related to e-learning outcomes, while the level of interaction among students is positively related to e-learning outcomes as well as e-learning satisfaction.

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