

Buddhist Theory of Education for E-Learning

Inpong Luanglath

Bangkok University – International College, Thailand
lecturepedia@gmail.com

Abstract - The objective of this paper is to test Buddha's theory on learning success in the context of e-learning. The purpose of the research is to show that student's efforts, concentration and application of knowledge are dependent on supervised learning environment in order to produce significant outcome. This research employs primary data which consists of a sample of 80 written questionnaires collected from a group of university students in Bangkok, Thailand. A parametric modeling is used. Testing for model validity was accomplished by ANOVA and interaction effect measurement. The dependent variable is identified as e-learning outcome (Y). The independent variable consists of four factors, namely mental outlook towards (*chandha*), efforts (*viriya*), concentration (*chitta*), and application (*vimangsa*); these variables are coded X1, X2, X3, and X4 respectively. The finding shows that all four elements of learning have significant interaction effect. However, individually only mental outlook and application of learning are statistically significant. Efforts and concentration serves as moderators in combined factors modeling, but have no independent direct effect. E-learning shows significant interaction between two pairs in a negative direction: (i) X2X4 showing learning effort with application $T = -4.00$ and (ii) X3X4 showing concentration with application $T = -7.50$. The ANOVA analysis shows that the MSR and MSE ratio is $F = 0.13$ compared to the theoretical value of $F_{v1/v2} = 1.53$. This parametric failure implies that the e-learning outcome does not depend on individual factors, but interaction among factors. It implies that e-Learning could not depend on the

interface between learner, technology and knowledge-base. The learning efforts, mental concentration and application of knowledge need institutional guidance.

Keywords - Buddhist Theory of Education, E-Learning, Interaction Effect Model, Learning Theory

I. INTRODUCTION

The issue presented in this research is whether the Buddhist theory of learning success could be used to explain e-Learning. A sample 80 Thai university students were used. The Buddha's theory of learning success is called *Ittibat-4* or the four elements of learning success: (i) *chantha* (desire to learn), (ii) *viriya* (efforts), (iii) *chitta* (mental focus), and (iv) *vimangsa* (application) [19]. This outcome oriented learning theory uses the learner as the focal point of analysis. It is consistent with the so-called student centered approach espoused by Western theory of education [10].

Much of learning theory introduced in the literature espoused the western approach to education. The purpose of this research is to introduce an alternative approach to the literature. The dependent variable (Y) is e-Learning, the independent variables consist the four elements of *Ittibat-4* (X).

II. LITERATURE REVIEW

There are two parts to this literature review. First, learning theory literature is presented. The conventional western approach to learning is contrasted with the Buddha's learning theory. Second, a brief description of simple, multiple and latent moderation structural equation (LMS) are presented for model selection.

A. Learning Theory

There are two approaches to analyze student learning outcome and process. One approach is to focus on teaching method; another approach is to look at how students learn. Active learning theory, for instance, advocates that learning is effective if students engage in the activity by doing and think of what they do at the same time [4]. Writers criticized the lecture method as a poor instructional approach [3]. Much of the criticism is based on studies showing student attention decline during lecture [18]. Evidence in support of active learning shows that “[i]n those experiments involving measures of retention of information after the end of a course, measures of problem solving, thinking, attitude change, or motivation for further learning, the results tend to show differences favoring discussion methods over lecture” [14].

In general, the research claims that students must be physically and psychologically involved in the learning process [2]. When students are active in the learning process, instead of being passive recipients, they learn more [5]. This point was further emphasized with the argument that students are the main agent of learning, not the teacher [1]. To this end, the distinction between instructional approach and student learning process becomes blurred. The literature focuses on learning outcome and drag instructional method into the fray under the rationale that outcome resulted from methodology. The urging for looking at the learning outcome is best exemplified by the argument that learning should leave something significant or permanent on students’ minds [17].

It is an accepted fact that students have different learning style [15]. In eLearning environment, students may optimize their learning style since more freedom is available in a less structure learning environment. However, regardless of the type of learning environment, all students are faced with the challenge of attention span. Attention span is defined as the mental focus that a learner has upon a particular subject in a given period. It

has been shown that in a structured environment, such as a lecture with live instructor, students have an attention span of about 10-20 minutes [4].

To combat attention span decay problem, it has been suggested that the instructor vary activities in class [11]. In eLearning environment where students are left to interface with the online information base without instructional guidance of a live instructor, student attention span may present additional decay problem. Activity variation suggested by Johnstone and Percival would not work since eLearning environment is student-paced without live instructor to control the learning activity.

eLearning provides students with high sensory environment where students can navigate the internet at will. It has been shown that this high sensory environment shortens student’s attention span [13]. To compensate for the attention decay, students maintain their alertness by engaging in multiple tasks with the electronic environment [16]. However, this multi-tasking activity substantiates that students lack mental focus on any given task.

This research attempts to tackle two issues in the literature: (i) student focus and result oriented learning theory, and (ii) modeling method for eLearning. The literature touches only on the surface on student learning outcome. The literature looks at the outcome without looking at the student as individual learning while claiming to serve student interest. In response to this gap in the literature, this research adopts the Buddhist theory for success learning to explain potential success or failure of eLearning. In answering the second issue, this research turns to using dichotomous data in the demographic data to construct predictive function for eLearning.

B. Modeling Multiple Variables

Relationship modeling is generally accomplished by linear regression. Linear regression is a modeling based on Ordinary Least Square (OLS). There are two basic types of regressions: (i) simple linear regression, and

(ii) multiple linear regression. Simple linear regression is given by:

$$Y = \beta_0 + \beta_1 X_1 + \varepsilon \quad (1)$$

where β_0 = Y-intercept; β_1 = coefficient of X or slope of the linear regression line; and ε = forecast error. The dependent variable is Y and independent variable is X. The objective of the model is to prove that there is a linear relationship between X and Y. This proof is accomplished by showing that $\beta_0 \neq 0$.

The next step is to prove that the relationship between X and Y is statistically significant: (a) determine the correlation coefficient r in a range of $-1 < r < 1$, and (b) prove that the observed critical value for T is larger than the theoretical T at a specified confidence interval. The correlation coefficient and T-Test for linear regression are given as:

$$r = b(S_x / S_y) \quad (2)$$

where b = slope or β_0 in (1); S_x and S_y are standard deviations for series X and Y respectively. With known r , the T-test follows:

$$T = (r\sqrt{n-2}) \div \sqrt{1-r^2} \quad (3)$$

The decision rule for 95% confidence interval is governed by the following hypothesis statements: $H_0 : T(obs) < 1.64$ where the relationship between X and Y is not statistically significant; and $H_A : T(obs) \geq 1.64$ where the relationship between X and Y is statistically significant.

The second type of linear regression is the multiple regression. In multiple regression, Y is explained by two or more independent variable (Xs). The multiple regression model is given by:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon \quad (4)$$

The corresponding test statistic is given by the following F-test in analysis of variance of Y (ANOVA):

$$F = MSR / SSR \quad (5)$$

where $MSR = SSR / p$ and $MSE = SSE / n - p - 1$. The two terms SSR and SSE are defined as:

$$SSR = \sum (\hat{Y}_i - \bar{Y})^2 \quad (6)$$

$$SSE = \sum (Y_i - \bar{Y})^2 \quad (7)$$

Multiple regressions were used to determine the interaction between the independent variables. This interaction effect measurement allows us to verify whether the independent variables are mutually exclusive or work together to produce the predicted value Y.

III. DATA & SAMPLE SIZE

The data used in this research is a primary data obtained through written questionnaires. This research drew 80 samples from mixed populations of Thai and international students in an International College at a private university in Bangkok metropolitan region. There were 4 defective surveys; the final sample count was 76 elements.

Minimum sample size requirement was validated under the Central Limit Theorem (CLT). The rationale of CLT is that if the sample size is adequate, the difference between the sample and population means approaches zero. Thus, under such a condition, the sample fairly represents the population. According to the Lindeberg-Levy method, the CLT proof is given by:

$$\lim_{n \rightarrow \infty} \Pr \left[\sqrt{n} (\bar{X} - \mu) \right] \leq Z = \Phi \left(\frac{\sigma}{\sqrt{n}} \right) \quad (10)$$

Students were conveniently selected from four courses. Randomness of data and non-biasness of the selection were tested to assure

data quality. The result of the Lindberg-Levy test for CLT is tabulated in Table I. All variables converge to CLT. The minimum sample size for this study is adequate.

TABLE I
SAMPLE SIZE & CENTRAL LIMIT THEOREM

Variable	μ	F(Z)	L-Levy
Y	2.26	0.516	0.64
X1	1.98	0.524	0.81
X2	1.82	0.528	0.96
X3	1.78	0.532	1.12
X4	2.04	0.520	0.77

The CLT convergence under Lindberg-Levy is verified by an alternative CLT method called variance-difference test using $\Phi(\alpha)$ as the threshold value. The variance-difference method is given by:

$$\lim_{n \rightarrow R} \frac{1}{\sqrt{S\sigma}} \Pr \left[\frac{|S^2 - \sigma^2|}{\sqrt{n}} \right] - \Phi(\alpha) \cong 0 \quad (11)$$

where R is a real number. Under this method CLT convergence were confirmed for all variables at $\Phi(\alpha) = 1\%$ level.

TABLE II
VARIANCE-DIFFERENCE METHOD FOR CENTRAL LIMIT THEOREM CONVERGENCE

Variable	S^2	σ^2	$\Phi(\alpha) = 1\%$	CLT
Y	0.1521	0.1521	0.01	0.01
X1	0.2401	0.2401	0.01	0.01
X2	0.3481	0.3364	0.01	0.01
X3	0.4624	0.4624	0.01	0.01
X4	0.2209	0.2209	0.01	0.01

The theoretical foundation for using CLT as the mean for verifying minimum sample size is that if the sample size is adequate, the means and variances of the variables would converge to zero. Both locations of the CDF and shapes of the PDF of the observed and theoretical values should match or having a difference of near zero. Under such a condition, the sample size is sufficient to substantiate that $T(\text{sample}) = \Phi(Z)$.

IV. FINDINGS

A. Adequacy of Linear Regression

Simple linear regression was used to verify the linear relationship between eLearning success and the four independent factors: (i) *chantha* (desire to learn), (ii) *viriya* (efforts), (iii) *chitta* (mental focus), and (iv) *vimangsa* (application). It was found that the sample manifests statistical significance for X1 and X2; factors X2 and X3 were not significant. This finding tells us about the learning perception or behavior of students towards eLearning. In the absence of institutional infrastructure of the formal learning environment, the learning process (X2 and X3) are absent. These factors (X2: efforts and X3: mental focus) are made possible by the formal classroom structure.

TABLE III
SIMPLE REGRESSION UNDER ITTIBAT-4

Model	Statistical test
$Y = 1.70 + 0.31X_1$	$T_{obs} = 3.57$
$Y = 2.1 + 0.12X_2$	$T_{obs} = 1.52$
$Y = 2.22 + 0.01X_3$	$T_{obs} = 0.86$
$Y = 1.70 + 1.92X_4$	$T_{obs} = 2.06$

When the four factors are combined into one multiple regression model, the significance of the relationship between the individual independent variables and the dependent variable dissipated. The anticipated model under multiple linear regression is $Y = 1.02 + 0.28X_{desire} + 0.11X_{effort} - 0.08X_{focus} + 0.15X_{apply}$.

The F score test for ANOVA is $F(obs) = 0.13$ compared to the theoretical value of $F(v1, v2) = 1.53$. This does not mean the model does not explain the data. It means that student perception about eLearning success does not conform to the proposed learning theory: *Ittibat-4*. The ANOVA result indicates that eLearning may be in a developmental stage. The fact that mental focus (X3) has a negative slope in the multiple regression equation indicates that eLearning without formal guidance or structure is not

conducive to mental focus. Mental focus allows concentration. Concentration produces metacognition. Mental focus also produces comprehension. [7].

B. Significant Interaction Effect as Proof of Validity of Theory

There are significant interactions between all pairs of independent variables. There are 6 possible pairs of interaction: $[p(p-1)]/2 = [(4(3))]/2 = 12/2 = 6$ or (X1X2, X1X3, X1X4, X2X3, X2X4, and X3X4). The proposed interaction effect model is given by:

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_1X_2 \quad (12)$$

The coefficient of the interaction is defined as $\beta_3 = \hat{\beta} - \beta_1 - \beta_2 - \beta_0$ and the expected coefficient $\hat{\beta} = \bar{Y} - (\beta_2 - \beta_0) - \beta_1$. The test statistics is given by:

$$T_{\beta_3} = \frac{\beta_1 - \beta_2}{\sqrt{\frac{n_1SE_1^2 + n_2SE_2^2}{n_1 + n_2 - 2}}} \quad (13)$$

The Interaction Effects among independent variables are paired by factors, thus:

$$\begin{aligned} Y_{x1x2} &= 1.11 + 0.30X_1 + 0.10X_2 - 0.11X_1X_2 \\ Y_{x1x3} &= 1.26 + 0.33X_1 - 0.02X_2 - 1.41X_1X_3 \\ Y_{x1x4} &= 1.09 + 0.26X_1 + 0.16X_4 - 0.93X_1X_4 \\ Y_{x2x3} &= 1.57 + 0.14X_2 - 0.004X_3 - 1.65X_2X_3 \\ Y_{x2x4} &= 1.27 + 0.08X_2 + 0.24X_4 - 0.93X_2X_4 \\ Y_{x3x4} &= 1.35 - 0.002X_3 + 0.28X_4 - 0.89X_3X_4 \end{aligned}$$

Variable X2 (efforts), X3 (mental focus) and X4 (application) have negative critical T score indicating that there is significant lacking of efforts and mental focus in eLearning environment. This finding may be an indication that eLearning may not be effective as a self-paced process. In order to success, it must be implemented by a formal institutional sponsorship and instructional guideline.

The interaction effect measurement may be extended by regressing the individual pairs' intercept $\beta_{i0} = y_i$ against the corresponding $\beta_{3j} = x_j$, the resulting predictive function is $y_{\beta 0} = 1.03 - 0.24X_{\beta 3}$ with T = 2.11 and r-squared of 0.52. This extended measure indicates the magnitude and drift of the interaction among the 4 variables. The stability of the interaction is at 1.03 with a drift in the negative direction at a rate of -0.24. It means that among this group, the factor factors positively contributes 1.03 to the learning success adjusted by -0.24X of the paired interactions.

C. Nationality Factor Analysis

The group has been bifurcated into Thai (53) and non-Thai (23) students. Among Thai students, the desire to learn is not statistically significant, but other factors are significant: efforts, mental focus, and application of knowledge.

When all four factors are combined, the regression function is $Y_{x1:4} = 1.5 + 0.21X_1 + 0.14X_2 - 0.11X_3 + 0.18X_4$ with R-square reading of $R^2 = 0.22$. After the insignificant factor (desire to learn) is taken out, the predictive function becomes: $Y = 1.73 + 0.20X_2 - 0.16X_3 + 0.27X_4$ and the r-square reading is reduced to $R^2 = 0.14$. These results are contrasted with the non-Thai group:

$$\begin{aligned} Y_{x1} &= 1.77 + 0.19X_1 \text{ with T} = 2.51; \\ Y_{x2} &= 2.01 + 0.16X_2 \text{ with T} = 1.68; \\ Y_{x3} &= 2.35 + 0.01X_3 \text{ with T} = 0.15; \text{ and} \\ Y_{x4} &= 1.8 + 0.0.26X_4 \text{ with T} = 2.36. \end{aligned}$$

In contrast, foreign students manifest only the desire for eLearning. Other factors: efforts, mental focus, and application of knowledge, are absent. This finding may indicate the perception of eLearning from the non-Thai perspective. Since this is a research on eLearning, this finding should not be used to generalize about foreign students in non-

eLearning context. However, what is clear is that this study shows that non-Thai students seems to lack interests in eLearning.

$$Y_{x1} = 1.61 + 0.31X_1 \text{ with } T = 2.35;$$

$$Y_{x2} = 2.26 - 0.02X_2 \text{ with } T = 0.11;$$

$$Y_{x3} = 1.95 + 0.15X_3 \text{ with } T = 1.21; \text{ and}$$

$$Y_{x4} = 1.02 + 0.10X_4 \text{ with } t = 0.53.$$

When all four factors are combined and regressed with Y (eLearning): $Y_{x1:4} = 1.58 + 0.31X_1 + 0.04X_2 + 0.05X_3 - 0.07X_4$ is not statistically significant.

D. Sex Factor Analysis

Holding nationality constant and examine the sample on the basis of sex. The sex segmentation presents an interesting finding about eLearning among a mixed group of nationalities. The regression of male students' orientation towards eLearning shows:

$$\bar{Y} = 2.23 \pm 0.38$$

$$Y_{x1} = 1.72 + 0.26X_1$$

$$Y_{x2} = 2.41 - 0.10X_2$$

$$Y_{x3} = 2.26 - 0.01X_3$$

$$Y_{x4} = 1.93 + 0.14X_4$$

For male students, only X1 (desire to learn) shows statistical significance (T = 2.40).

Other factors that are requires for successful learning are absent. This outlook sharply contrasts with female students who manifest significant desire for learning, efforts, and application of knowledge. However, in both male and female, mental focus is not statistically significant.

$$\bar{Y} = 2.49 \pm 0.36$$

$$Y_{x1} = 1.84 + 0.30X_1$$

$$Y_{x2} = 1.94 + 0.26X_2$$

$$Y_{x3} = 2.3 + 0.09X_3$$

$$Y_{x4} = 1.97 + 0.24X_4$$

Segmentation by sex confirms the problem of attention span through significant finding of

lacking mental focus. The lack of mental focus has been shown to be counter-productive to learning. [7] & [9]. This study elucidates that eLearning cannot operate as a standalone unit; it must be interface with an institutional guidance in order to stimulate and motivate students to maintain mental focus to obtain learning objectives.

E. Online Degree as Proxy for E-Learning

The survey asks about the acceptability of online degree as a proxy for the ultimate goal of eLearning. In a regression model, the combine group shows no statistical significance; however, when the group is separated by sex, female students show significant acceptance of online degree program. The T-score for the linear regression model under OLS exceeds 0.95 confidence interval $T_{female} = 2.72$ compared to 0.54 by male students.

V. DISCUSSION

The theory of learning success under *Ittibat-4* is not uncommon. In fact, it is applied under other names and is a common practice in all educational institutions around the world. This research demonstrates that students shows the desire to learn, but do not want to undertake the learning process. The research shows that there is a leap of faith from desire to learn to application of knowledge in eLearning context. This mental outlook may be counter-productive to learning. Since most eLearning process is self-accessed and self-paced, in the absence of institutional guidance, students may be misled into believing that accessibility to knowledge base equals learning and, thus, the presumed knowledge gained could be applied in life. However, according to *Ittibat-4*, successful learning consists of (i) *chantha* (desire to learn), (ii) *viriyā* (efforts), (iii) *chitta* (mental focus), and (iv) *vimangsa* (application). Without the right "efforts" and "mental focus", eLearning may not help students achieving the anticipated outcome.

A. Output Orientation with Missing Process and Impact

The result of this study shows that students show significant desire to learn by accessing the knowledge base online. However, this desire to learn lacks development and process. Learning development is accomplished through exertion of efforts. Efforts in learning are efficient when it is exerted under proper guidance, such as a formalized learning structure. Efforts under guidance of instructors or institutional guidelines motivate students to maintain a mental focus towards achieving success in learning; hence a mental focus is an indispensable element of effective learning. Without the four elements of learning success working side-by-side eLearning becomes ineffectual and without impact.

B. Online Degree Thailand's Education Hub in AEC-2015

Online degree has been used as a proxy for the output of eLearning. Respondents were asked to score on a (0 = none; 1 = low; 2 = medium; and 3 = high) scale whether online degree is a credible learning outcome. The rationale for using this proxy is that if eLearning is a credible enterprise, the ultimate outcome of eLearning in a more institutionalized form is the online degree.

Only female students are receptive to online degree program. This finding has practical and significant implications. Firstly, sex is a factor on the perception of worth and value towards online degree. Secondly, if this sample represents the population at large in the Thai market, online degree remains an explored option. Female learners among the Thai student population are more liberal and receptive to alternative source of education. Sex segmentation in Thailand's education market may be a significant factor.

Traditionally, the R-square score is used as an indicator for the model's explanatory power; however, this interpretation of the coefficient of determination is narrow, and limits the interpretation of research result to the data at hand without contemplating practical implication of the study. The

R^2 score of 0.22 actually means that there is $1 - R^2$ or 0.78 or 78% unexploited opportunity. In this context, Thailand is a blue ocean for eLearning as a means towards online degree in the education market. As Thailand promotes itself up as an education hub in the ASEAN Economic Community (AEC), a market potential of 78% blue ocean is an attractive potential [12]. The finding of this research has positive policy implication in promoting Thailand as a potential education hub in the AEC.

VI. CONCLUSION

Using the Buddhist theory of learning success called Ittibat-4 as the basis for eLearning research, it was found that students possess the desire for learning but lack mental focus. This finding reaffirms that the institutionalized education remains an indispensable part of education. E-learning provides an alternative source of education; however, the process of educating still requires formal instructional guidance to stimulate and motivate students in order to maintain mental focus on the learning process. E-learning is not a substitute for formal educational structure, but could serve as an alternative medium and environment for education. Effectiveness in learning is measured by learning outcome. Knowledge acquisition remains dependent on the four factors for successful learning: (i) *chantha* (desire to learn), (ii) *viriyā* (efforts), (iii) *chitta* (mental focus), and (iv) *vimangsa* (application). Factor (iii) requires instructor's interface. Thus, eLearning could not operate as a stand-alone unit.

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