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Predicting Factors Influencing Acceptance on Online Learning Platforms during the COVID-19 Pandemic

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Abstract. The sudden shift from the traditional face-to-face classes to fully online learning due to the COVID-19 pandemic stunned the education sector worldwide. The abrupt adjustment led to quick decision on what online learning platform to utilize during the COVID-19 pandemic. The aim of this study was to predict factors influencing students actual use and acceptance of online learning platforms during the COVID-19 pandemic. Through convenience sampling, a total of 712 respondents answered the self-administered online survey voluntarily. Utilizing random forest classifier with Python 3.8, the results revealed that system and information quality, ease of use, and perceived ease of use of online learning platforms led to high and very high actual use. The results of this study indicated that as long as there is comfort, ease of use, design, user friendly, and accessibility among the online learning platforms, there would be high to very high actual usage, leading to acceptance among students. This study presented a 92% accuracy with 0.00 standard deviation, thus indicating the reliability of the outcome. Lastly, the findings could be applied by other educational sectors worldwide.

Keywords: Random forest classifier, online learning platforms, TAM, delone and mclean IS success model

1. Introduction

The shift on the education sector has left universities to shift from traditional face-to-face classes to fully online learning. To which, different learning platforms are being utilized to deliver the subject matter [1]. The main aim of the utilization of platforms was to be able to deliver effective communication and continuous learning among students [2].

In the Philippines, the most widely utilized platforms are Zoom, Blackboard, and MS Teams. These platforms create an environment for resources (e.g. materials, grades, etc.), virtual classes, presentations, and communication lines for students and teachers [3]. However, the sudden shift to fully online learning became a challenge among universities and their faculty members.

Effectivity of the platforms have been underexplored, especially in the Philippines. The abundant number of platforms led to different qualities and system usage applicable only to some [4]. The generalizability of the online meeting platforms has been underexplored. In addition, the utilization of these platforms led to learning inequalities [5]. Ong et al. [2] explained how these platforms have been invested on in the Philippines to be utilized during the COVID-19 pandemic.

Limited studies have tackled how these online meeting platforms could be acceptable among students [1]. To assess the acceptance, different models such as the DeLone and McLean IS Success Model (DM) and Technology Acceptance Model (TAM) have been considered. TAM, similar to the study of Al-Fraihat et al. [2] explained how several factors should be taken into consideration to determine what influences the acceptance of the technology [3]. Studies have dealt with technology system usefulness, ease of use, attitude, and intention have been dealt with [6,1]. Moreover, technology application to library has also been considered to assess service quality [7].

Subsequently, DM have been considered to evaluate user behavior among systems and technology being considered [8]. Ojo [9] and Prasetyo et al. [1] explained how DM could be utilized for decision of system usability. Thus, utilizing DM could be beneficial for strategy making and decision making towards adaptation of a system, such as online learning platforms.

This study aimed to predict factors that greatly influence students' acceptance on online learning platforms. Specifically, this study adopted the model utilized by Prasetyo et al. [1], integrating DM and TAM to evaluate information quality (IQ), system quality (SQ), perceived usefulness (PU0, perceived ease of use (PEU), user interface (UI), behavioral intention (BI), and actual use (AU). The study of Prastyo et al. [1] considered structural equation modeling (SEM) to evaluate the causal relationship among the different factors. However, Fan et al. [10] explained how SEM could have lower significance of the important factors due to the interference of indirect effects present in a model.

Considering the large interrelationship among the different factors, this study considered utilizing machine learning algorithm, specifically random forest classifier (RFC). RFC is a type of decision tree (DT) that considers the optimum classification for each run [11]. This therefore produces higher accuracy. The advantage of using machine learning algorithm is the high accuracy, easily interpretable output, and reliable classification [11,12]. Chen et al. [11] and Snehil and Gohel [12] indicated that RFC produces higher accuracy compared to other algorithms. Therefore, this study would be beneficial among academicians, educational sector, and the government in promoting online learning and the most effective platforms to be utilized.

2. Methodology

This study considered the framework and questionnaire (Table 1) utilized by Prasetyo et al. [1], integrating DM and TAM as seen in Fig. 1. The data gathered in this study considered 712 valid responses from senior high school (70.18%) and undergraduate and graduate students (29.82%). As seen in Table 1, there were 46.07% male respondents and 53.93% female respondents ranging from 16-21 years old. The data was collected using an online self-administered survey (Table 2) using convenient sampling, distributed through different social media platforms.

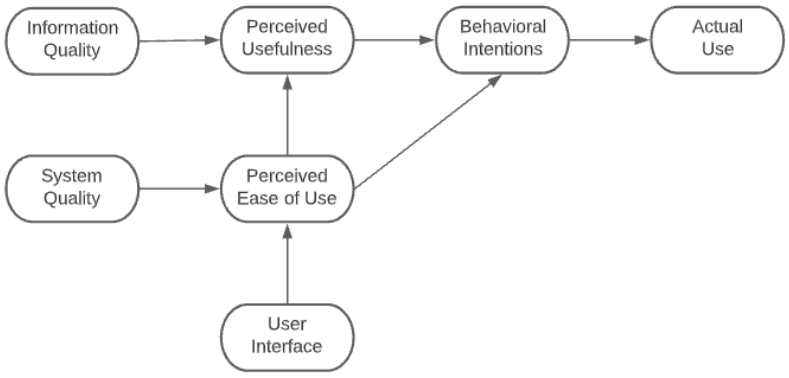

Fig. 1. Theoretical Framework [1]

TABLE I. DEMOGRAPHICS

Characteristics	**Category**	**N**	**%**
Gender	Male	328	46.07
	Female	384	53.93
Education Status	Senior High School	500	70.18
	College	179	25.20
	Graduate School	33	4.620
Hours Consumed in Online Class per Week	Less than 10 hours	83	11.63
	10 – 20	230	32.28
	21 – 30	326	45.81
	31 – 40	66	9.300
	More than 40 hours	7	0.980
Tuition Fee (per year)	Less than 15,000 Php	38	5.360
	15, 000 – 70, 000 Php	486	68.27
	More than 70, 000 Php	188	26.37

TABLE II. QUESTIONNAIRE

Construct	Measurements
System Quality	I find the online meeting platform easy to use.
	I find it flexible to communicate with the online meeting platforms.
	I have a clear and understandable interaction with online meeting platforms.
	I feel comfortable using the online meeting platform services and functionalities.
	The online meeting platform's interface and system design is friendly.
Information Quality	Online meeting platforms deliver useful information to my needs.
	Online meeting platforms offer exactly the knowledge I need.
	Online meeting platforms provide me knowledge and organized content.
	Online meeting platforms provide up-to-date information and content.
	Online meeting platforms provide accurate information.
Perceived Usefulness	Online meeting platforms are very useful in this time of pandemic.
	Online meeting platforms increase my productivity in my academics.
	Online Meeting platforms make it easier to study in distance learning.
	Online meeting platforms improve my performance in my academics.
	Online meeting platforms enable me to study asynchronously.
Perceived Ease of Use	I find online meeting platforms to be easy to use.
	Online meeting platforms make me feel comfortable.
	Online meeting platforms enhance my academic performances
	Online meeting platforms are much convenient for me to use.
User Interface	Online meeting platforms provide user-friendly features.
	I found various features in the platform that were well integrated.
	I think I would like to use online meeting platforms.
	I would imagine myself that I would learn to use this system very quickly.
	I think I would recommend to others to use online meeting platforms.
Behavioral Intentions	I am motivated to use online meeting platforms.
	I recommend using online meeting platforms.
	I am willing to use online meeting platforms for the whole year.
	I am very likely to use online meeting platforms.
	Using online meeting platforms makes online learning interesting.
Actual Use	I think everyone learns more when using online meeting platforms.
	I think everyone has fast internet access to use online meeting platforms.
	I think everyone has a good environment to use online platforms.

A total of 22,784 data was analyzed in this study. Data pre-processing and data cleaning was done using correlation analysis. A threshold of 0.20 correlational value was set and p-value less than 0.05. To which, all data was considered significant. Following which was data aggregation and data normalization before running the RFC.

Utilizing python 3.8 to run the RFC, this study optimized the parameters such as the criterion (gini or entropy), splitter (best or random), training and testing ratios (60:40, 70:30, 80:20, 9:10), and the tree depth (4, 5, 6, 7). A total of 6,400 runs were considered for the analysis.

3. Results

Following the suggestion of Chen et al. [11], RFC can produce a more accurate DT with higher accuracy rate than the basic DT. This is because RFC algorithm chooses the optimum DT among all DTs produced. With that, the RFC as an MLA tool was also utilized in this study. Utilizing Analysis of Variance, the 6,400 runs for RFC presented that depth 5, ‘gini’ as the criterion with best splitter at 80:20 training and testing ratio showed the most significant difference. Presented in Table 3 is the summary of results, to which 92% with 0.00 standard deviation produced the optimum decision tree (Fig. 2).

TABLE III. SUMMARY OF RESULTS

Category	**60:40**	**70:30**	**80:20**	**90:10**
Random				
Gini	83.11	78.67	84.33	84.80

Std. Dev	2.949	5.434	4.030	5.846
Entropy	83.53	81.80	85.73	83.73
Std. Dev	6.069	5.361	4.682	5.175
Best				
Gini	84.00	83.00	92.00	88.00
Std. Dev	0.000	0.000	0.000	0.000
Entropy	83.33	86.27	89.00	88.00
Std. Dev	0.488	0.458	0.000	0.000

It could be seen from the results that the indicator for AU would be IQ (X1). Following which would be the child node of SQ (X0). If this considered a value less than or equal to 0.123, it led to considering IQ which led to high or very high AU. If not satisfied, it considered PU (X2) with value less than or equal to 1.555. If satisfied, it considered SQ which led to high AU, otherwise PEU that led to high AU.

If the child node considered values less than or equal to 2.13, this led to the consideration of IQ and SQ that led to very high AU. Otherwise, it would consider IQ that considered PU and PEU leading to high AU.

It could therefore be deduced that these parameters would influence students' acceptance of online meeting platforms. The arrangement of influence would be SQ, followed by IQ, PU, and then the last would be PEU. Comparing to the results of Prasetyo et al. [1], PEU was seen to be the most significant factor utilizing SEM, followed by UI, SQ, PEU, and IQ. Following Fan et al. [10], the different results are due to the indirect relationship that influenced the level of significance among the different factors considered in the framework.

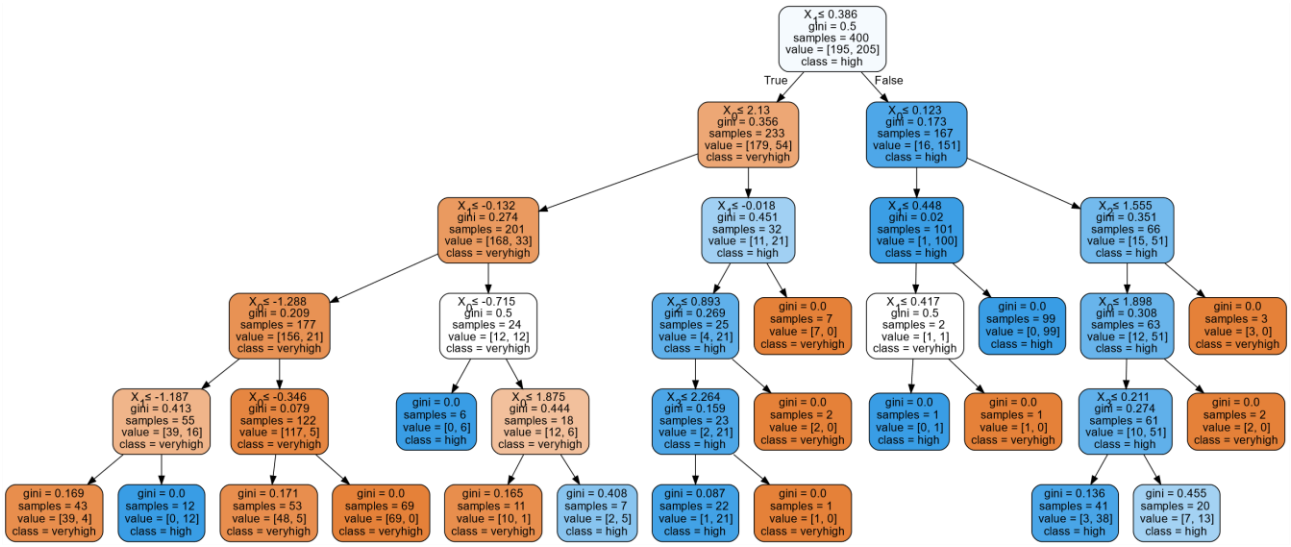

Fig. 2. Optimum Random Forest Classifier

4. Discussion

This study considered RFC to predict factors influencing online learning platform acceptance among students during the COVID-19. With 92% average accuracy with 0.00 standard deviation, RFC was deemed to be an acceptable tool for analysis [11]. To which, SQ, IQ, PU, and PEU were the most significant factors that influenced high to very high AU among students.

SQ and IQ was the parent and primary child node that was considered by the optimum RFC. Alsabawy et al. [13] explained how both these factors should be key parameters in a successful system for online learning. The SQ factor would dictate how easily and useful a technology is upon utilization [7]. Basing on the constructs, there has been evident ease of use, flexibility, user-friendly interaction, there is comfort in using the interface, and the design in general is easily accessed. Therefore, the quality of the system should be the primary indicator upon choosing a system for online learning.

Following which would be PU. The constructs indicated that students feel productive, usefulness as a significant factor, improvement in performance, and the accessibility would lead to the positive perception of

usefulness. Following Zheng [6], he explained how PU is the primary factor under TAM that indicates the acceptance of a technology upon usage. Prasetyo et al. [1] highlighted how PU would be beneficial during remote learning. Thus, during the COVID-19 pandemic, the students highlighted that PU would be a factor that they would be considering to have high AU.

In relation to PU, PEU was also seen to have a significant very high AU among students. When comfort, ease of usage, convenience, and enhancement of performance are evident upon the usage of a technology, there will be evident and very high AU. Both long-term and short-term period would be considered by users when there is PEU (36). This is similar to the results of Prasetyo et al. [1] that indicated PEU being a factor that has a strong indirect effect towards AU.

During the COVID-19 pandemic, everyone became dependent on using technology for education, work, and business. With that, the education section should be able to classify their online meeting platforms. The quality of information and system, ease, and usefulness would lead to high impact on actual usage. Ong et al. [2] indicated that high acceptability of platforms would engage students, which may lead to a positive performance in academics and output.

5. Conclusion

Considering the shift of traditional classes to fully online classes brought significant challenges, especially in the education sector. This study aimed to predict factors influencing high acceptance among students using an adopted framework. Different factors were considered and the results highlighted that SQ, IQ, PU, and PEU were the most significant factors leading to high and very high AU.

The results presented highlighted that ease of use, increase in productivity, comfort, quality, and accessibility would be determinants of actual usage of an online learning platform during the COVID-19 pandemic.

It could be advised among the education sector to choose an online learning platform that covers the different significant indicators for student acceptance. Moreover, effective communication would be inclined with the ease of access, coordination among faculty and students, and consider students without access to technology should also be considered to have an effective delivery of learnings during the COVID-19 pandemic. Lastly, the results showed general findings, thus could be considered and applied by different education sectors worldwide.

6. References

[1] Prasetyo, Y. T., Ong, A. K., Concepcion, G. K., Navata, F. M., Robles, R. A., Tomagos, I. J., Young, M. N., Diaz, J. F., Nadlifatin, R., & Redi, A. A. (2021). Determining factors affecting acceptance of e-learning platforms during the COVID-19 pandemic: Integrating Extended Technology Acceptance Model and Delone & McLean is success model. *Sustainability*, *13*(15), 8365. https://doi.org/10.3390/su13158365

[2] Ong, A. K., Prasetyo, Y. T., Young, M. N., Diaz, J. F., Chuenyindee, T., Kusonwattana, P., Yuduang, N., Nadlifatin, R., & Redi, A. A. (2021). Students' preference analysis on online learning attributes in industrial engineering education during the COVID-19 pandemic: A conjoint analysis approach for sustainable industrial engineers. *Sustainability*, *13*(15), 8339. https://doi.org/10.3390/su13158339

[3] Al-Fraihat, D.; Joy, M.; Sinclair, J. Evaluating E-learning systems success: An empirical study. Comput. Hum. Behav. 2020, 102, 67–86

[4] Wlodarczyk, J.R.; Wolfswinkel, E.M.; Carey, J.N. Coronavirus 2019 video conferencing: Preserving resident education with online meeting platforms. Plast. Reconstr. Surg. 2020, 146, 110–111.

[5] Hasan, N.; Bao, Y. Impact of "e-Learning crack-up" perception on psychological distress among college students during COVID-19 pandemic: A mediating role of "fear of academic year loss". Child. Youth Serv. Rev. 2020, 118, 105355.

[6] Zheng, J.; Li, S. What drives students' intention to use tablet computers: An extended technology acceptance model. Int. J. Educ. Res. 2020, 102, 101612

[7] Rafique, H.; Almagrabi, A.O.; Shamim, A.; Anwar, F.; Bashir, A.K. Investigating the acceptance of mobile library

applications with an extended technology acceptance model (TAM). Comput. Educ. 2020, 145, 103732.

[8] Aldholay, A.H.; Isaac, O.; Abdullah, Z.; Ramayah, T. The role of transformational leadership as a mediating variable in DeLone and McLean information system success model: The context of online learning usage in Yemen. Telemat. Inform. 2018, 35, 1421–1437

[9] Ojo, A.I. Validation of the DeLone and McLean information systems success model. Healthc. Inform. Res. 2017, 23, 60

[10] Fan, Y., Chen, J., Shirkey, G., John, R., Wu, S. R., Park, H., & Shao, C. (2016). Applications of structural equation modeling (SEM) in Ecological Studies: An updated review. *Ecological Processes*, *5*(1). https://doi.org/10.1186/s13717-016-0063-3

[11] Chen, J., Li, Q., Wang, H., & Deng, M. (2019). A Machine Learning Ensemble Approach Based on Random Forest and Radial Basis Function Neural Network for Risk Evaluation of Regional Flood Disaster: A Case Study of the Yangtze River Delta, China. *International Journal of Environmental Research and Public Health*, *17*(1), 49. https://doi.org/10.3390/ijerph17010049

[12] Snehil, & Goel, R. (2020). Flood Damage Analysis Using Machine Learning Techniques. *Procedia Computer Science*, *173*, 78–85. https://doi.org/10.1016/j.procs.2020.06.011

[13] Alsabawy, A.Y.; Cater-Steel, A.; Soar, J. Determinants of perceived usefulness of e-learning systems. Comput. Hum. Behav. 2016, 64, 843–858