Asian Journal of Business and Technology
Vol. 2, No. 1, (2019)
ISSN 2651-6713 (Print)
ISSN 2651-6721 (Online)

Impact of Innovation and Perceived Ease of Use on E-Learning Adoption

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Abstract - *E-learning adoption (AEL) is a phenomenon that is contingent on the particular context. Thus, the research endeavored to determine the association of innovation (INO) and perceived ease of use (PEOU) variables on AEL in the context of Sri Lankan private international schools. Quantitative methods together with correlation, ANOVA, ANCOVA, hierarchical regression, Hayes's process for moderation analyses were used. The empirical evidence supported the positive relationship of INO and PEOU variables towards AEL by correlation analysis and hierarchical regression analysis. Presence of differences in AEL between the students engaged in aesthetic subjects and science subject categories were also supported by contrast test of ANOVA. Results of ANCOVA revealed that the covariate; age was not significantly related to the student's AEL while the Hayes's process for moderation analysis has confirmed that the relationship between INO and AEL is being moderated by student's age. As a result of time and resource constraints, sample size has been restricted while the research is limited only to quantitative method. Limited number of researches are available in literature amalgamating technology acceptance model (TAM) along with additional variables in explaining AEL, given the rapid changes taking place in online education field. Nevertheless, combining a variable such as INO is the significance of the study to comprehend the present AEL in Sri Lankan context with special reference to private education institutions. In conclusion, suggestions are postulated for future researchers in the field of online education.*

Keywords – E-learning, hierarchical regression, innovation, perceived ease of use, TAM.

INTRODUCTION

Contemporary technology developments have revolutionized the students' learning experience by dramatically changing the way one acquires the knowledge. Technology could be best defined as a tool that supports and promotes human learning in this scenario. Technology adoption in the domain of education services could be conspicuous through the usage of scientific calculators, portable tablets: iPad, smart boards, video cameras and obviously, the computer and multimedia devices. All these are innovations which overwhelmingly impact on classroom learning taking it to new dimensions. Although there is some ambiguity on the threshold of technology usage, almost all the stakeholders believe that integrating technology onto the teaching and learning processes would assist adapting the students for the dynamic global challenges in a positive manner.

Ministry of Education (MOE) of Sri Lanka has formulated a medium-term strategic plan for the period of 2018 to 2025, while articulating a national policy for science, technology, engineering and mathematics education, compatible to the policy agenda of the government in order to facilitate long due policy reforms for education sector [1]. Moreover, there is continuous improved involvement by the non-state institutions in education services that includes international schools operating in the country. Initiatives are already in place to commence a pilot project on digital classrooms, in tandem with internet mediated education whilst framing the ICT education master plan. More than eighty thousand students and over nine thousand teachers are being

represented in the whole Sri Lankan international school system where the student/teacher ratio is recorded approximately as nine [1]. Although the literacy rate is high is Sri Lanka, there is a huge potential for development in electronically mediated education, particularly in e-learning sphere to accommodate teaching/learning processes intended for both the students and teachers with a view to optimize investments in education, in the long run. Originality of the research is that the contribution to both the theory and practice perspectives on adoption of e-learning in the context of international school networks operating in Sri Lanka by incorporating interrelated models on technology adoption.

OBJECTIVES

Resolved to identify the effect of innovation (INO) on student's adoption of e-learning (AEL) in the context of leading private international school networks in Sri Lanka, as the primary objective. Secondly, it was determined to recognize the effect of TAM predictor, namely perceived ease of use (PEOU), on AEL. Thirdly, research attempted to identify whether there are any differences in adoption, based on different subject categories. Demographic variable age has been used, by way of student's school grade, to inquire into whether there is a moderation effect of age in between the relationship of INO and AEL. Simultaneously impact of the covariate; student's grade (age) on AEL also been investigated.

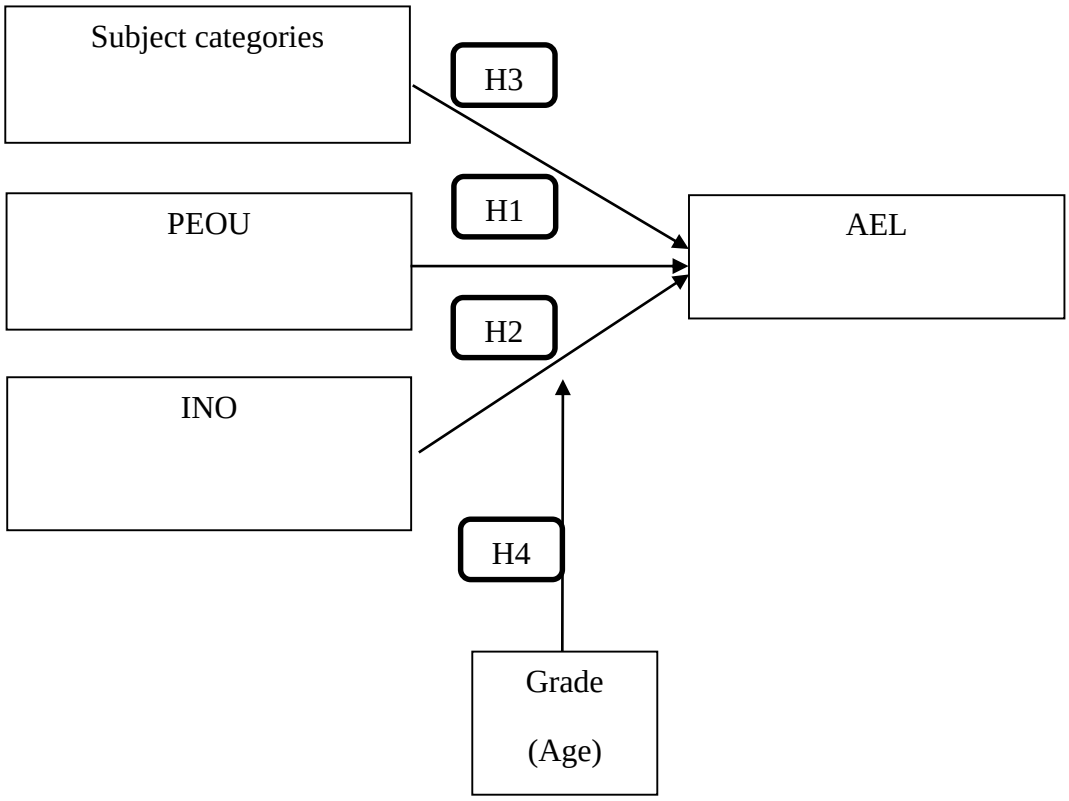
METERIALS AND METHODS

Deductive methodology and quantitative method had been used in the study. Attributable to the large sample and considering the expenditure, questionnaire survey deemed suitable [2]. Respondents were the students of three leading private international school networks operating in Sri Lanka. Respondents were selected on multi-level cluster sampling method as per provinces/districts and major cities in which these schools are in operation. Class teachers, in charge of the classes were selected as enumerators for data collection process of this research. Enumerators have collected data through self-administered questionnaires from the individual students. Altogether 450 questionnaires were distributed and 271 duly completed questionnaires (60%) were considered for the final data analysis. INO is a latent variable and there are several constructs that determine the INO such as relative advantage, compatibility, simplicity, trialability and etc. Hence, principal component analysis has been deployed enabling identification of factors related to INO. Subsequently, reliability analysis was performed using Cronbach's alpha coefficients on INO, PEOU and AEL variables. To determine the relationship Pearson's correlation coefficient used. Regression analysis performed to investigate the coefficients and degree of explanation of AEL by the respective model. ANOVA with planned contrasts used to determine the differences in AEL in different subject categories. Trend variables was determined by the ANOVA trend analysis. Covariate effect on investigated by ANCOVA. Similarly, Hayes' process was used to analyze the moderating effect of grade of the student (student's age) in between INO and AEL.

Conceptual Framework

TAM is an extended explanation of the theory of reasoned action [3] [4] [5]. Extended versions of TAM developed by incorporating factors from interconnected models on customer adoption, by means of integrating additional or alternative belief factors, and lastly by examining antecedents and moderators of PU and PEOU [6] [7]. Similarly, TAM had been successful in explaining many kinds of systems such as e-learning, learning management systems, web-based systems etc. Based on this discussion and review of literature following conceptual model was formulated for the study,

Figure 1: Conceptual model



Hypotheses of the Study

Perceived usefulness (PU) is the one's perception of degree of enhancement of a particular task by a system and PEOU is the effort freeness of a system [3]. PEOU was a predictor of PU; both the PU and the attitude of the user were predictors of intention to use [8]. PU and PEOU are significantly predicting the AEL [9]. Determinants of TAM are the major factors influencing the adoption of the technology [10] [11] [12]. Considering the aforesaid facts following hypothesis is proposed,

$H_1$1-There is a positive relationship in between PEOU and AEL

E-learning has been researched as instructional innovation in higher education institutions [13]. Cloud e-learning service strategies for improving e-learning innovation performance in a fuzzy environment by using new hybrid fuzzy multiple attribute decision-making model also being identified [14]. An extensive study of emerging e-learning technologies for higher education in Hong Kong has been conducted with reference to the innovation aspect as well [15]. E-learning for ungraded schools of Kazakhstan also performed referring to experience, implementation and innovation [16]. ICT and e-learning as catalysts for innovation and quality in higher education was also noted [17]. Organizational culture and technology in relation to enhanced innovation in higher education was recognized [18]. Considering the aforementioned facts following hypothesis is proposed,

$H_1$2-There is a positive relationship of INO and AEL

The integration of perceived satisfaction and technology acceptance in accordance with psychological traits and learner beliefs have been highlighted by several researchers [19]. Considering the aforementioned facts following hypothesis is

proposed,

$H_1$3-There are differences in AEL between the students enrolled for aesthetic subject category and other subject categories (commerce & science students)

Subjective norm represented by peers is found to significantly moderate the relationship between attitude and intention toward the technology [10]. The results of the meta-analysis demonstrated a moderating effect for user-related factors and technology-related factors for several evaluated causal paths [20]. Social identity and social bonds could moderate the effect of subjective norms on intention [21]. Among the individual differences namely, age, gender and experience; age moderates the behavioral intention and technology use [22] [6] [23] [24]. Considering the aforementioned facts following hypothesis is proposed,

$H_1$4-There is a moderation effect of student's grade (age) on the relationship of INO and AEL

RESULTS AND DISCUSSION

The IBM SPSS 20 along with Hayes's process was used for analysis. Initial screening demonstrated that almost all the socio-demographic characteristics of the population are being replicated by the elected sample. As INO is a latent variable that could not be directly observed rather measured, principle component analysis (PCA) was conducted on the 24 items of INO with orthogonal rotation (varimax). Kaiser–Meyer–Olkin (KMO) measure verified the sampling adequacy for the analysis [25]. Bartlett's test of sphericity (χ^2, $p < .001$), indicated that correlations between items were sufficiently large for PCA. As the initial step, obtained the eigenvalues for each of the component of data. Components totalling to four had eigenvalues over and above the Kaiser's criterion of 1. Similarly, these four components have explained 50.9% of the variation, in combination. Additionally, scree plot also supported retaining of four components although there was a slight ambiguity and depicted somewhat inflexions. However, in view of the relatively large sample size (N=271) and converging of Kaiser's criterion and the scree plot on the four components, same has been retained for further analysis. Accordingly, factors pertinent to INO were recognized as relative advantage, compatibility Simplicity and trialability. Subsequently, Cronbach's alpha values were scrutinized are higher than 0.7. Moreover, K-S test and Levene's test performed to ensure normal distribution of respondents' data and homoscedasticity where results were not significant for both the tests.

Pearson correlation analysis (table 1) revealed that the AEL possesses a positive relationship with both INO and PEOU variables whilst both the relationships were significant at .01 level (1-tailed) supporting both first and second hypotheses. This signifies the importance of innovation and perceived ease of use aspects, in relation to acceptance of e-learning in the context of the selected three international school networks operating in Sri Lanka.

Table 1-Correlation matrix

	AEL	**INO**	**PEOU**
AEL	1		
INO	.875**	1	
PEOU	.916**	.847**	1

****** Correlation is significant at the 0.01 level (1-tailed)

A multiple regression analysis was conducted using hierarchical method to determine the degree to which independent variables; PEOU and INO impact the AEL (table 2 & table 3). In

accordance with model 1 (table 2), the overall variance of AEL explained by INO is 76.2% as per the adjusted R square figure. According to the significance value, model 1 is statistically significant.

Table 2-Hierarchical regression output of the initial model

	t	***Sig.***	***β***	***F* Change**	***df***	***Sig. F* Change**	**Adj. R^2**
Model 1 (Constant) INO	 26.29 29.68	 .000 .000	 2.108 0.621	881.14	1	.000	.765

Dependent variable: AEL
Predictors: (Constant), INO

In accordance with model 2 (table 3), the overall variance of AEL explained by INO and PEOU is 87.4% in keeping with the adjusted R square figure. As shown by the significance value, model 2 is also statistically significant
.

Table 3- Hierarchical regression output of the final model

	t	***Sig.***	***β***	***F* Change**	***Df* Change**	***Sig. F* Change**	**Adj. R^2**
Model 2 (Constant) INO PEOU	 17.29 08.62 15.24	 .000 .000 .000	 1.339 0.249 0.496	232.27	1	.000	.874

Dependent variable: AEL
Predictors: (Constant), INO, PEOU

Hierarchical regression output also demonstrates the positive relationship of INO and PEOU variables on adoption of e-learning, in accordance with significantly positive Beta values. Correspondingly, as per the results, there are factors other than INO and PEOU which explains the adoption of e-learning that represent 12.6 per cent of the variation of adoption of e-learning. On behalf of the current model, the VIF and Tolerance values recorded are well below 10 and above 0.2 subsequently; hence, no collinearity within the data. Even the average VIF which is not substantially greater than 1, which also shows that there is no cause for concern. In order to determine the cases which are influencing the regression model, case-wise diagnostics, Cook's distance, Mahalanobis distance, DFBeta statistics and covariance ratio (CVR) were checked and all were in order. Enabling to generalize the model beyond the sample, it is necessary to check some of the assumptions of regression residuals. Graph of standardized residuals (ZRESID) and dependent variable (ZPRED) checked, histograms looked like normally distributed and P-P plot looked as curving around a diagonal line which is also supportive for generalizing the model beyond the sample. Therefore, it could be summarized that the model almost appears both accurate for the sample and generalizable to the

population of interest as the assumptions have been met and could be safely assumed that this model would generalize to AEL in the research context of this study.

In order to examine the specific hypothesis stated as, there are differences in AEL between the students enrolled for aesthetic subject category and other subject categories (commerce & science students), one-way ANOVA with planned contrasts was performed (table 4 & table 5). There was a significant effect of subject category on AEL, F (2, 268) = 244.01, $p < .05$, $\omega = .80$. Secondly, there was a significant linear trend, F (1, 268) = 459.97, $p < .01$, $\omega = .78$. Contrast tests further revealed that, engaging in commerce and science subjects significantly increases AEL compared to engaging in aesthetic subjects and that engaging in science subjects significantly improved AEL as against enrolling for commerce subjects. The one-way ANOVA-contrast test results supports in favor of accepting the third hypothesis of the research as per the highly significant p value.

Table 4- One-way ANOVA-Trend analysis results

		Sum of Square	***df***	**Mean Square**	***F***	***Sig.***
Between Groups (Combined)		34.479	2	17.239	244.007	.000
Linear Term	Unweighted	32.497	1	32.497	459.972	.000
	Weighted	33.796	1	33.796	478.353	.000
	Deviation	.683	1	.683	9.661	.002
Quadratic Term	Unweighted	.683	1	.683	9.661	.002
	Weighted	.683	1	.683	9.661	.002
Within Groups		18.934	268	.071		
Total		53.413	270			

Table 5- One-way ANOVA-Contrast test results

	Contrast	**Value of Contrast**	**Std. Error**	***t***	***df***	***Sig.***
Assume equal variances	1	1.8647	.08555	21.796	268	.000
	2	.4810	.04567	10.531	268	.000
Does not assume equal variances	1	1.8647	.08314	22.429	60.925	.000
	2	.4810	02169	22.174	174.000	.000

Empirical results of ANCOVA as depicted in table 6, revealed that the covariate, student's grade (age) was not significantly related to the student's AEL in the present context, F (1, 267) = 1.776, $p > .05$, effect size as shown by partial eta squared is .007. However, there was a significant effect of subject categories on AEL after controlling for the effect of student's age, F (2, 267) = 147.947, $p < .05$, partial eta squared = .526.

Table 6- ANCOVA- Tests of between-subjects effects

Dependent Variable: AEL

Source	**Type III Sum of Squares**	***df***	**Mean Square**	***F***	***Sig.***	**Partial Eta Squared**
Corrected Model	34.604[a]	3	11.535	163.734	.000	.648
Intercept	277.211	1	277.211	3935.025	.000	.936
Age	.125	1	.125	1.776	.184	.007
Income	20.845	2	10.422	147.947	.000	.526
Error	18.809	267	.070			
Total	5433.694	271				
Corrected Total	53.413	270				
a. R Squared = .648 (Adjusted R Squared = .644)						

Output of the moderation analysis (Table 7) has exposed a moderation effect attributable to the significant interaction of INO and student's grade (age) and in this study the interaction is highly significant, b = -.23, 95% confidence interval (CI) (-.32, -.14), t = -5.09 , p < .01, indicating that the relationship between INO and AEL is moderated by the student's grade (age) while supporting the fourth hypothesis. Both the significant p statistic and the confidence intervals, reporting only two negative figures without crossing the zero value confirms the acceptance of the final hypothesis.

Table 7- Moderation analysis output- as per Hayes's process version 3.4 for SPSS

	b	***SE B***	***t***	***p***
Constant	.53	.32	1.66	.0991
INO	1.05	.09	11.58	.0000
Age	.88	.17	5.21	.0000
INO x Age	-.23	.05	-5.09	.0000

In line with the empirical results given in preceding section, AEL has been significantly predicted by PEOU and INO variables in the context of selected three international school networks in Sri Lanka, while supporting both the first and second hypothesis. Furthermore, results of correlation analysis outcome noted that two aforementioned predictor variables were positively correlated with the outcome variable of AEL. In addition, there are empirical evidences supporting the positive relationship between PEOU and INO variables on AEL. Therefore, the findings of present research study conform to the previous findings. Accordingly, this research is consistent with the previous findings related to TAM. As per the regression analysis using hierarchical method, although PEOU and INO are the determinant variables as per the study, there are other factors which were not discussed in this study, although such factors have an impact on AEL. Additionally, planned contrasts revealed by supporting third hypothesis, that engaging in commerce and science subjects significantly increases AEL compared to engaging in aesthetic subjects and that engaging in science subjects significantly improved AEL compared engaging in commerce subjects. Moreover, study revealed that the covariate, age was not significantly related to the participant's AEL in the research context while the moderation analysis has confirmed relationship between INO and AEL is being moderated by the grade (age) of the student which is in agreement with

the previous empirical evidences; whilst supporting the fourth hypothesis.

CONCLUSION AND RECOMMENDATION

Results of data analysis supported all hypotheses; positive relationship of INO and PEOU on AEL, existence of differences in AEL, between students of different subject streams and moderation effect of student's grade (age) between INO and AEL. From the practical perspective, all these international school chains perform relatively well in the presence of sporadic technology changes in the today's operating environment. Nevertheless, school administrators cannot undermine the threat of highly influential foreign education facilitators which are invading the local sphere to a greater extent with latest technology-based distance learning education services, amidst challenging domestic regulations. Consequently, it is recommended marketers of local education service providers, to exploit the awareness on PEOU and innovation aspects in conjunction with simplicity, trustworthiness, security of web-based learning modules and etc. Research findings are beneficial for the education service providers and policy making officials representing the government ministries, institutions, universities and tuition service providers, enabling them to profiling their students with the assistance of previously discussed factors alongside differentiation on socio-demographic characteristics related to individual students with a view to uplift e-learning adoption by means of a holistic approach. Present study is also subjected to several limitations with time and resource constraints. Future researches could be performed in search of diverse findings in different country, cultural and societal contexts. Similarly, diverse research approaches and perspectives alongside the usage of novel and different models on technology adoption related to online learning, cloud-based learning, computer aided collaborative learning etc. will undoubtedly enhance the significance of future researches in time to come.

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