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Moodle and Google Classroom: a comparative study of acceptability

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ABSTRACT

The popularity of online learning gives rise to learning management system (LMS) development as a central medium of instruction, communication, assessment, and collaboration for flexible learning. However, different LMS platforms present different acceptability to users, making it challenging for educational institutions to choose a platform for implementation. This study used a quantitative research design to compare the acceptance scores of Moodle and Google Classroom based on the technology acceptance model (TAM). Using convenience sampling, 40 students from the City College of Davao (CCD) participated in a survey to determine the perceived usefulness (PU), the perceived ease of use (PEOU), and the overall acceptance scores of the 2 LMSs. An independent t-test was used to compare the acceptance scores after determining the normality and homogeneity of the data sets. The comparative analysis determined no significant difference between the acceptance scores of Moodle and Google Classroom. Despite the limited number of participants, the findings suggest that CCD can use either of the 2 LMSs for official implementation. The findings can also inform other institutions and help them adopt the methods and recommendations in the study. The study contributes to the growing literature on technology acceptance and LMS.

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1. INTRODUCTION

The rising popularity of online learning has paved the way for the development of learning management systems (LMS). LMS has become the central online learning medium and comes in various platforms [1], [2]. Its use has been proven effective and has become a flexible learning tool for institutions due to the collaborative, content-sharing, and assessment mechanisms [3]. Some of the most popular LMSs worldwide include Moodle, Google Classroom, Canvas, Brightspace, and Blackboard. However, the choice of institutions on which LMS platform to implement is challenging due to the varying features and designs these platforms offer [4]–[7]. Additionally, each platform presents different acceptance scores to users that may affect the overall learning experience [8]. Studies by [9]–[11] highlighted the key factors that influence acceptance of LMS. Studies suggest the importance of user acceptance anchored on the technology acceptance

model (TAM) regarding using the LMS platform [12]. The TAM is a widely used model to evaluate the acceptance of different LMS worldwide. Initially developed by Davis [13], the TAM is a theoretical framework that explains and predicts user behavior towards technology acceptance according to perceived usefulness (PU), perceived ease of use (PEOU), attitude toward using (ATU), behavioral intention to use (BI), and actual system use (AU).

Among the TAM components, the PU and PEOU are the preliminary constructs leading towards ATU, BI, and AU, consequently with acceptance of the technology according to the TAM framework [14], [15]. PU is the degree to which users believe a particular technology can enhance their efficiency, productivity, and effectiveness on related tasks. In contrast, PEOU is the degree to which users believe a particular technology can be easily used with minimal effort. PU and PEOU both influence ATU. ATU influences BI, and BI leads to AU. The TAM implements a questionnaire to measure acceptance scores, which can be an appropriate instrument for evaluating an LMS [16]–[18], as evident in various studies.

Different LMS platforms' acceptance scores vary from country to country [19] and user to user. Implementing an LMS in an institution without assessing its acceptance poses a significant challenge due to risks such as lack of knowledge, orientation practices, and technical support [20], which may hinder the LMS's overall effectiveness. Although most LMSs have been accepted by students worldwide, research has shown differences in acceptance scores based on gender, year levels [21], and actual usage [22]. In the Philippines, studies highlighted that factors such as problems with internet connectivity [23]–[25] and resistance to change [26] complicate the acceptance scores of LMS. These issues emphasize the need to assess LMS for successful implementation and utilization.

Moodle and Google Classroom are two of the most widely assessed LMS based on TAM [27], [28]. However, studies focused their TAM assessments on either one of these platforms or compared either one against another popular LMS. A study by García-Murillo *et al.* [29] assessed Moodle based on TAM according to professors' perceptions. The studies of [30], [31] assessed Google Classroom based on TAM according to student perspectives. In comparison with another LMS, the study of Francom *et al.* [32] compared the acceptability of Google Classroom against Brightspace LMS.

Comparing the acceptance scores of Moodle and Google Classroom is crucial to understanding their strengths and weaknesses. Although a comparative study by Sharip *et al.* [33] on usability indicated that Google Classroom has a higher usability score than other LMSs, and the study of Gumasing *et al.* [34] resulted in no significant difference in usability, the literature may lack comparative studies of Google Classroom against Moodle regarding acceptability. Moreover, studies by [35], [36] compared the 2 LMSs using qualitative and quantitative methods but not using a technology acceptance framework like TAM. Despite these LMS platforms' popularity and widespread use, comparative studies on acceptance based on student perspectives may still be lacking. These are the identified gaps this study intends to fill, thereby contributing to the literature.

With research gaps to fill, this study assessed Moodle and Google Classroom by comparing their acceptance scores on student perspectives based on TAM. The results of the comparative research can generate insights for educational institutions on which LMS to implement based on current settings. Moreover, the results can become a data-driven decision for institutions already using Moodle or Google Classroom to enhance and improve their course design and implementation. Furthermore, developers of these LMS platforms can use the results to enhance further or add more features relevant to PU, PEOU, and overall acceptability.

2. METHOD

The study used a quantitative comparative research design based on the TAM framework. It aimed to determine if a statistically significant difference exists in students' Moodle and Google Classroom acceptance scores. 40 Students from the City College of Davao (CCD), a Local Government Unit (LGU) sanctioned institution in the Davao Region, Philippines, were selected as participants through convenience sampling. The participants only include the 1st and 2nd year students since CCD has been operating for two years thus far. CCD is currently planning an official LMS implementation.

Using the LMS and student-tailored TAM questionnaires in Table 1 and Table 2, the acceptance scores of the two LMSs were determined based on overall acceptance, PU, and PEOU. The TAM questionnaires are measured by a 7-Likert scale wherein a score of 1 stands for strongly disagree and 7 stands for strongly agree. The TAM questionnaires, which have a Cronbach's alpha value range of 0.70 to 0.91 [37], [38], were administered via Google Forms to 2 groups of students from the 40 volunteering students. One group assessed Moodle, and the other assessed Google Classroom. The form included promotional video presentations and demos showcasing the features of Moodle and Google Classroom before letting the participants answer the TAM questionnaires.

Table 1. The TAM questionnaire administered to the participants for PU

PU indicator	Strongly disagree						Strongly agree
Using Moodle/Google Classroom in my academics enables me to accomplish tasks more quickly.	1	2	3	4	5	6	7
Using Moodle/Google Classroom would improve my academic performance.	1	2	3	4	5	6	7
Using Moodle/Google Classroom in my academics would increase my productivity.	1	2	3	4	5	6	7
Using Moodle/Google Classroom would enhance my academic effectiveness.	1	2	3	4	5	6	7
Using Moodle/Google Classroom would make it easier for me to do my academics.	1	2	3	4	5	6	7
I would find Moodle/Google Classroom useful in my academics.	1	2	3	4	5	6	7

Table 2. The TAM questionnaire administered to the participants for PEOU

PEOU indicator	Strongly disagree						Strongly agree
Learning to operate Moodle/Google Classroom would be easy for me.	1	2	3	4	5	6	7
I would find it easy to get Moodle/Google Classroom to do what I want it to do.	1	2	3	4	5	6	7
My interaction with Moodle/Google Classroom would be clear and understandable.	1	2	3	4	5	6	7
I would find Moodle/Google Classroom to be flexible to interact with.	1	2	3	4	5	6	7
It would be easy for me to become skillful at using Moodle/Google Classroom.	1	2	3	4	5	6	7
I would find Moodle/Google Classroom easy to use.	1	2	3	4	5	6	7

Each participant's acceptance score was calculated by averaging the scores for all indicators in the questionnaire for PU and PEOU, as shown in (1) and (2), respectively. As shown in (3) and (4), the acceptance scores for PU and PEOU, respectively, were calculated by averaging each participant's score. The overall acceptance scores were calculated by adding both acceptance scores of PU and PEOU with equal weights of 50% each, as shown in (5). Interpretations of the acceptance scores were categorized as high acceptance (5-7), moderate acceptance (3-4.9), and low acceptance (1-2.9). The study aimed to determine if the difference between these scores is significant enough to determine whether one LMS has a better acceptance score than another, thereby informing and contributing to the literature a comparative study on Moodle and Google Classroom acceptability.

$$PU_{(participant\ score)}=\frac{\sum PU\ indicator\ scores}{Number\ of\ PU\ indicators} \quad (1)$$

$$PEOU_{(participant\ score)}=\frac{\sum PEOU\ indicator\ scores}{Number\ of\ PEOU\ indicators} \quad (2)$$

$$PU_{(acceptance\ score)}=\frac{\sum PU\ participant\ scores}{Number\ of\ PU\ participants} \quad (3)$$

$$PEOU_{(acceptance\ score)}=\frac{\sum PEOU\ participant\ scores}{Number\ of\ PEOU\ participants} \quad (4)$$

$$Overall\ _{(acceptance\ score)}=(PU_{(acceptance\ score)}\times 0.5)+(PEOU_{(acceptance\ score)}\times 0.5) \quad (5)$$

Table 3 shows the characteristics of students who responded to the questionnaire voluntarily. The 40 students from CCD were randomly divided into 2 to assess Moodle and Google Classroom, respectively. Students who assessed Moodle comprised 10 males and 10 females, while those who assessed Google Classroom comprised 1 male and 19 females. Regarding discipline, 18 students who assessed Moodle are taking a science, technology, engineering, and mathematics (STEM) degree program, while only 2 are taking non-STEM. All students who assessed Google Classroom are taking non-STEM degree programs. For the year level, 5 1st-year and 15 2nd-year students assessed Moodle, while 9 1st-year and 11 2nd-year students assessed Google Classroom.

Table 3. The characteristics of students as participants of the study

Demographic	Moodle participants	Google Classroom participants
Gender		
- Male	10	1
- Female	10	19
Discipline		
- STEM	18	0
- Non-STEM	2	20
Year Level		
- 1st Year	5	9
- 2nd Year	15	11

A normality test using the Shapiro-Wilk test and a homogeneity test using Levene's test were used to determine which statistical tool was appropriate: a parametric or non-parametric test. The appropriate statistical tool, an independent t-test, was used to compare the acceptance scores of the two LMSs. The overall acceptance scores and each TAM construct (PU and PEOU) were compared to determine if there were significant differences. Microsoft Excel and the R programming language and its relevant libraries are the software tools used throughout the computational and analysis stages of the study.

3. RESULTS AND DISCUSSION

The study compared the acceptance scores of Moodle and Google Classroom to determine if there is a significant difference in acceptability based on the TAM framework. This section discusses the study's results following the methods discussed in the previous section. This section is divided into 3 sub-sections: acceptance scores of Moodle and Google Classroom, normality and homogeneity tests, and comparative analysis. These subsections are necessary to showcase how the study contributed to the lack of comparative studies on Moodle and Google Classroom acceptability.

3.1. Acceptance scores of Moodle and Google Classroom

The combined data collected from the Moodle and Google Classroom surveys for PU and PEOU from the 40 participants is shown in Table 4. A Microsoft Excel file was generated from Google Forms, and data was manipulated to calculate the acceptance scores. The acceptance scores were calculated accordingly, following the equations and interpretation in the method section.

Table 4. Combined data collected from the surveys of Moodle and Google Classroom for PU and PEOU

Participant	PU Scores												PEOU Scores											
	Moodle						Google Classroom						Moodle						Google Classroom					
	I1	I2	I3	I4	I5	I6	I1	I2	I3	I4	I5	I6	I1	I2	I3	I4	I5	I6	I1	I2	I3	I4	I5	I6
Participants 01-02	7	7	7	7	7	7	7	6	6	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Participants 03-04	5	4	7	6	7	7	5	4	5	5	6	6	5	5	5	5	5	6	6	5	4	4	4	5
Participants 05-06	4	4	4	4	4	4	6	6	6	5	6	4	4	4	4	4	4	4	4	5	4	7	7	7
Participants 07-08	6	6	6	6	5	6	3	1	1	1	1	3	5	6	5	5	5	5	6	6	3	4	4	4
Participants 09-10	6	7	6	6	7	7	5	4	5	4	3	1	7	7	6	6	6	7	4	2	5	4	3	4
Participants 11-12	3	3	4	4	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Participants 13-14	7	5	5	6	7	7	4	4	4	4	4	4	6	5	5	6	6	5	4	4	4	4	4	4
Participants 15-16	6	6	5	6	6	5	5	5	7	5	5	5	6	6	5	6	5	5	7	7	7	5	6	6
Participants 17-18	7	7	7	7	7	7	4	4	4	5	4	4	7	7	7	7	7	7	4	4	4	4	4	4
Participants 19-20	6	6	6	6	6	6	6	5	5	5	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Participants 21-22	4	4	4	4	4	5	7	6	6	6	6	7	3	4	3	4	3	4	7	6	6	7	6	6
Participants 23-24	6	6	6	6	6	6	5	4	5	4	4	6	6	6	6	6	6	6	7	6	4	6	6	6
Participants 25-26	4	4	4	4	4	5	4	3	3	4	6	6	3	4	5	5	4	4	6	6	4	4	6	6
Participants 27-28	4	4	4	4	4	4	4	6	6	6	6	6	3	4	3	4	3	5	7	6	7	6	6	7
Participants 29-30	6	6	6	6	6	5	6	5	5	5	5	6	6	4	5	3	6	6	5	5	6	6	5	5
Participants 31-32	5	6	7	5	4	6	7	6	6	5	6	6	6	5	5	7	7	5	5	5	6	5	5	6
Participants 33-34	4	3	4	4	5	6	3	3	3	3	3	3	6	6	4	4	5	7	7	2	7	3	2	7
Participants 35-36	5	4	3	5	6	6	6	6	6	6	6	6	5	5	4	4	4	5	6	6	6	6	6	6
Participants 37-38	4	4	3	3	3	3	7	5	6	6	7	7	7	3	3	6	6	5	7	7	7	7	7	7
Participants 39-40	4	4	4	4	5	4	6	6	6	5	6	6	4	4	4	4	4	4	6	6	6	6	6	6

The Moodle and Google Classroom acceptance scores for PU, PEOU, and overall acceptance are shown in Table 5. Moodle has an overall acceptance score of 5.17, while Google Classroom has a slight edge with 5.18. Both have high acceptance scores, indicating that the participants have strong positive perceptions and are likely to adopt the LMSs. For PU, Moodle edges Google Classroom with 5.20, a high acceptance score,

against 4.96, a moderate acceptance score. This indicates that the participants believe Moodle can enhance their academic productivity, efficiency, and effectiveness more than Google Classroom. These findings conform to the study of Badidles [25], in which students' writing skills are enhanced more with Moodle. Additionally, according to Bojiah [39], Moodle can improve teaching and learning in education, further conforming to Moodle's capability to enhance overall academic effectiveness. For PEOU, Moodle trails with 5.14, while Google Classroom got 5.41. While both have high acceptance scores, the acceptance scores indicate that Google Classroom is easier to use than Moodle. Although not assessing acceptability, the PEOU findings conform to the study of Myška and Samková [40], indicating that Google Classroom is more user-friendly than Moodle. The determination of the acceptance scores is limited to the 40 participants from CCD. Further research may consider adding more participants with diverse demographics.

Table 5. Acceptance scores and interpretation of Moodle and Google Classroom based on TAM

Component	Moodle	Interpretation	Google Classroom	Interpretation
Overall	5.17	High acceptance	5.18	High acceptance
PU	5.20	High acceptance	4.96	Moderate acceptance
PEOU	5.14	High acceptance	5.41	High acceptance

3.2. Normality and homogeneity tests

Using the Shapiro-Wilk test, a test for normality was performed to determine whether a parametric or non-parametric statistical tool [41] would be used for the comparative analysis. Table 6 shows the normality test results with a significance level alpha set at 0.05. Both the overall acceptance scores of Moodle and Google Classroom are normally distributed with p-values of 0.097 and 0.302, respectively. Moreover, p-values of 0.105 and 0.146 for Moodle and Google Classroom in terms of PU, respectively, indicated the normal distribution of the scores. Furthermore, in the case of PEOU, the scores are normally distributed with p-values of 0.44 and 0.277 for Moodle and Google Classroom, respectively. The results of this test indicated the use of a parametric test for the comparative analysis. The Shapiro-Wilk test calculation result was generated using the R programming language through the stats library. The Shapiro-Wilk test was used because it effectively determines the normality of the data distribution, particularly for small to moderate sample sizes.

Using Levene's test, a homogeneity test was performed using the R programming language through the car library to validate further if a parametric test is appropriate by checking if the variances of the parameters are approximately equal [42]. Table 7 shows the result of Levene's test, where the significance level alpha was set at 0.05. The overall acceptance, PU, and PEOU variance comparisons are all approximately equal, with p-values of 0.95, 0.86, and 0.93, respectively. These tests further validated the need for a parametric test for the comparative analysis, particularly a t-test.

Table 6. Normality test results of the acceptance scores using Shapiro-Wilk at 0.05 alpha

Component	Test statistic W		p-value		Remarks	
	Moodle	Google Classroom	Moodle	Google Classroom	Moodle	Google Classroom
Overall	0.92	0.95	0.097	0.302	Normally distributed	Normally distributed
PU	0.92	0.93	0.105	0.146	Normally distributed	Normally distributed
PEOU	0.95	0.94	0.44	0.277	Normally distributed	Normally distributed

Table 7. Homogeneity test results of the acceptance scores using Levene's test at 0.05 alpha

Component	Test statistic F	p-value	Remarks
Overall	0.0036	0.952	Approximately equal in variance
PU	0.0297	0.864	Approximately equal in variance
PEOU	0.0087	0.926	Approximately equal in variance

3.3. Comparative analysis

Due to the normal distribution and homogeneity of all data sets, the study conducted the comparative analysis using the independent t-test, a parametric test [43], [44]. Using the R programming Language through the stats library, an independent t-test was used because the participants who assessed Moodle and Google Classroom were unique individuals. With a significance level alpha at 0.05, the results of the comparative analysis are shown in Table 8. A null hypothesis was formulated that no significant difference exists between the acceptance scores of Moodle and Google Classroom. Test results showed that the overall acceptance level, the PU, and the PEOU failed to reject the null hypothesis with p-values of 0.486, 0.266, and 0.212, respectively.

This means that user acceptance of Moodle and Google Classroom is not significantly different, indicating that CCD can choose either as its official LMS.

Table 8. Results of the comparative analysis using independent t-test at 0.05 alpha

Component	Test-statistic t	p-value	Remarks
Overall	-0.035	0.486	Failed to reject the null hypothesis
PU	0.63	0.266	Failed to reject the null hypothesis
PEOU	-0.807	0.212	Failed to reject the null hypothesis

The study's findings complement the study's results of Sharip *et al.* [33], where Google Classroom was found to have no significant difference in usability using the system usability scale (SUS) compared to other LMS, but not including Moodle. In contrast to the study's findings, the study of Bonang *et al.* [45] showed differences across multiple parameters. However, the study was not based on TAM but on satisfaction scores. In the context of acceptability, the study's findings can be valuable insight for CCD to consider implementing either of the 2 LMSs.

4. CONCLUSION

The study compared the acceptance scores of Moodle and Google Classroom based on overall acceptance, PU, and PEOU. Moodle got high acceptance scores for the overall acceptance, PU, and PEOU with values of 5.17, 5.20, and 5.14, respectively. Google Classroom got high overall acceptance and PEOU scores of 5.18 and 5.41, respectively, but got a moderate acceptance score on PU with 4.96. According to participants, Google Classroom's moderate acceptance score on PU indicates that Moodle is perceived as more useful. However, according to participants, Google Classroom is perceived as easier to use than Moodle. In overall acceptance, Google Classroom had a slight advantage over Moodle. Based on these scores, the study used a quantitative comparative approach to determine if the difference between the acceptance scores is significant.

The study used an independent t-test to compare the 2 LMSs due to the normality and homogeneity nature of the data sets. With 40 student participants from CCD, the study determined no significant difference between the acceptance scores of Moodle and Google Classroom despite having differences in the mean values of overall acceptance, PU, and PEOU. The study highlights the non-comparable acceptability of both LMSs in educational settings, indicating that both LMSs can be a good platform for implementation.

Future research, however, should broaden the scope of the study to include more participants with diverse characteristics and with identification of first-time users of the LMSs. A study may also consider participant's prior knowledge and familiarity with either LMS as an inclusion criteria for participation. Another study that can be considered is an experimental study where all participants assess both LMS. Moreover, future research can also include students from other universities as participants. Studies may also consider a comparative study applying TAM as perceived by instructors and administrators. Furthermore, including TAM2 and TAM3 is strongly recommended for future studies.

Nevertheless, the study findings can be valuable to CCD in considering either Moodle or Google Classroom for their official LMS implementation. Other institutions may use the study's findings in their settings and the methods in this study to compare other LMSs of their choice. Researchers can use the recommendations of this study to enrich the TAM and LMS research domains. Overall, the study contributes to the growing literature on technology acceptance and online learning using LMSs.

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