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Google Classroom Adoption as Learning Management System in Senior High School Using Technology Acceptance Model

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Abstract: Google Classroom Adoption as Learning Management System in Senior High School Using Technology Acceptance Model. Objectives: The purpose of this study was to determine the acceptance of Google Classroom as a learning management system for public high school at one state university in Laguna, Philippines, using the Technology Acceptance Model (TAM). It further determined the effect of online learning self-efficacy on the original TAM-related factors. **Methods:** Using a quantitative through survey method, the data were collected using a web-based program from 742 students and were analyzed using structural equation modelling. The content-validated research instrument was adapted from previous studies (Al-Maroof & Al-Meran, 2018; Fathema et al., 2015; Zimmerman and Kulikowich, 2016). **Findings:** Findings revealed that all hypotheses were supported. Both perceived ease of use (PEOU) and perceived usefulness (PU) positively influence the attitude towards use (ATU), according to the study's findings. The PU and ATU can likewise significantly predict behavioral intention to use (BIU), which in turn explains the actual usage (AU) of Google classrooms. Furthermore, Online learning self-efficacy (OLSE) demonstrates a positive impact on both PU and PEOU. **Conclusion:** This study concludes that the students found Google Classroom as an effective tool for teaching and learning, as evidenced by a positive perspective and strong intent to continue using the platform. The salient implications for implementing LMS-based courses and future lines of research were also discussed.

Keywords: behavioral intention to use, online learning self-efficacy, perceived ease of use, perceived usefulness, technology acceptance model.

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■ INTRODUCTION

The impact of technology on education has irrefutably revolutionized the delivery of education to people around the world. The synergy between education and technology shaped dynamic teaching and learning experiences in order to reinvent teachers and students in order to fuel the digital economy (Garcia, 2017; Rhode et al., 2017). The incorporation of information and communication technology into education paved the way for the use of learning management systems (henceforth, LMS), which facilitate the innovative delivery of learning content. LMS is defined as software that combines an interactive learning environment with administration and facilitates the creation of individualized online instructional materials (Ifenthaler, 2012). It also serves as a platform for the creation, management, and delivery of course content. It is an integral part of any online learning or distance learning program. It enables teachers and students to meet the demands of knowledge delivery and acquisition despite physical location constraints (Dash, 2019; Turnbull et al., 2019). Famous web-based LMSs, i.e., Moodle, Schoology, Facebook, Edmodo, and Google Classroom, have been used to support the conventional, online, and blended learning models of teaching and learning (Fathema et al., 2015).

In the Philippines, prominent higher education institutions and universities such as the University of the Philippines Open University, De La Salle University – Manila, Ateneo de Manila University, and the University of Santo Tomas, among others, have been proliferating and integrating e-learning technology in their educational system; thus, using their own LMS to deliver quality and responsive education (Garcia, 2017). In the case of Laguna State Polytechnic University (LSPU), the university institutionalized Google Classroom as the official LMS for system-wide adoption as it transitioned to an online learning modality as a result of the implications of the industrial revolution and the unprecedented challenges posed by the COVID-19 pandemic. Google Classroom as LMS is a free web service developed by Google for schools that aims to simplify assignment creation, distribution, and evaluation. Google Classroom is an effective tool for facilitating the teaching and learning process (Shaharanee et al., 2016). It is an easy-to-use tool that enables educators to manage and assess student progress while strengthening connections with students at school and home. This learning management system can resolve pedagogical issues such as the elimination of paper, the absence of students during face-to-face classes, asynchronous learning, and others (Esber, 2019).

Previous research on using Google Classroom as an LMS focused on the period before adoption. With the advantages of using LMS, this study focused on the post-adoption of the LMS grounded on students' acceptance of the technology towards continuous use of the system. Similarly, recent studies on the adoption of LMS have focused primarily on higher education (Al-Maroof & Al-Meran, 2018; Fathema et al., 2015; Granic & Marangunic, 2019; Iqbal & Bhatti, 2015; Sharma et al., 2017; Shroff et al., 2011; Stockless. 2018). Accordingly, there is a paucity of research examining the factors influencing senior high school students' acceptance of Google Classroom in general and in the Philippines. As a prime university in the province of Laguna, LSPU has instituted educational reforms since the global pandemic in 2019, which caused the conventional class to have flexible learning. LSPU aimed to become a center for flexible learning providing a reliable and effective online learning environment to its students and faculty members. In view of this, Google Classroom was implemented as the official LMS of the university to support the delivery of quality education in a flexible learning system. To determine the platform's efficacy,

researchers investigated the factors influencing students' acceptance of Google Classroom at the senior high school level in accordance with TAM principles.

Theoretical Framework

All The user acceptance is necessary for the implementation of an innovation or new technology, such as an LMS, to support teaching and learning process. The key to increasing the usage of information technology systems is to enhance their acceptance, which can be ascertained by asking individual users have intent to use the technology in the future (Holden & Karsh, 2010). In an attempt to explain technology acceptance, numerous models and theories in information system were developed. TAM proposed by Fred Davis (1989) is one of the well-established and frequently used models in predicting the use and acceptance of information systems and technology by individual users (Surendran, 2012; Venkatesh, 2000; Venkatesh et al., 2012). The main tenet of TAM is that users' behavioral intentions were governed by their perspectives regarding perceived usefulness (PU) and ease of use (PEOU) of the technology that led to user acceptance (Wu, 2006; Wu & Tsai, 2006). Davis (1989) defined PU as "the degree to which a person believes that using a particular system would enhance his or her job performance, p. 320." It explains the user's subjective likelihood that a particular application system will make their action better. On the other hand, Davis (1989) defined PEOU as "the degree to which a person believes that using a particular system would be free of effort, p. 320." This variable expresses the notion that using a particular technological system should be simple for users.

TAM has been used to in the literature to study technology adoption in the field of education (Al-Maroof & Al-Meran, 2018; Fathema et al.., 2015; Farahat, 2012; Granic & Marangunic, 2019; Iqbal & Bhatti, 2015; Panergayo & Aliazas, 2021; Shroff et al., 2011) In the present study, the TAM is used as a theoretical lens in determining the students' acceptance of Google Classroom as LMS in senior high school level. The TAM provides a robust framework for the adoption of new technology (Iqbal & Bhatti, 2015). In addition, TAM contended that there are various factors that affects students' behavioral intention to use technology, which in turns translate to actual use. It is also claimed that TAM provides space for other factors that may affect user acceptance of technology by ascertaining external variable that may play a vital role on the original model. In this study, Online Learning self-efficacy was used as an external variable to determine the PU and PEOU. The OLSE refers to the beliefs of persons that the can successfully accomplish tasks and solve problems in an online environment (Andal et al, 2020; Zimmerman & Kulikowich, 2016; Panergayo & Mansujeto, 2020). Literature also suggests that facilitating conditions, perceived enjoyment, and subjective norms are determinants of PU and PEOU (Jovanka et al., 2023). Since the OLSE of the students is a significant element in an online learning environment, the researchers believed that it can institute impact on the TAM-related constructs specifically in PU and PEOU. In fact, Panergayo and Aliazas (2021) demonstrated that OLSE established an effect to PU and PEOU. It reveals that OLSE has a positive and direct effect to PU and PEOU, which eventually transmit the effect to BIU. Similarly. Broadbent (2016) further recognized the central role of self-efficacy in determining the students' performance in an online learning environment. It shows that self-beliefs accounts for learning analytics and experience in using online learning management systems. Moreover, Landrum (2020) contended in his study that confidence in

using online learning tools and platforms is the strongest predictor of satisfaction and perceived usefulness of online classes. It follows that the students who are more confidents in online platforms are more satisfied in the course. Thus, this study presupposed the conceptual framework in figure 1.
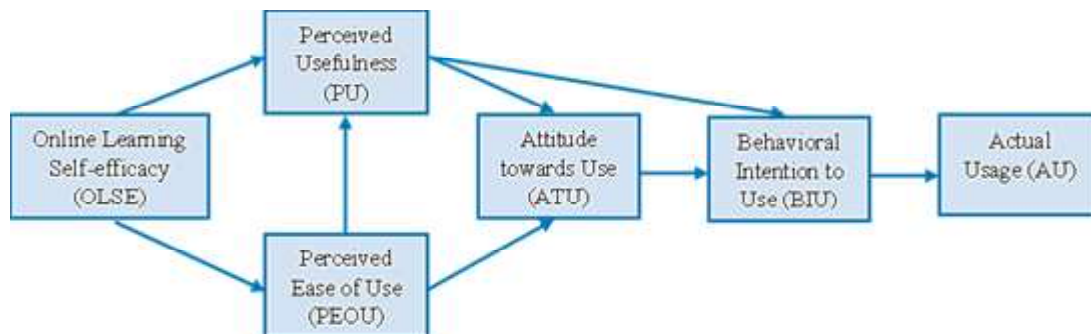

Figure 1. Conceptual framework of the study

Thus, the following hypotheses were formulated based on the original TAM proposed by Davis (1989) and the framework of the study.

H1: OLSE of the students significantly influences the PU of Google classroom.
H2: OLSE of the students significantly influences the PEOU of Google classroom.
H3: PEOU of Google classroom significantly influences its PU.
H4: PU significantly influences the ATU of Google Classroom.
H5: PU significantly influences the BIU Google Classroom.
H6: PEOU significantly influences the ATU of Google classroom.
H7: ATU significantly influences the BIU Google Classroom.

H8: BIU Google Classroom significantly influence its AU.

■ METHODS
Participants

The study was conducted in Laguna State Polytechnic University System composed of four campuses across the Province of Laguna, specifically in Senior High School Department. The university institutionalized Google Classroom as official learning management system for all levels in all departments in 2020. The target sample of this study are the senior high school students enrolled in academic year 2020-2021. The participants have already utilized Google Classroom for approximately five months, or one semester. Table 1 provides a summary of the respondent characteristics.

Table 1. Profile of the respondents (n=742)

Demographics		f	%
Campus	Sta. Cruz City	231	31.1
	San Pablo City	366	49.3
	Los Banos City	112	15.1
	Siniloan City	33	4.4
Sex	Female	492	66.3
	Male	250	33.7

Age	15 years old	1	0.1
	16 years old	157	21.2
	17 years old	342	46.1
	18 years old	233	31.4
	19 years old	9	1.2
Grade Level	Grade 11	355	47.8
	Grade 12	387	52.2
Senior High School (SHS) Track	Accountancy and Business Management (ABM)	184	24.8
	Humanities and Social Science (HUMSS)	208	28.0
	Science, Technology, Engineering, and Mathematics (STEM)	198	26.7
	Technical-Vocational Livelihood (TVL)	152	20.5

Instrument

The research instrument used in this study was adapted from previous studies (Al-Maroof & Al-Meran, 2018; Fathema et al., 2015; Zimmerman and Kulikowich, 2016). The instrument was composed of three parts: the first part asked about the demographic information of the respondents such as gender, age, grade level and SHS track. The second part was composed of TAM-related survey items. The items in PU (7 items), PEOU (6 items), BIU (3 items), and AU (2 items) are adapted from Al-Maroof and Al-Meran (2018) while the ATU (4 items) is adapted from the study of Fathema et al. (2015). The third part is intended to collect information about the OLSE (22 items) of the respondents. This is adapted from the study of Zimmerman and Kulikowich (2016). The researchers sought permission via email to utilize the instrument for the purposes of this study. The adapted instruments underwent to expert validation and rewording for the appropriateness of the questionnaire to the target respondents and alignment with the context of the study.

Data Collection

The data was collected through an online survey embedded in a web application. The target population received the survey link via private and group messages and was posted on their Google Classroom. The faculty of the senior high school department was asked to assist with the distribution of the survey and ensure a high response rate. Proper research ethics measures and protocols was strictly observed by providing respondents with a consent form indicating their knowledge and understanding of the study's objectives. The form specifies that the respondent's anonymity and confidentiality will be highly considered. Names and email addresses of respondents, as well as other sensitive information, are only accessible to the data analysts.

Data Analysis

The internal consistency and reliability of the survey items were evaluated using Cronbach's alpha, composite reliability, and extracted average variance. These measures ensured construct validity for each variable in the study. The acceptable alpha threshold is 0.7 or higher, indicating that the items are homogenous and measuring the same constant (Hair et al., 1998). Prior to Structural Equation Modelling (SEM), correlation tests were conducted using Pearson's correlation coefficient to determine whether a significant association existed between the study variable and the independent variable. Then, SEM was implemented to test the proposed relationship between study variables using TAM as the theoretical framework.

■ RESULTS AND DISCUSSION

This study aimed to determine the acceptance of Google Classroom as LMS for education delivery in the senior high school level in four campuses of one state university in Laguna in the light of TAM. Specifically, it examined the factors influencing how senior high school students accept and continue using Google Classroom as LMS. It also seeks to determine the effect of online learning self-efficacy as an external factor to perceived usefulness and ease of use of Google Classroom.

Table 2. Reliability and validity of study variables

Variable	No. of Items	CA	Item loadings	CR	AVE
OLSE	22	.929	.419-.682	.731	.590
PU	7	.777	.622 - .789	.879	.550
PEOU	6	.851	.664-.808	.855	.510
ATU	4	.874	.758-.813	.876	.638
BIU	3	.833	.768-.815	.834	.626
AU	2	.790	.779-.840	.831	.623

Table 2 shows the evidence of the validity and reliability of the variables involved in the present study. The table presents the Cronbach's alpha (CA), which measures the internal consistency of the variable. CA further represents how closely the set of items is as a variable (Cronbach, 1951). Generally, a critical value of 0.7 is recommended for acceptable reliability (George & Mallery, 2003; Van Griethuijsen et al., 2014; Nunnally, 1978; Taber, 2017). In the current study, all variables emerged to have alpha values greater than the prescribed threshold, thus, demonstrating acceptable to high internal consistency. Factor loading displayed the variance on that specific factor explained by the variable. According to Awang (2015), a factor loading of 0.6 and above for each item indicate a high convergent validity. Based on the table, the variables generally passed the recommended cut-off for factor loading. It can be noted, however, that the variable OLSE did not meet the prescribed factor loading with a minimum loading of 0.419, which can be attributed due to a high number of items. For composite reliability (CR), a value of 0.70 and above is prescribed (Hair, 1997). The table revealed that the CR of each construct is deemed adequate given the recommended threshold.

Based on the series of tests conducted using factor loading, CA, CR, and AVE, the study constructs were valid and reliable. Moreover, the average variance extracted (AVE) should be 0.5 or higher to indicate adequate reliability (Awang, 2015; Fornell & Larcker, 1981; Hair et al., 2012). The reported AVE values emerged to be higher than 0.5.

Table 3. Mean, standard deviation, and correlation analysis among study variables

	OLSE	PU	PEOU	ATU	BIU	AU
OLSE						
PU	0.721**					
PEOU	0.695**	0.680**				
ATU	0.724**	0.744**	0.763**			
BIU	0.707**	0.704**	0.693**	0.826**		
AU	0.592**	0.596**	0.543**	0.588**	0.631**	

Mean	3.69	3.61	4.11	3.83	3.73	3.78
SD	0.56	0.60	0.63	0.73	0.78	0.86

**Correlation is significant at the 0.01 level

Table 3 reports the study variables' mean, standard deviation, and correlation analysis results. The table revealed that PEOU got the highest mean rating (M=4.11, SD=0.63), suggesting that the students evaluated the Google Classroom fairly high regarding its manageability and comfortability as LMS. On the other hand, PU obtained the lowest mean value (M=3.61, SD=0.60) compared to other variables but still indicates a fairly high rating. It shows that students found Google Classroom useful in the teaching-learning process. In addition, it can be gleaned from the table that all associations among the variables emerged to be significantly correlated at the 0.01 level. The same findings were reported by Fearnley & Amora (2020) and Fathema et al. (2015) in their study, in which the bivariate relationships among study variables were all significantly correlated with each other at the 0.01 level. Furthermore, Panergayo and Aliazas (2021) found that OLSE, PU, PEOU, and BIU established a strong and positive significant relationship, as revealed by coefficient r tested at a 95% confidence interval.

In terms of fit indices of the proposed model, the absolute fit indices were reported using the Chi-square probability level is p=0.000 (significant at p < 0.05), Relative Chi-Square (CMIN/DF) is 4.288, (CMIN/DF < 5) (Bentler, 1990), the Root Mean Square of Error Estimation (RMSEA) is 0.067, (RMSEA ≤ 0.06) (Joreskog & Sorbom,1993). In terms of incremental fit indices, the Comparative Fit Index (CFI) reported value is 0.849 (CFI ≥ 0.90) (Browne & Cudeck,1992), Incremental Fit Index (IFI) was found to be 0.849 also (IFI ≥ 0.90) (Bentler, 1990), the Normed Fit Index (NFI) emerged to be 0.812 (NFI ≥ .95 good, .90 to .95, (Bentler,1990), the Tucker Lewis Index (TLI) was computed to be 0.840, (TLI ≥ .90) (Marsh et al., 2004). Akaike Information Criterion (AIC) was calculated in terms of parsimonious index and was found to be 3297.144. Generally, the fit and quality indices of the structural model in the current study are within the range of tolerable boundaries.

Table 4. Parameter estimates of the technology acceptance model for LMS

H	Path	Estimate	Standard Error	Critical Ratio	Result
H_1	OLSE → PU	0.514	0.065	9.275	Supported[**]
H_2	OLSE → PEOU	0.800	0.053	15.300	Supported[**]
H_3	PEOU → PU	0.379	0.062	7.048	Supported[**]
H_4	PU → ATU	0.438	0.050	9.259	Supported[**]
H_5	PU → BIU	0.207	0.061	3.526	Supported[**]
H_6	PEOU → ATU	0.542	0.062	10.656	Supported[**]
H_7	ATU → BIU	0.772	0.063	11.803	Supported[**]
H_8	BIU → AU	0.778	0.055	16.711	Supported[**]

Table 4 presents the parameter estimates of the TAM for LMS and the results for the assumed relationships based on the TAM. The table revealed that all of the hypotheses were sustained, indicating that the TAM is valid and applicable within the study context. It further

revealed that the acceptance of Google Classroom as LMS is fairly high within the tenets of TAM. The SEM uncovered that the external variable OLSE could significantly explain the variation in the PU (β=.514) and PEOU (β=.800). This means that when OLSE goes up by one standard deviation, PU and PEOU change by 0.514 and 0.800 standard deviations, respectively. This clearly shows that self-confidence and their belief regarding their capabilities in the online learning environment can influence their perspective about the usefulness and manageability features of the LMS.

Additionally, the original TAM constructs emerged to have positive and direct relationships based on the model's proposed association. PEOU can statistically explain the variation in PU, while PU can also explain the variation of BIU. The table further revealed that both PU and PEOU have a statistical effect on ATU, in which PEOU emerged as a stronger predictor. In the same manner that ATU can predict BIU, which explains the AU. In fact, BIU obtained the strongest estimate to predict the AU. These findings provided evidence that senior high school students found the Google Classroom an effective tool for teaching and learning, demonstrating a positive perspective and strong intent to continue using the platform. These results are consistent with Panergayo and Aliazas's (2021) study and Al-Maroof and Al-Emran (2018) that PU and PEOU are significant predictors of students' BIU. The previous studies revealed that the students' observations regarding the usefulness and ease of using the LMS can predict their future intention and continue to use LMS.

The current study sought to determine the applicability of the original TAM by Fred Davis (1989) in adopting Google Classroom as LMS at senior high school level in a university. It further aimed to confirm the assumed relationship among the external and original TAM variables toward continuous use of the Google Classroom.

Influence of Online Learning Self Efficacy

Online learning self-efficacy (OLSE) of the students is a significant element in an online learning environment. The idea that a person can complete activities and overcome problems in an online world is referred to as OLSE (Andal et al., 2020; Zimmerman & Kulikowich, 2016). According to Shen et al. (2013), this is crucial for an online learning program to be successful. OLSE includes efficient time management and technological utilization in addition to students' self-efficacy to learn in an online environment. In this study. OLSE served as an external variable to predict PU and PEOU. Findings revealed that OLSE has a statistical effect on PU and PEOU. The same observation was revealed in the study of Fearnley and Amore (2020) that perceived self-efficacy significantly affects PU and PEOU. It is claimed that users with high self-efficacy eventually translate to a high level of comfort and confidence that using the LMS would enable them to achieve their work goals. Holden and Rada (2011) also contended that K-12 teachers' technology self-efficacy influences teachers' use of technology. However, Holden and Rada (2011) noted that the result is population-dependent and situation-based, varying across the target sample. The present findings were also consistent with Fathema et al. (2015). Faculty perceived self-efficacy as a vital factor in determining their technology use. The results showed that, compared to faculty members with lower self-efficacy, faculty members with higher self-efficacy find LMS valuable and simple to use. In other words, teachers who are confident in their LMS proficiency view

the LMS as a helpful technology to employ and report less complexity when utilizing it. In addition, Panergayo and Aliazas (2021) demonstrate that students' behavioral intentions to utilize LMS can be attributed to their confidence in studying in an online context. Hence, the present study revealed that self-efficacy is an essential factor in using LMS, signifying that self-beliefs account for learning analytics and frequent use of LMS, which in turn increases students' intent to use LMS.

Influence of Original TAM Constructs

The outcomes of the present study confirmed the model originally proposed by Davis (1989) and confirmed the existing literature in TAM (Al-Maroof & Al-Emran, 2018; Holden & Rada, 2011; Fathema et al., 2015; Fearnley and Amore, 2020; Panergayo & Aliazas, 2021). This study is expected to enhance the explanatory power of the TAM to explain the process by which students accept and use e-learning technology. In this study, significant predictive relationships were established, indicating strong relationships among all the study constructs; thus, the proposed relationships based on TAM were all supported. The findings of Al-Maroof & Al-Emran (2018) support the current result. They demonstrated that behavioral intention, which affects the actual use of Google Classrooms, is positively influenced by perceived ease of use (PEOU) and perceived usefulness (PU). Fearnley and Amore (2020) provided empirical validation of extended TAM, which supported the results of the present study. They used the TAM to examine the acceptance of LMS and found that PU and PEOU can predict the BIU, which in turn explains the AU. In the study conducted by Seyal et al. (2015) on the acceptance of mobile learning, they found the same observation that the original constructs of TAM are strong predictors of students' intention to use mobile

learning. They further argued that future mobile learning design should be based on its usefulness, easy to use, and appropriate to the students' perception. Hsu and Chen (2018) further revealed that PU and PEOU were significantly linked to intention to use. In this regard, they argued that the contents and design of mobile learning should give considerable attention to the usefulness and ease of use of the learning resources intended to be delivered. However, Wedari et al. (2022) disclosed that the PU and PEOU of Zoom cloud meetings directly affect satisfaction but do not influence acceptance intention. They argued that adopting new technology due to educational disruption, such as the COVID-19 pandemic, forced the students to use and adapt new technology and transition to a new mode of instructional delivery. Students' perception of how easy or complex technology was not considered in implementing new technology resulted in the compulsory acceptance of the system.

■ **CONCLUSIONS**

This study investigated the senior high school students' acceptance of Google Classroom as LMS using Davis's (1989) information system model. It further explored the impact of OLSE on the TAM-related constructs such as the PU and PEOU. The study found that the model can explain the process of acceptances and actual use of LMS in the target sample. In this regard, the outcomes of the study further validate the explanatory power of the TAM, which emerged as a primary contribution of the study. The TAM is one of the well-established information system models used to predict users' acceptance of new technology based on students' behavior and perception grounded on their reasoned actions. Extending the TAM by adding other external variables, such as the OLSE utilized in this study, can better understand the technology acceptance and students' intent to

utilize LMS. In this study, the results revealed that all hypotheses were sustained based on the SEM assessment approach. The outcomes disclosed that all TAM-related constructs could significantly influence the students' behavioral intention to use, eventually translating to actual LMS usage. This indicates that the present findings empirically validate the original TAM proposed by Davis (1989) extended by adding OLSE as an external variable.

The study results provide salient implications to enhance the teaching and learning process using Google Classroom as LMS in a flexible learning environment. For the students, self-confidence and belief regarding their ability to perform well in online learning environments can fuel their skills in using LMS features, increasing their acceptance of the platform based on its usefulness and manageability. The students' perceptions must be considered in implementing LMS-based courses since they are the primary users of the tool. For the teachers, the study's results can be used as significant inputs in designing an LMS-based courses in a flexible learning environment including an online learning system. The teachers must source out the students' confidence level on the tool and their awareness regarding the use and features of the LMS to be used in the instructional delivery. For educational administrators, they can assess the strengths and weaknesses in implementing a practical LMS-based course by evaluating the technology acceptance of the students. The study provides entry points for the policymakers to prioritize institutional support in training the target users of the platform. For future research directions, it is recommended to employ other research designs to explain the user acceptance of Google Classroom as LMS to validate the study's results further. A qualitative inquiry or mixed-method approach can be used to address the same research problem. Likewise, future researchers may ascertain other external variables aside from OLSE to further extend the TAM's ability to explain user acceptance of LMS.

This study encountered some limitations in terms of generalizing the results of the study. First, the study employed a single data collection method utilizing a quantitative technique. This means that the data we collected using self-reported questionnaires may be influenced by extraneous variables such as the survey's emotions. Second, the study adapted the original TAM with OLSE as an external variable. Thus, further research may extend the TAM by using multiple factors that may influence the students' behavioral intention to use Google Classroom. Third, the participants in this study are only students and do not include the teachers. Since teachers are also primary users of LMS, their perception of TAM-related constructs may be assessed further to strengthen the empirical findings of the current study.

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