

Development and analysis learning behavior through creative e-learning system for Community-based Tourism in Phatthalung Thailand

Yananda Siraphatthada, Duangkamol Thitivesa, Parichart Rattanabunsakul

Suan Sunandha Rajabhat University, Thailand

Email: yananda.si@ssru.ac.th; duangkamol.th@ssru.ac.th; parichart.th@ssru.ac.th

Abstract

The objective of the current study is to examine the role of the event log and e-learning system in analysis of learning behavior of learners in Phatthalung Thailand. Data is collected from Phatthalung Thailand by using a survey questionnaire. Respondents of the study are based on the e-learners in Phatthalung Thailand. Area cluster sampling is used in this study for data collection. Finally, the current study used 265 valid responses for data analysis. Data analysis is carried out by using Partial Least Square (PLS) in which measurement model and structural model is used to examine the relationship. Findings of the study show that; the event log has an influential role to promote the e-learning system which further causes to increase learning behavior of e-learners. E-learning systems transfer the positive effect of event log on learning behavior. Thus, the current study has theoretical and practical implications to promote learning behavior through event log and e-learning system in Thailand.

Keywords. Event log, e-learning system, learning behavior.

1. Introduction

Electronic learning (e-learning) is increasing globally because it has several benefits (Currat et al., 2022; Kaniadakis & Padumadasa, 2022). The usage of e-Learning in few years has increased dramatically. Particularly in academic institutions the e-Learning is increased with high speed. Most of the academic institutions are started e-learning activities rather than physical activities. It has several benefits such as cost saving and it also save the time. Several institutions developed the comprehensive learning system and started the services electronically. The electronic trend of learning is increased also due to the Coronavirus. The increase in Coronavirus

forced the institutions to start e-learning activities rather than physical activities. In this situation the e-learning is more suitable. E-learning activities are most cost saving for the institutions as well as for the learners. As reported in previous studies the e-learning has several benefits which could not be achieved with the help of physical learning (Alzahrani, 2020).

However, to learn electronically it is important to have willingness of the learners. The acceptability of e-learning system is most important in the society. To learn electronically, the learner must be willing to use electronic system. Therefore, number of hurdles are existing in electronic system because most of the people do not

accept this system. Furthermore, the people do not have the access to the internet as well as other facilities. The equipment's to learn electronically is also one of the limitations because all the people do not have the equipment. Therefore, there are several limitations in the way of e-learning. All these limitations have major effect on the learning behavior of the people. Thus, the analysis of the learning behavior of the people is most important (Dahleez, El-Saleh, Al Alawi, & Fattah, 2021; Zou, Shen, & Dadparvar, 2022).

There are several factors affecting on e-learning behavior of people and it is important to identify these factors and work on these factors to promote learning behavior. Several limitations in e-learning may affect negatively on learning behavior of the learners which effect automatically on the level of learning. Therefore, the learning behavior of the learners is most important in the adoption of e-learning system. E-learning system can affect positively on the learners only if the learners have positive learning behavior which is lacking among various learners. Thus, it is needed to promote learning behavior of the learner. According to the current study, event log has central importance on e-learning system. It has vital role to influence e-learning behavior of the learners. Data mining and process mining technologies allow the use of the event log data which is most helpful

(Grigorova, Malysheva, & Bobrovskiy, 2017). Therefore, the objective of the current study is to examine the role of event log and e-learning system in analysis of learning behavior of learners in Thailand. The e-learning has increased significantly among the Thai learners, however, learning behavior is not addressed. Several studies addressed e-learning in Thailand (Lake, 2020; Siritongthaworn, Krairit, Dimmitt, & Paul, 2006).

2. Hypotheses Development

To promote learning behavior of the learner, it is important to promote event log. As event log has the ability to enhance e-learning system. It has major connection between event log and e-learning system to develop a good e-learning system. The event log is most important as it has role in e-learning system development. Therefore, it is needed to address learning in relation to the e-learning system (Al-Okaily, Alqudah, Matar, Lutfi, & Taamneh, 2020; Almaiah & Alyoussef, 2019). Furthermore, it also has effect on learning behavior. The event log features have the ability to influence the learning behavior of the learner. Therefore, according to the current study, the problem of learning behavior can be managed with the help of event log. As event log has influence on e-learning system which causes to promote learning Behavior. The relationship promoted by the current study is shown in Figure 1.

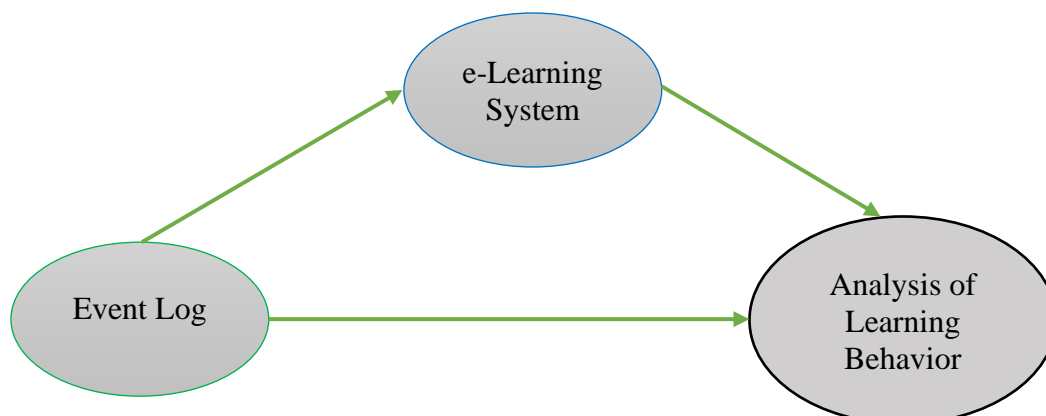


Figure 1. Theoretical framework of the study

To examine the role of event log in learning behavior of learners is considered in relation to the Thailand. In Thailand, the e-learning is also increasing. It is found that there is a tremendous growth in e-learning activities in Thailand. The number of e-learners are increasing in Thailand due to the Coronavirus. Most of the institutions are started rendering their services based on e-learning. As highlighted by several studies e-learning is most common in Thai institutions (Lake, 2020; Srakaew et al., 2021), however the problems related to the learning behavior of the peoples are existed in Thailand, therefore, it is needed to manage the problems of learning behavior of the people.

This study highlighted that event log and e-learning system has the potential to promote learning behavior of the people. Number of studies carried out research on e-learning (Almaiah & Alyoussef, 2019; Grigorova et al., 2017) and number of studies carried out research on learning behavior, however the literature have not considered the combination between event log and e-learning system in relation to the analysis of learning behavior. Therefore, this study has significant importance for the practitioners to enhance learning behavior of the people in Thailand with the help of event log and e-learning system. According to this study, event log has positive influence on e-learning system and it also has positive role to influence learning behavior directly. Furthermore, event log has effect through e-learning system, therefore, e-learning system is playing a mediating role between event log and analysis of learning behavior. Hence, following hypotheses are proposed;

Hypothesis 1. Event log has positive effect on analysis of learning behavior.

Hypothesis 2. Event log has positive effect on e-learning system.

Hypothesis 3. E-learning system has positive effect on analysis of learning behavior.

Hypothesis 4. E-learning system mediates the relationship between event log and analysis of learning behavior.

3. Research Methodology

Generally, the research methodology is based on three types of research approaches which include quantitative research approach, qualitative research approach and mixed method research approach. Quantitative research approach generally based on primary data as well as secondary data. Qualitative research is based on the interviews including the structured and unstructured interviews. On the other hand, mixed method approach is based on the quantitative as well as qualitative research approach in which both type of data is used. The current study selected research approach with the help of observing previous studies and by following the recommendations of previous studies. Number of studies carried out learning behavior in several aspects and these studies measured learning behavior with the help of quantitative research approach. While using quantitative research approach previous studies use primary data as secondary data is not available on learning behavior. Therefore, the learning behavior can only be measured with the help of primary data in which the quantitative research approach is most suitable. Consequently, the current study used quantitative research approach in which a survey is carried out for data collection. Additionally, the current study also used cross-sectional research design which is most recommended by previous studies as

the longitudinal design is not appropriate for the current study.

The current study measured learning behavior with the help of considering the behavior of various learners in relation to the event log as well as e-learning system. The positive as well as negative aspects of learning behavior are considered to measure the analysis of learning behavior. The current study measured event log with the help of creating as well as collection of data. The e-learning system is measured by using the suitability of e-learning for the user. While measuring e-learning system the current study considered various advantages of e-learning system for learners. Finally, these variables are measured by using a survey questionnaire in which 7-point Likert scale is used. 7-point Likert scale is most suitable to get the response in more depth as compared to the 5-point Likert scale. Thus, the current study designed a survey questionnaire on 7-point Likert scale. The relationship between event log, e-learning system and analysis of learning behavior is considered.

The data collection is made from Phatthalung Thailand from various e-learners. The population of the study is based on the e-learners in Phatthalung Thailand. Sample size selected in this study by observing the previous studies and found that most of the studies use sample size between 300 to 500. Several previous studies are also recommended that 300 sample size is satisfactory. On the other hand, other studies recommended that sample size of 300 is good and it must be

selected based on the number of populations. The population of the current study is more than one hundred thousand because population is the number of people using e-learning system. The e-learning system is significantly increasing among the public as it is most suitable and easy to access. In this way, the current study used 500 sample size for data collection. All the questionnaires are distributed among the e-learners in Thailand and 275 returned. Finally, the current study used 265 valid responses for data analysis.

4. Data Analysis

Data screening is most important step before to examine the relationship between variables. While collecting primary data, several errors in the data is possible. These errors are expected to bring significant change in the results; therefore, it is important to remove several errors from the data. The errors in the data may include the missing value. The current found that event log has five missing values, analysis of learning behavior has three missing values and the learner system has four missing values. All these missing values were removed before data analysis. It is important to remove the outliers in the data related to the event log. It is found that event log has 5 outliers, e-learning system has eight outliers and analysis of learning behavior has one outlier. The current study removed all these outliers before data analysis by using recommended technique. Finally, the data statistics are provided in Table 1

Table 1. Data Statistics

	No.	Missing	Mean	Median	Min	Max	Standard Deviation	Excess Kurtosis	Skewness
ELO1	1	0	3.159	3	1	7	1.395	-0.577	-0.013
ELO2	2	0	3.246	3	1	7	1.731	-0.383	0.486
ELO3	3	0	3.384	3	1	7	1.608	-0.214	0.339
ELO4	4	0	3.341	3	1	7	1.709	-0.57	0.249
ELO5	5	0	3.283	3	1	7	1.655	-0.998	-0.014

ELO6	6	0	3.449	3	1	7	1.766	-0.535	0.316
ELO7	7	0	3.348	3	1	7	1.78	-0.312	0.576
ELO8	8	0	3.377	3	1	7	1.827	-0.75	0.279
ELS1	9	0	3.29	3	1	7	1.754	-0.3	0.51
ELS2	10	0	3.457	3	1	7	1.762	-0.539	0.326
ELS3	11	0	2.978	3	1	7	1.406	0.338	0.719
ELS4	12	0	3.029	3	1	7	1.34	1.171	0.933
ELS5	13	0	3.08	3	1	7	1.291	1.27	0.871
ELS6	14	0	2.942	3	1	7	1.208	0.117	0.386
ELS7	15	0	2.884	3	1	7	1.234	0.183	0.434
ALB1	16	0	3.022	3	1	7	1.31	0.077	0.428
ALB2	17	0	2.964	3	1	7	1.176	0.629	0.585
ALB3	18	0	2.899	3	1	7	1.287	-0.204	0.315
ALB4	19	0	3.043	3	1	7	1.334	0.472	0.604
ALB5	20	0	3.014	3	1	7	1.351	-0.087	0.508
ALB6	21	0	3.036	3	1	6	1.23	0.227	0.544
ALB7	22	0	3.123	3	1	7	1.282	0.352	0.497

The current study used partial least square (PLS) as statistical tool to analyze the data. Partial least square (PLS) is based on structural equation modeling (SEM) which is consisting of two major steps. These steps include measurement model and structural model. First of all, the current study used measurement model to check the reliability and validity of the data. In this step, confirmatory factor analysis is carried out which is used by several previous

studies in which factor loading must be higher than 0.7 (Afthanorhan, 2013; Hair et al., 2019). The factor loading given in Figure 2 and Table 2 highlighted that event log has factor loading above 0.8. The e-learning system has factor loading above 0.7. Finally, analysis of learning behavior has loading above 0.8. Thus, the variables have factor loading above 0.5, the loading which is also acceptable by the literature. On the other hand, the current study has factor loading above 0.7.

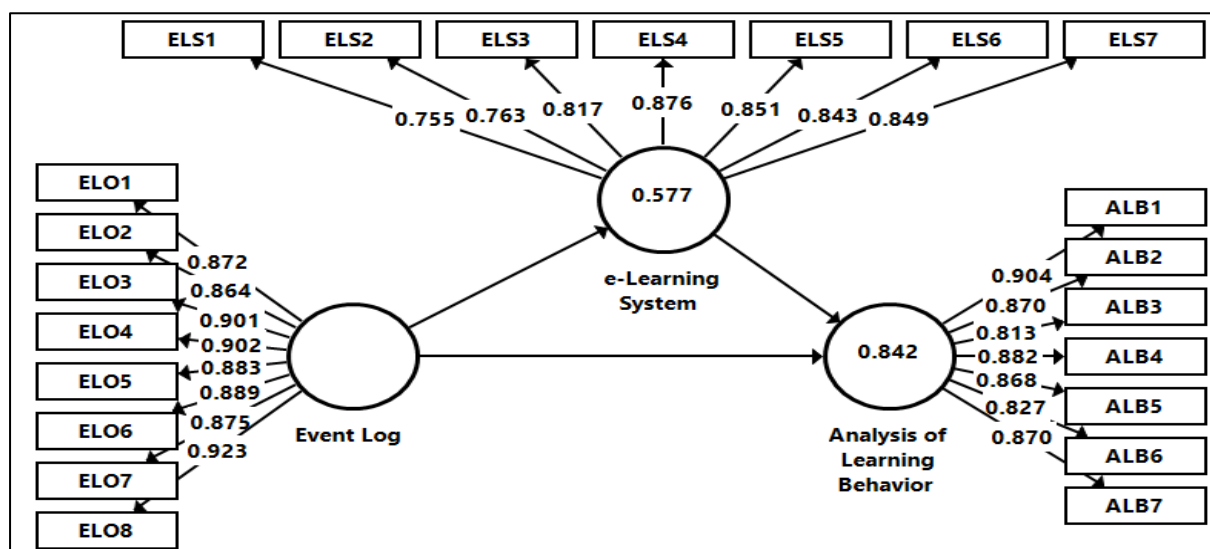


Figure 2. Measurement Model Assessment

Table 2. Factor Loading, CR and AVE

Variables	Items	Loadings	Alpha	Composite Reliability	Average Variance Extracted (AVE)
Analysis of Learning Behaviour	ALB1	0.904	0.942	0.953	0.744
	ALB2	0.87			
	ALB3	0.813			
	ALB4	0.882			
	ALB5	0.868			
	ALB6	0.827			
	ALB7	0.87			
Event Log	ELO1	0.872	0.962	0.968	0.79
	ELO2	0.864			
	ELO3	0.901			
	ELO4	0.902			
	ELO5	0.883			
	ELO6	0.889			
	ELO7	0.875			
	ELO8	0.923			
e-Learning System	ELS1	0.755	0.92	0.936	0.677
	ELS2	0.763			
	ELS3	0.817			
	ELS4	0.876			
	ELS5	0.851			
	ELS6	0.843			
	ELS7	0.849			

Moreover, after the factor loading identification, the current study also considered reliability of the data. All the factor loadings are also considered internal item reliability; however, it is also important to examine construct reliability. The construct reliability is given in Table 2 which is above 0.7 for analysis of learning behavior. It is also above 0.7 for event log. Finally, e-learning system has composite liability above the minimum threshold level which is 0.7. Furthermore, this study also examined Cronbach Alpha which is above 0.7 for analysis of learning behavior, event log and e-Learning system. Along with the composite reliability, the current study

examined average variance extracted which must be above 0.5. It is given in Table 2 that analyses of learning behavior has average variance extracted above 0.5 which is 0.74. It is 0.79 for event log and 0.677 for e-learning system. Previous studies recommended that to achieve the convergent validity, the composite liability must be above 0.7 and average variance extracted must be above 0.5. In the current study, all the variables have achieved minimum required level which confirmed the convergent validity. The convergent validity is not sufficient to achieve, therefore, this study also examined discriminant validity. The discriminant

validity is examined by using cross-loadings as well as HTMT_{0.9} value. The discriminant validity is given in Table 3

which is reported with the help of cross loading.

Table 3. Discriminant Validity

	Analysis of Learning Behaviour	Event Log	e-Learning System
ALB1	0.904	0.539	0.8
ALB2	0.87	0.604	0.824
ALB3	0.813	0.595	0.811
ALB4	0.882	0.422	0.763
ALB5	0.868	0.46	0.744
ALB6	0.827	0.512	0.763
ALB7	0.87	0.467	0.76
ELO1	0.572	0.872	0.702
ELO2	0.556	0.864	0.677
ELO3	0.564	0.901	0.709
ELO4	0.544	0.902	0.668
ELO5	0.472	0.883	0.632
ELO6	0.472	0.889	0.66
ELO7	0.528	0.875	0.673
ELO8	0.527	0.923	0.672
ELS1	0.555	0.651	0.755
ELS2	0.574	0.632	0.763
ELS3	0.808	0.484	0.817
ELS4	0.801	0.572	0.876
ELS5	0.812	0.532	0.851
ELS6	0.811	0.521	0.843
ELS7	0.846	0.575	0.849

The second step of data analysis is based on to examine the relationship between variables. It is highlighted in Figure 3 which is structural model showing the relationship between event log, e-learning system and analysis of learning behavior. Other studies highlighted that while analyzing primary data, the structural model is most important to check the relationship between variables. PLS structural model (Hair, Hult, Ringle, Sarstedt, & Thiele, 2017) which is most appropriate to measure learning behavior. The effect of event log is also considered in relation to the e-learning system. Furthermore, while examining the direct effect, the current study considered the effect of e-learning system on analysis of

learning behavior. All these relationships are given in Figure 3 in which the t-value is considered to check the significance of the relationship and beta value is checked to examine the direction of the relationship. The results have direct effects are given in Table 4. The results of the study shows that event log has significant effect on analysis of learning behavior with t-value 3.922. The t-value is above 1.96 which shows the significant relationship. Furthermore, the effect of event log on e-learning system found t-value 18.406 which is also about 1.96. Additionally, the effect of e-learning system on analysis of learning behavior shows t-value 26.936 which is also significant. Therefore, all the direct effects are significant along with the positive beta value.

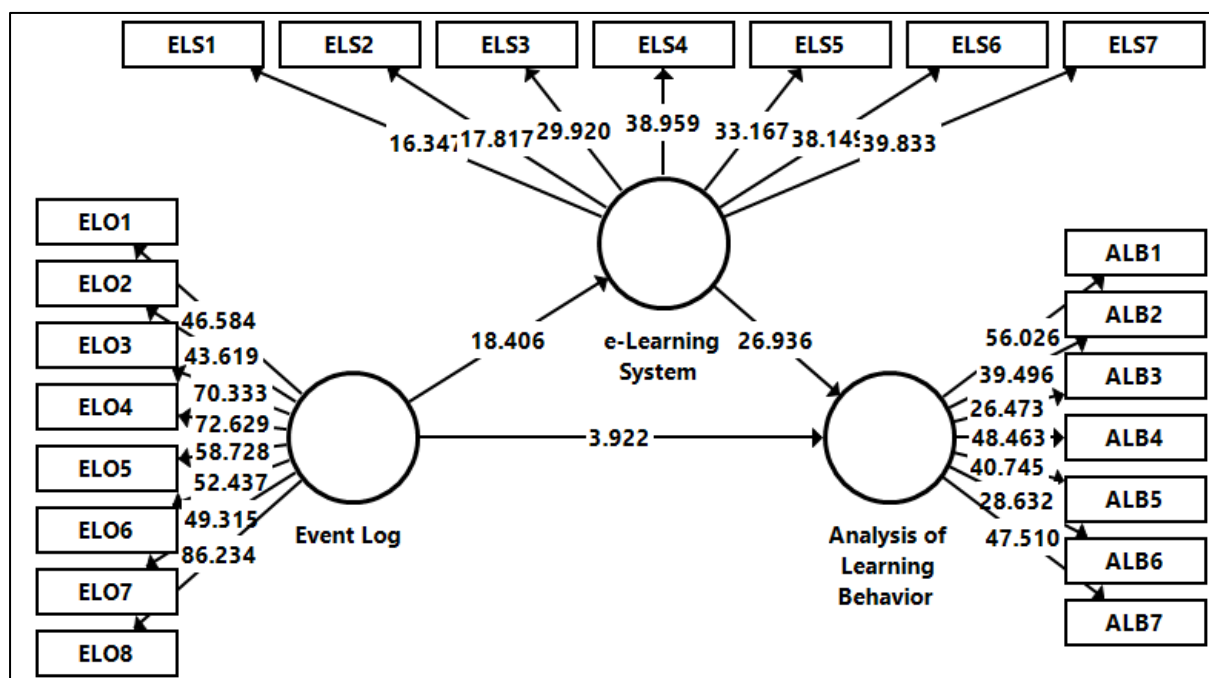


Figure 3. Structural Model Assessment

Table 4. Results (Direct Effect)

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values
Event Log -> Analysis of Learning Behaviour	0.216	0.213	0.055	3.922	0
Event Log -> e-Learning System	0.76	0.759	0.041	18.406	0
e-Learning System -> Analysis of Learning Behaviour	1.071	1.068	0.04	26.936	0

Along with the investigation of direct effect the current study also examined the indirect effect. The indirect effect is based on the mediation effect of e-learning system. The mediation effect of e-learning system is examined between event log and analysis of learning behavior which is given in Table 5.

It is highlighted that the e-learning system is a mediating variable between event log and analysis of learning behavior because the t-value is 15.506 which is above 1.96. The significance of this mediation effect shows that e-learning system transfer the positive effect of event log on analysis of learning behavior.

Table 5. Results (In-Direct Effect)

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values
Event Log -> e-Learning System -> Analysis of Learning Behaviour	0.813	0.811	0.052	15.506	0

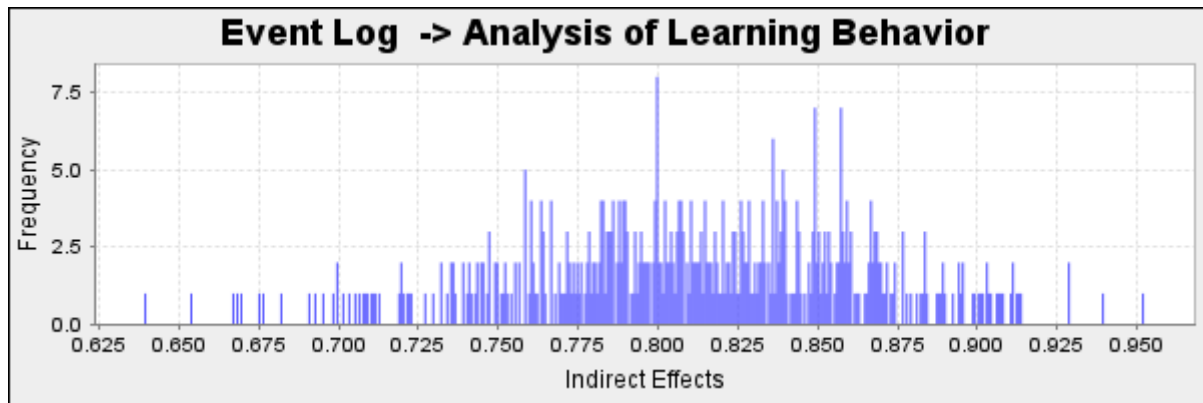


Figure 4. Mediation effect histogram between event log and analysis of learning behavior

Moreover, the current study considered to check the quality of the study model which is examined by using predictive relevance. Predictive relevance shows the quality of the model in which the value of dependent variable must be above zero. It is given in Table 6 that the value of analysis of learning behavior is 0.618 and value of e-learning system is 0.374. Both the values are above zero which indicated that the current study model has achieved the minimum quality criteria. Finally, the current study also

checked the variance explained by all the variables. The r-squared value is given in Figure 2 which is 0.842. It indicates that event log and e-learning system are expected to bring 84.2% change in analysis of learning behavior which is strong. Furthermore, the r-square value for e-learning system is 0.577 which indicates that event log expected to bring 57.7% change in e-learning system which is moderate.

Table 6. Predictive Relevance (Q^2)

	SSO	SSE	$Q^2 (=1-SSE/SSO)$
Analysis of Learning Behaviour	966	369.04	0.618
Event Log	1104	1104	
e-Learning System	966	604.558	0.374

5. Discussion and Conclusion

The current study examined the relationship between event log, e-learning system and analysis of learning behavior. This study is carried out in Thailand and respondents of the current study are the e-learner in Thailand. The cross-sectional data is used in this study which is collected with the help of questionnaire survey. The data analysis is carried out by using statistical tool which is partial least square (PLS). To achieve this purpose, this study proposed different direct hypotheses and mediation hypotheses. This study proposed three direct effects and one indirect effect based on e-learning system.

Findings of the study shows that event log has influencer role in analysis of learning behavior. As hypothesis 1 examined the relationship between event log and analysis of learning behavior. This process shows that event log has positive effect on analysis of learning behavior. It indicates that the promotion of event log among the learners promote positive learning behavior. It shows the direct relationship between event login and learning behavior. Thus, learning behavior is influenced by event login which ha influential role among the learner which is influenced by event log. It has the ability to promote positive behavior of learning which can be promoted by using event log. As hypothesis 2 shows that event log has positive effect on e-learning system. The availability of event log and its use has the ability to influence positively the e-learning system. Therefore, in Thailand to encourage learners, it is important to enhance event log among them. Furthermore, this study reported the relationship between e-learning system and analysis of learning behavior in hypothesis 3. The result shows that increase in e-learning system can increase the analysis of learning behavior among the learners. Therefore, it is found that e-learning system has positive role to promote learning

behavior. The learning behavior has influential role among the learners because positive behavior has the ability to learn more but negative learning behavior may affect negatively on learning. Thus, learning behavior is most important element which can be promoted by using e-learning system. Results of this study are consistent with previous studies as several other studies highlighted that e-learning system has positive effect on learning behavior (Al-Rahmi et al., 2019; Budu, Yinping, & Mireku, 2018).

Additionally, the current study also examined the indirect effect of e-learning system. Along with the direct effect, the mediation effect of e-learning system is examined between event log and analysis of learning behavior. Results of hypotheses shows this mediation affect which is highlighted that e-learning system is most important to transfer the positive effect of event log on analysis of e-learning behavior. E-learning system has the ability to reflect the positive effect of event log on analysis of learning behavior among Thailand. Therefore, it is concluded that event log and e-learning system has influential role in learning behavior. Event log has positive role to promote e-learning system which further lead to the analysis of learning behavior.

6. Implications of the Study

6.1 Theoretical Implications

The current study considered the unique relationship between event log, e-learning system and analysis of learning behavior in Thailand. This unique relationship has several theoretical implications as number of relationships considered in this study is not highlighted in previous studies. These relationships are ignored by previous studies among the Thai learners. All studies have examined learning behavior of the learners however the analysis of learning

behavior of learners is not considered by previous studies. Furthermore, studies have not considered the effect of event log on analysis of learning behavior in Thailand. The studies are available on event log, however, the study on the relationship of event log and access of learning behavior is not addressed in the literature. Additionally, the unique relationship between event log and learning system is most important which is addressed in this study. Although studies are highlighted e-learning system as well as event log, but the relationship between these two elements is less address in the literature. And the current study has several implications for the literature and started a new debate on the importance of event log for the analysis of learning behavior. In addition to this, the study addressed the mediation effect of e-learning system between event log and analysis of learning behavior which is not addressed in the literature.

6.2 Practical Implications

As the current study address number of theoretical implications, these theoretical implications lead towards the practical implications. The results of this study are quite helpful in practice in relation to the learners. Thai learners can promote their performance with the help of e-learning system. Therefore, it is important for practitioners to promote e-learning system to enhance the learning behavior. As the study reported that e-learning system has the potential to promote positive effect on e-learning behavior, therefore it can promote positively the learning behavior of the learners which is helpful to learn. Therefore, it is important to introduce various methods of e-learning system. Therefore, the current study recommended that the practitioner should promote the techniques of e-learning to enhance learning behavior. It is also recommended

that the event log must be used to enhance e-learning system. Therefore, this study recommended that the combination between event log and e-learning system must be promoted to enhance learning behavior of learners. And positive learning behavior can be promoted among the learners by using the benefits of event log and e-learning system

7. Limitations and Future Directions

The current study covered major areas related to the event log, e-learning system and analysis of learning behavior, however, there are few aspects which was not covered by the current study. The current study has few limitations which could be the future directions. This study only considered event log as a whole variable; however, it is recommended to use various other variables related to the event log. Furthermore, the current study considered e-learning system as a whole, it is better to consider various systems of e-learning as mediating variable. This study only considered quantitative research approach; the future studies should use qualitative research in which the structured interviews must be conducted which can provide better results.

References

- Afthanorhan, W. (2013). A comparison of partial least square structural equation modeling (PLS-SEM) and covariance based structural equation modeling (CB-SEM) for confirmatory factor analysis. *International Journal of Engineering Science and Innovative Technology*, 2(5), 198-205.
- Al-Okaily, M., Alqudah, H., Matar, A., Lutfi, A., & Taamneh, A. (2020). Dataset on the Acceptance of e-learning System among Universities Students' under the COVID-19 Pandemic Conditions. *Data in brief*, 32, 106176.
- Al-Rahmi, W. M., Yahaya, N., Aldraiweesh, A. A., Alamri, M. M., Aljarboa, N. A., Alturki, U., & Aljeraiwi, A. A. (2019). Integrating

- technology acceptance model with innovation diffusion theory: An empirical investigation on students' intention to use E-learning systems. *Ieee Access*, 7, 26797-26809.
- Almaiah, M. A., & Alyoussef, I. Y. (2019). Analysis of the effect of course design, course content support, course assessment and instructor characteristics on the actual use of E-learning system. *Ieee Access*, 7, 171907-171922.
- Alzahrani, N. M. (2020). Augmented reality: A systematic review of its benefits and challenges in e-learning contexts. *Applied Sciences*, 10(16), 5660.
- Budu, K. W. A., Yinping, M., & Mireku, K. K. (2018). Investigating the effect of behavioral intention on e-learning systems usage: Empirical study on tertiary education institutions in Ghana. *Mediterranean Journal of Social Sciences*, 9(3), 201-201.
- Currat, L., Suppan, M., Gartner, B. A., Daniel, E., Mayoraz, M., Harbarth, S., . . . Stuby, L. (2022). Impact of Face-to-Face Teaching in Addition to Electronic Learning on Personal Protective Equipment Doffing Proficiency in Student Paramedics: Randomized Controlled Trial. *International Journal of Environmental Research and Public Health*, 19(5), 3077.
- Dahleez, K. A., El-Saleh, A. A., Al Alawi, A. M., & Fattah, F. A. M. A. (2021). Student learning outcomes and online engagement in time of crisis: the role of e-learning system usability and teacher behavior. *The International Journal of Information and Learning Technology*.
- Grigороva, K., Malysheva, E., & Bobrovskiy, S. (2017). *Application of data mining and process mining approaches for improving e-learning processes*. Paper presented at the 3rd International Conference on Information Technology and Nanotechnology.
- Hair, J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., & Thiele, K. O. (2017). Mirror, mirror on the wall: a comparative evaluation of composite-based structural equation modeling methods. *Journal of the academy of marketing science*, 45(5), 616-632.
- Hair, J. F., Ringle, C. M., Gudergan, S. P., Fischer, A., Nitzi, C., & Menictas, C. (2019). Partial least squares structural equation modeling-based discrete choice modeling: an illustration in modeling retailer choice. *Business Research*, 12(1), 115-142.
- Kaniadakis, A., & Padumadasa, E. U. (2022). Can e-Learning Enable the Transition to University for Computing and Electronic Engineering Students from Low Socio-Economic Status? A Socio-Cultural Approach. *Journal of Information Systems Education*, 33(1), 87-97.
- Lake, P. (2020). Factors Influencing Attitudes Toward Blended E-learning Using Learning Management Systems: A Case Study in a University in Thailand. *Humanities, Arts and Social Sciences Studies (FORMER NAME SILPAKORN UNIVERSITY JOURNAL OF SOCIAL SCIENCES, HUMANITIES, AND ARTS)*, 247-295.
- Siritongthaworn, S., Krairit, D., Dimmitt, N. J., & Paul, H. (2006). The study of e-learning technology implementation: A preliminary investigation of universities in Thailand. *Education and Information Technologies*, 11(2), 137-160.
- Srakaew, S., Polvichai, J., Sugiyama, Y., Motohashi, K., Mochizuki, A., Ohara, K., & Shirouzu, M. (2021). Development and Verification Survey of Human Resource Development Program in Engineering Utilizing E-Learning System and Project Based Learning in Engineering with The Cooperation of Japan and Thailand for the New Normal after COVID-19. *International Journal of Advanced Research in Engineering Innovation*, 3(3), 76-83.
- Zou, Y., Shen, L., & Dadparvar, S. (2022). The Influence of E-learning Behavior on Students' Learning Performance of Disaster Emergency Knowledge. *International Journal of Emerging Technologies in Learning (iJET)*, 17(1), 49-59.