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Integration of Learning Management System as an Aid in Teaching: An Assessment

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Abstract: The research delved into the assessment of integrating Learning Management System as an aid in teaching. Data were collected from 26 students at Rizal Technological University-College of Education, Philippines, through pretest-posttest quasi-experimental and normative survey design of research. Data were statistically tested using the frequency, percentage, mean, standard deviation, t-test for dependent and independent samples, and paired t-test. Results of the research indicate that the respondents have optimistic attitudes towards the integration of learning management system in teaching. The respondents performed poorly in the pretest examination but performed very satisfactorily in the posttest examination. Furthermore, the research found out that there is no significant difference between the performances of the experimental group and control group in pretest and posttest, moreover, there is a significant difference between the pretest and posttest scores of the experimental group and the pretest and posttest scores of the control group.

Keywords: *Educational technology, higher education, learning management system, teacher education.*

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Introduction

Technology has an impact on education, just as it does on other aspects of society. In recent times, there seems to be an increased use of technology-based learning systems in education. For the past few years, experts, particularly those interested in developing modern methods of teaching, have been researching ways to improve the teaching-learning process. According to Pishva et al. (2010), teaching has changed primarily for the reason that there was speedy development of technology in the past decades. Using of traditional classroom methods in delivering lessons has changed dramatically over time, owing to the utilization of modern technologies in the classroom (Bottino & Robotti, 2007).

Nowadays, learning environments, particularly those that are considered communal, facilitate educational interactions among students and teachers, including group collaboration and easy sharing of documents and performance results (Thongmak, 2013). This learning environment is possible in today's situation because social websites provide numerous learning platforms such as profile pages, emails, and online communications (Rigby, 2008). Technology such as Learning Management System (LMS) is one of the components of the technological evolution aimed at altering the landscape of educational instruction. Learning Management Systems (LMS) are websites with online technologies that are used for the establishment, administration, and provision of course materials for learning (Turnbull et al., 2019). Sarfo and Yidana (2016) added that an LMS is one of the strategies that might be used in e-learning. An LMS is a program used in the classroom that allows students to respond to, share, and answer questions online (Buckner & Kim, 2014). Furthermore, Govender and Govender (2012) defined LMS as a software platform that enables and promotes efficient management, delivery, and interaction between teachers and students. As per Heirdsfield (2011), with the features of LMS, it is expected that LMS will be at the forefront of most colleges and universities' e-learning system initiatives. Furthermore, Kulshrestha and Kant (2013) argued in essence that LMS utilization may be beneficial to students due to their modern learning styles.

Learning management system therefore as defined by different works of literature is about technology, websites, e-learning strategies, software, a platform, and an e-learning initiative. In the academic institution, LMS establishes an

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inclusive environment for learning that upholds collaboration, training for professionals and LMS users' communication (Jung & Huh, 2019). These institutions believed that LMS when integrated in learning and teaching supports student learning and self-management (Al-Fraihat et al., 2020). Kehrwald and Parker, (2019), stated that LMS gives teachers flexibility as LMS provides media and communication tools. However, to use LMS good ICT literacy is needed (Kimmons et al., 2019). Literacy in information and communications technology is needed as teachers using LMS must convey lessons effectively to learners using computer and the internet and they must sustain learners' intrinsic motivational factors and performance feedback (Shukla & Verma, 2019).

LMS is an avenue for asynchronous learning that includes video and audio presentations and emails (Alzahrani, 2019). Educational practitioners are driven to use online asynchronous learning because they can use varied tools for communications and other support tools for learning found on the internet (Quinn & Gray, 2020). In addition, asynchronous learning will enable students to balance obligations and assignments (Alzahrani, 2019). The use of online asynchronous tool in learning such as LMS positively affects both students and teachers, it makes learning more organized, more engaging, autonomous, convenient and it allows instantaneous feedback (Alenezi, 2018; Anshari et al., 2017). LMS also supports forums, peer interactions, tracking of student works and student registrations (Ghilay, 2017; Mwalumbwe & Mtebe, 2017).

However, there are still universities, colleges, and schools that do not incorporate technology into their educational instructional processes. This research sought to examine the integration of a learning management system as a teaching aid and to determine whether this system can provide students with a dynamic form of learning platform in which they can interact with or collaborate with their classmates and teachers without the usual face-to-face classroom setup. NEO-LMS was used in this study. We used NEO-LMS because it features manageable characteristics for a learning management system. It supports easy management of classroom activities, creation and delivery of educational content, assessment of students' performance, tracking of learners' achievement, promoting cooperation and communication among teachers and students, and it is readily available on the internet. It is one of the most widely used LMS applications. It is from Cypher Learning, which describes and defines NEO- LMS as a cloud-based learning management system designed specifically for colleges, universities, and other educational institutions, with tools for great learning and teaching experience. Since its inception in 2007, the company has provided e-learning solutions to thousands of businesses. NEO LMS was used by many schools all over the world, from the United States of America to the Philippines. The platform is completely responsive and designed as a minimalist LMS that can be used on all devices, including desktops, laptops, and smartphones, and it has a variety of functionalities. NEO LMS is a widely used LMS that is also used in the Philippines. The University of the Philippines (UP) was one of the most successful users of the aforementioned LMS in their Open University (OU). This implementation triggered an Integrated Virtual Learning Environment platform, which is used to provide students with course materials, permitting suppleness for both the learners and instructors (Librero, 2004). Furthermore, the program prompted and encouraged other academic institutions to incorporate LMS into their course offerings (Lim et al., 2007).

Literature Review

Teaching in the Traditional way

Prior to the proliferation of modern-day teaching scenarios that are technology-based, students learned through the strict guidance of teachers. The school environment was entirely focused on the teacher. According to Nazzal (2014), the traditional method of teaching is defined by a teacher-centered classroom, where they tend to be the dispensers of information as opposed to being enablers, where they are used to question and answer strategies, where there is authoritarianism in the classroom, where there is a lack of collaborative learning, and where there is a greater emphasis on exams rather than conceptual learning as well as a misalignment of objectives, activities, assessments, and evaluations. These scenarios employ traditional approaches, such as the lecture method (Murphy et al., 2011). When practiced, the traditional approach to teaching manifests itself by the teacher as a supervisor of the teaching activity, providing systematic knowledge, sharing academic convictions that are speculative of philosophy, emotionally driven, and beneficial to the development of the students' Intelligence Quotient and Emotional Quotient (Chunyang & Long, 2014). However, as education has evolved, new methods have been developed to accommodate modern learners. These methods, however, continue to be consistent with popular teaching theories and principles. Newly adopted methodologies are often drawn after the philosophy of constructivism, such as Piaget's reasoning, and Vygotsky and Von-Glaserfield constructivist ideas. Conventional schooling techniques do not align with the constructivist view of teaching; hence, several innovative approaches in teaching were developed (Abdulwahed et al., 2012).

Technology Integration in Teaching

Technology integration in education has been revolutionary in recent decades. Cuban et al., (2001) and Hew and Brush (2007), stated that educational technology encapsulates the terms "teacher" and "computer." Technology integration refers to the use of technology while teachers perform routine tasks to increase productivity (Hennessy et al., 2005). Lim et al. (2007), argued that utilizing technological advancement in teaching happens when teachers use technology to help students develop their thinking skills. Technology integration also assists students in developing information technology skills (Oliver et al., 2012).

Technologies in education are thought to cause a paradigm shift in learning practices, including increased learner interest, resulting in better learning experiences (Karasavvidis & Kollias, 2014). As a result, educational institutions have provided substantial support and investment in educational technology over the last decade (Bebell et al., 2004). Higher education and other academic institutions' support for modern integration of technology in the educational setting is based on the realization that technologies in education can support innovative teaching and the development of better assessment processes (Fernández-Ferrer & Cano, 2016). According to Drent and Meelissen (2008), learning technologies can assist students in conducting research, collaborating, and problem-solving. Teachers who have participated in professional development focusing on technology integration in learning have improved their teaching methods (Faizal & Jamil, 2014).

Learning Management System in Teaching

Online courses have grown in popularity over the last ten years as an alternative method of delivering class content (Falvo & Johnson, 2007). For the past 15 years, technology and learning management systems have undergone a rapid transformation. Learning management systems (LMS) were first introduced in the 1990s. Learning management systems paved the way for a greater emphasis on students' learning needs (Craig, 2007). LMS implementation should begin with teachers or instructors accepting the technology (Al-Busaidi and Al-Shihi, 2010). As per Waycott, et al. (2010), personnel in higher education institutions perceived that using technology has several benefits such as better correspondence, lecture facilitation efficiency, better contact to data, entry to resources, and persistent learner engagement. Unfortunately, Venkatesh et al., (2003) identified several challenges in the use of technology in classrooms, including increased personnel, technical expertise, and technological advances and ethical standards. Although there have been some concerns raised regarding the utilization of technology in the schoolroom, instructors must remember that they are a crucial component to the learning experiences of their learners. Although some teachers or instructors may view learning management systems passively, the majority expressed an interest in using LMS (Wagner et al., 2008). According to Vord and Pogue (2012)'s research, while face-to-face classroom setup takes more time, some aspects of LMS may also take more time. The value of an LMS on the learning and teaching processes varies because it is determined through student-to student and teacher-to teacher evaluation (Lonn et al., 2011).

Many professors began to use the learning management system (LMS) platform along with video conferencing to aid in mathematics learning activities after higher education institutions implemented the learning policy at home because of the pandemic (Gunawan et al., 2020). Google Classroom, Edmodo, eLearning portals for each academic institution, and others are among the most extensively used LMS platforms while zoom, Webex, Google Meet, Microsoft Teams, and more video conferencing tools are available (Sulisworo et al., 2020). COVID-19 research related to education has begun since the outbreak of the COVID-19 pandemic in the world (Rahimi & Abadi, 2020). In a pandemic, online learning is an alternate approach, and it is very practical, and it could be used anywhere at any moment (Taha et al., 2020). There is a belief that LMS has the ability to increase access, lower costs, and improve educational standards, allowing institutions to accommodate learners (Bervell & Umar, 2017). The adoption of LMS by institutions of higher education has begun to increase, because of the benefits of LMS (Bervell & Umar, 2017).

Theoretical Framework

Theoretically, this research is founded on three fundamental theories: Jean Piaget's Constructivism Theory, Siemens' Theory of Connectivism, and Engestrom Activity Theory. According to Jean Piaget's constructivism theory, a child who conducts activities as his experiments can form active connections and integrate his experiences into his daily life (Piaget, 1971). Some would say that the theory of constructivism is not related to using technology in teaching however Forster and Washington (2000) concur that technology plays a key role in making constructivist approaches more accessible hence, constructivism and technology are both concerned with creating interesting and interactive learning situations. Lunenberg (1998) contends that constructivism and the inclusion of information technology into the curriculum have the potential to significantly improve all students' performance in key areas of study. According to Mayer (2004), constructivism and computer technology, associated tactics, and teaching methodologies have a complementary and reciprocal relationship. Constructivist proponents often try to illustrate links between constructivist teaching/learning methodologies and educational technology in the classroom as these two can create a better and more dynamic learning environment because of the technology's richness and the theory's student-centered nature (Duffy & Cunningham, 1996). Teachers must use technology to connect students' learning and their daily lives, as technology provides learners with the flexibility to adapt to a variety of scenarios, and technology can be used in a variety of pedagogical approaches (Ford & Lott, 2011).

The Connectivism theory of Siemens that was founded in 2005, on the other hand, contends that learning begins when knowledge is activated, and learners connect and feed information into a learning community (Siemens, 2005). In 2005, Siemens claims that his theory is a digital age theory, stating that technology can form a community with shared interests. This community is a gathering place for students to interact, share, dialogue, and think together. Knowledge is dispersed over information networks and can be preserved in several digital formats, according to connectivism theory, which contextualizes the importance of human-computer interaction (Siemens, 2005). This holds true in integrating LMS in teaching, as it needs a variety of digital space to work and at the same time there must be an interaction between the user and the computer. Engestrom's (2008) Activity Theory also contextualizes the interaction between humans and computers by recognizing a mediator, which could be tools, rules, or other computer-related endeavours. The use of LMS in conjunction with this theory makes use of a mediation system to connect learners and computers. To fully utilize the LMS, you must have access to the internet.

Research Questions

The objectives of this study were to (1) obtain the perspectives of the student respondents on the integration of LMS in teaching Analytic Geometry and (2) assess and understand the efficacy of integrating learning management system (LMS) as a teaching aid in Analytic Geometry.

This study specifically sought to answer the following research questions:

1. How do the respondents feel about the incorporation of a learning management system as an aid in teaching Analytic Geometry?

2. How did the respondents fare on the pretest and posttest in Analytic Geometry?

3. Is the experimental group's mean pretest score in Analytic Geometry significantly higher than the control group?

4. Is the experimental group's mean posttest score in Analytic Geometry significantly higher than the control group?

5. Is the mean posttest scores of the respondents significantly higher than their mean pretest scores for both the experimental and control groups in Analytic Geometry?

Research Hypotheses

The research has the following hypotheses:

1. The student respondents shall have positive outlook towards the incorporation of a learning management system as an aid in teaching Analytic Geometry.

2. The respondents will perform better on posttest in Analytic Geometry.

3. The mean score of the experimental group on pretest in Analytic Geometry is not significantly higher than the control group.

4. The mean score of the experimental group on posttest in Analytic Geometry is not significantly higher than the control group.

5. The mean score of the respondents on posttest in Analytic Geometry is not significantly higher than the pretest of the respondents.

Methodology

The quantitative approach was used in this study, specifically quasi-experimental research with a pre-test – post-test design of two groups; this design was used to determine the effectiveness of the NEO-LMS as a teaching aid in Analytic Geometry. The descriptive method of research was also used in this study, specifically the normative survey design, which was used to poll respondents about their impressions of the NEO-LMS.

Participants: Control and Experimental Group

The third-year level students at Rizal Technological University-College of Education (Philippines) Major in Mathematics who were currently enrolled in Math108: Analytic Geometry during the academic year 2018 – 2019 were used as the experimental and control group of this study. From the pre-test to the post-test, a total of 26 respondents were chosen over the course of two months. The participants were split into two groups: experimental (G1) and control (G2). This means that each group had 13 students in it. The pre-test was taken by both groups. Then, prior to the post-test examination, both groups received an intervention. Both the experimental and control groups were taught using the traditional method of instruction in a typical classroom. The experimental group, however, was introduced to NEO-LMS, which was used to reinforce learning and as an additional tool for teaching this group. Furthermore, the researchers oversaw the teaching-learning process in both the traditional classroom and the e-learning interface. The participants evaluated their attitudes toward the integration of LMS in teaching in the final phase of the study.

Research Instrument

The research instrument was divided into two parts: the first part was made to assess the students' performance and the second part was made to determine the students' attitudes toward the use of the LMS in teaching Analytic Geometry. In this study, a teacher-created test with 50 multiple-choice items was used for the pre-test and post-test to assess the students' performance. It covered all of the lessons over the course of the research. The test was created using meticulous testing procedures. First, a table of specifications was created to identify the various competencies to be tested. The experts also checked and validated the test questionnaire. The Kuder-Richardson 21 (KR21) was used to know the reliability of the test. After several modifications, the test was finalized with a computed KR 21 of 0.61 which means that the items of the test were reasonable or reliable. To establish its validity, it was then pilot tested with students who were not participating in the study. The content validity index (CVI) was then calculated and found to be 0.97, indicating that the test had a high level of content validity. The polished test was then used to evaluate the performance of the students in this study.

The researchers prepared questions to ascertain the respondents' appraisal of the use of the learning management system to examine the attitudes of the experimental group about the integration of LMS as a teaching aid. Expert judgment, as well as pilot testing or a dry run, are all part of the instrument validation process. A draft of the instrument was shown to the experts. Following that, comments and suggestions were integrated into the final draft of the instrument. A dry run was carried out with 15 students who were not involved in the study. The Cronbach Alpha computation was performed on the survey instrument, and the benchmark statements were found to be acceptable, with a computed value ranging from 0.7 to 0.8.

Data Analysis

As the distribution of the data is normal, the frequency distribution, percentage formula, mean, standard deviation, t-test for dependent and independent samples and paired t-test were used to analyze the data of the study. Statistical Package for the Social Sciences (SPSS) was used to compute all the needed statistical treatment.

Results

This section includes a discussion of the research findings as presented in tabular form, analyzed, and interpreted in accordance with the order of the research questions.

Respondents' attitude towards the integration of a learning management system as an aid in teaching.

Table 1. Respondents' Attitude Towards the Integration of a learning Management System as an Aid in Teaching

Attitudes	Mean	Interpretation	Rank
LMS is beneficial for my learning.	4.15	Agree	7
LMS has the potential for group work and offers rapid communication.	3.74	Agree	12
LMS can assist me in looking for my study resources.	4.56	Strongly Agree	4
LMS can open many opportunities to develop the learning process.	4.35	Agree	5
The LMS can be utilized to acquire study materials at any time and from any location.	4.70	Strongly Agree	1
The Learning Management System (LMS) is a simple and easy way to acquire instructions from the professor.	4.32	Agree	6
A learning management system (LMS) is a useful way to share study materials with peers.	3.89	Agree	11
LMS had aided me in efficiently managing my learning.	3.73	Agree	13
LMS had the capability of completing homework and classwork at home.	4.64	Strongly Agree	2
LMS can help me improve my learning abilities.	4.13	Agree	8
LMS is a great way for me to interact with my teachers and peers.	4.01	Agree	10
Feedback from students and teachers is useful in the LMS.	4.11	Agree	9
I will recommend using LMS applications for learning other subjects.	4.62	Strongly Agree	3
Overall	**4.25**	**Agree**	

Legend: 1.00 – 1.49 =Strongly Disagree, 1.50 – 2.49 = Disagree, 2.50 – 3.49 = Neutral, 3.50 – 4.49 = Agree, 4.50 – 5.00 = Strongly Agree

Table 1 shows that the respondents' attitudes toward the integration of the learning management system in teaching Analytic Geometry are positive, with an overall mean of 4.25, which is interpreted as "agree". It is also worth noting that the respondents agreed most strongly that an LMS is an important tool for easily accessing their lectures or materials. However, respondents perceived that LMS has less potential for group work, communication, and material sharing with their classmates because it has the lowest mean value of 3.73 and 3.74, respectively, even though both are interpreted as "agree".

The average level of performance of the respondents in pretest and posttest in Mathematics.

Table 2. Distribution of the Respondents According to their Performance in Pretest in Mathematics

	Experimental Group		Control Group (With Aid of LMS)	
SCORES	**F**	**%**	**F**	**%**
11 – 13	4	31 %	4	31 %
14 – 16	3	23 %	5	38 %
17 – 19	3	23 %	2	15 %
20 – 22	3	23 %	1	8 %
23 – 25	0	23 %	1	8 %
TOTAL	**13**	**100 %**	**13**	**100 %**
	Mean = 16.23	SD = 3.79	Mean = 15.46	SD = 3.60

Table 2 demonstrates that the experimental group's mean score of 16.23 is marginally higher than the control group's mean score of 15.46. However, the standard deviation of the control group of 3.60 is smaller than that of the experimental group which is 3.79. Despite outperforming the control group on the pretest, the experimental group's scores are more spread than the control group.

Table 3. Distribution of the Respondents According to their Performance in Posttest in Mathematics

	Experimental Group		Control Group (With Aid of LMS)	
SCORE	**F**	**%**	**f**	**%**
28 and below	1	8%	2	15%
29 – 31	1	8%	0	0%
32 – 34	0	0%	1	8%
35 – 37	1	8%	2	15%
38 – 40	6	45%	8	62%
41 and above	4	31%	0	0%
TOTAL	**13**	**100 %**	**13**	**100 %**
	Mean = 37.92	SD = 4.52	Mean = 36.31	SD = 5.15

Table 3 indicates that the experimental group's mean score of 37.92 is greater than that of the control group which is 36.31. Moreover, the standard deviation of the experimental group of 4.52 is smaller than that of the control group with 5.15. This basically means that the experimental group did better on average than the control group.

Significance of the performances of the experimental and control groups in the pretest.

Table 4. Difference Between the Performances of the Respondents in Pretest

$T_{\text{-Comp}}$	$T_{\text{-Crit}}$ p	Decision	Interpretation
0.53	±1.96 0.961	Failed to reject H_0	Not Significant

Legend: If tcomp > tcrit with 0.05 level of significance at two-tailed test, then the null hypothesis is not rejected.

No significant difference was found between the pretest in Analytic Geometry of both experimental and control group as shown in Table 4. This result is based at 0.05 level of significance with a t-value of 0.53. The t-value of 0.53 is less than the critical value of 1.96 which supports the claim that no significant difference exists between the pretest in Analytic Geometry of the experimental and control groups.

Significance of the performances of the experimental and control groups in the posttest.

Table 5. Difference Between the Performances of the Respondents in Posttest

t_{comp}	t_{crit} p	Decision	Interpretation
0.85	±1.96 0.964	Failed to reject H_0	Not Significant

Legend: If tcomp <tcrit with 0.05 level of significance at two-tailed test, then the null hypothesis is not rejected.

The experimental and control groups' posttest results in Analytic Geometry also revealed no significant differences as shown in Table 5. This means that even after the experimental group received the intervention, which was the LMS, the two groups performed equally well on the posttest. The significance level for this finding remains at 0.05. The t-value was calculated at 0.85 which is less than the critical value of 1.96.

Significance of the performances in the pretest and posttest scores of experimental and control groups.

Table 6. Difference Between the Performances of the Respondents in Pretest and Posttest

T_{comp}	T_{crit} p	DECISION	INTERPRETATION
17.42	±1.96 0.001	Reject H_0	Significant

Legend: If tcomp > tcrit with 0.05 level of significance at two-tailed test, then the null hypothesis is rejected.

When the experimental and control groups' pretest and posttest results in Analytic Geometry were compared, it was discovered that there was a substantial difference between them. This means that in the posttest, both the experimental group and control group did better. The result is still based on a 0.05 level of significance with a t-value of 17.42. The t-value is higher than the critical value of 1.96 and the effect size was moderate at 0.065.

Discussion

According to the findings of the study, respondents have favourable attitudes toward the use of the NEO LMS or the incorporation of technology in the teaching of mathematics, as shown in Table 1. However, the findings also revealed that students had some difficulty communicating with one another and sharing materials on the platform. This could be because the respondents are accustomed to communicating with one another face to face. Moreover, sharing resources is a bit of a challenge for them because they are used to be supplied with physical lecture materials by the teachers, and these materials are discussed in the classroom. The findings are consistent with previous research on learner attitudes toward educational technology, such as learning management systems (LMS) (Hasan, 2014). According to Hasan (2014)'s research, agreement to use technology in education is an important factor because teachers use technology in education. Furthermore, Zaharias and Poylymenakou (2009) discovered that technology acceptance in education is a common factor that should be taken into consideration in integrating technology in the educational setting. On the other hand, Wu et al. (2009), discovered that educational technology system's content and quality increase learners' developmental objectives to use the system. Technology usage information was also observed to have a significant impact on website usability (Bringula & Basa, 2011). The currency of the content of the technology used in education was also revealed to have a substantial effect on the success of using technology as an aid in teaching (Noorulhasan et al., 2017).

Table 2 shows that the small variation in the pre-test mean score in Analytic Geometry of the experimental and control group is due to the homogeneity of the test subjects. The students came from a single class, so their performance is quite similar to one another. Furthermore, because the test is a pre-test, it is normal for the respondents' overall score to be quite low for a 50-item test. The results, on the other hand, show that the scores of respondents in the control group are more dispersed than those in the experimental group, as shown in Table 3. Nonetheless, because the post-test mean scores are high and the standard deviations are small, both groups performed well in the post-test.

Table 4 indicates that the two groups performed almost identically in the pre-test, as it was found out that no significant differences exist between the pre-test of the experimental and control groups. Because the mean scores of the two groups were lower than the average, both groups performed poorly on the pre-test in Analytic Geometry. This is because the lessons have yet to be discussed in both the traditional and the use of an integrated LMS. Both groups require intensive supervision and lesson implementation. Furthermore, Table 5 implies that the two groups achieved the same level of performance based on the post-test in Analytic Geometry after some interventions were administered, as the result shows that no differences exist between the post-test scores of the experimental and control groups. Because the mean scores of the two groups are higher than the average, both groups performed very well on the post-test. This also implies that regardless of whether an intervention is provided, both groups have a clear understanding of the lesson. Table 5 shows that the use of the traditional method of teaching, as used in the control group, is still on par with methods of teaching that use an intervention or integrated technology, such as an LMS, as used in the experimental group. The outcome, as shown in Table 5, also demonstrates that integrating LMS is not a bad thing at all, because the students who received the intervention still performed very satisfactorily. This means that a teacher can use the traditional method of teaching while also incorporating technology, such as an LMS, to make learning more interesting and enjoyable. The result, as shown in Table 6, indicates that the respondents' post-test scores in Analytic Geometry are significantly higher than their pre-test scores for both the experimental and control groups. This implies that, regardless of the teaching strategy used in both groups, most of the students had attained the required competencies for the topic. Both teaching strategies have a significant impact on respondents' performance in Analytic Geometry.

The study's findings regarding the differences in academic performance between the control and experimental groups are inconsistent with other studies. Baepler et al. (2014) discovered that when technology was used in learning in the experimental group, students performed better academically than individuals in the traditional learning control group. Students learned from technology-assisted instruction, lending credence to the claim that technology integration can aid in the achievement of preferred knowledge outcomes (Boateng et al., 2016). Furthermore, other research findings show that when LMS is used as an aid in discussing lessons with learners, learners have better performance, hence, better knowledge acquisition (Thyagharajan & Nayak, 2007).

In terms of using LMS in teaching mathematics, Magno (2017) found out that when LMS is used in teaching mathematics for grades 10 and 11, the students' performance was significantly higher than those that were given the treatment which was the LMS. The same result was obtained by Ahmed and Mesonovich (2019) in a study they conducted using LMS to students in teaching mathematics, they found out that when LMS was used to students, the students improved their total course grades. The inconsistencies between the results of this study and other studies may be because this study only attempted to determine the effectiveness of the LMS when integrated into teaching rather than using the LMS throughout the course.

Conclusion

After analyzing the collected data, the researchers concluded that: (1) respondents have positive attitudes toward the integration of a learning management system as a tool in the teaching learning process in Analytic Geometry, (2) The respondents performed poorly on the pretest examination in Analytic Geometry but very well on the posttest examination, indicating that the respondents improved their academic performance after the pretest (3) There is no significant difference in the pretest performance between the experimental and control groups in Analytic Geometry, implying that both groups have nearly the same level of knowledge prior to the start of the lessons (4) there is no significant difference in posttest performance between the experimental and control groups in Analytic Geometry, implying that both groups achieved the same level of knowledge because the experimental group's performance is quite close to the control group, and (5) there is a significant difference between the pretest and posttest scores of the experimental group and the control group in Analytic Geometry, which means that the respondents' posttest scores are significantly higher than their pretest scores and that most of the students had attained the required competencies of the topic regardless of the teaching strategy used in both groups, which means that both teaching strategies have a significant impact on respondents' mathematics performance.

Recommendations

Based on the findings of this study, the researchers propose the following: (1) Academic institutions may begin to provide training on how to use a Learning Management System in their institution, as an alternative method of teaching, this is extremely beneficial in the teaching-learning process especially in mathematics, (2) faculty members, teachers, or instructors may not only use traditional methods of teaching mathematics, but they may also use a learning management system to provide the students with the learning activities they require, (3) use of NEO-LMS as a learning management system will be an aid in teaching mathematics because it is very accessible and user-friendly. Furthermore, LMS platform has the potential for group work, rapid communications, and material sharing; and (4) researchers may conduct similar research but from a different perspective, but not limited to using LMS in other mathematics subjects aside from Analytic Geometry.

Limitations

The study was limited to the third-year level students at Rizal Technological University-College of Education (Philippines) with specialization in Mathematics. The subject covered was Math108: Analytic Geometry during the academic year 2018 – 2019. Because there was only one block/class (section) in this level (third year level), the number of respondents listed in the "participants" portion of this study was only limited to all students of the single class (block) during the academic year 2018-2019. These constraints could be used as a starting point for future research.

Authorship Contribution Statement

Garcia: Conceptualization, drafting manuscript, technical or material support, critical revision of manuscript, data interpretation, literature review. Abaratigue: Conceptualization, statistical analysis, data analysis/interpretation, concept and design, data acquisition. Alcantara: Admin, supervision, drafting manuscript, material support.

References

Abdulwahed, M., Jaworski, B., & Crawford, A. (2012). Innovative approaches to teaching mathematics in higher education: a review and critique. *Nordic Studies in Mathematics Education*, *17*(2), 49-68.

Ahmed, K., & Mesonovich, M. (2019). Learning management systems and student performance. *International Journal of Sustainable Energy Development, 7*(1), 582-591. https://doi.org/10.20533/ijels.2046.4568.2019.0073

Alenezi, A. (2018). Barriers to Participation in Learning Management Systems in Saudi Arabian Universities. *Education Research International*, *2018*, 1–8. https://doi.org/10.1155/2018/9085914

Alzahrani, A. A. (2019). The effect of distance learning delivery methods on student performance and perception. *International Journal for Research in Education, 43*(1), 293-317.

Al-Busaidi, K. A., & H. Al-Shihi. (2010). "Instructors' Acceptance of Learning Management Systems: A Theoretical Framework." *Communications of the IBIMA 2010* (2010), 1–10. https://doi.org/10.5171/2010.862128

Al-Fraihat, D., Joy, M., Masa'deh, R., & Sinclair, J. (2020). Evaluating e-learning systems success: An empirical study. *Computers in Human Behavior, 102*(1), 67-86. https://doi.org/10.1016/j.chb.2019.08.004

Anshari, A., Almunawar, M. N., Shahrill, M., Wicaksono, D. K., & Huda, M. (2017). Smartphones usage in the classrooms: Learning aid or interference? *Education and Information Technologies, 22*(6), 3063–3079. https://doi.org/10.1007/s10639-017-9572-7

Baepler, P., Walker, J., & Driessen, M. (2014). It's not about seat time: Blending, flipping, and efficiency in active learning classrooms. *Computers & Education, 78*, 227–236. https://doi.org/10.1016/j.compedu.2014.06.006

Bebell, D., Russell, M., & O'Dwyer, L. (2004). Measuring teachers' technology uses: Why multiple measures are more revealing. *Journal of Research on Technology in Education, 37*(1), 45–63. https://doi.org/10.1080/15391523.2004.10782425

Bervell, B., & Umar, I. N. (2017). Validation of the UTAUT model: Re-considering non-linear relationships of Exogeneous variables in higher education technology acceptance research. *Eurasia Journal of Mathematics, Science and Technology Education, 13*(10), 6471–6490. https://doi.org/10.12973/ejmste/78076

Boateng, R., Boateng, S. L., Awuah, R. B., Ansong, E., & Anderson, A. B. (2016). Videos in learning in higher education: assessing perceptions and attitudes of students at the University of Ghana. *Smart Learning Environments, 3*(8), 1-13. https://doi.org/10.1186/s40561-016-0031-5

Bottino, R., & Robotti, E. (2007). Transforming classroom teaching & learning through technology: Analysis of a case study. *Journal of Educational Technology & Society 10*(4), 174–186.

Bringula, R. P., & Basa, R. S. (2011). Factors affecting faculty web portal usability. *Educational Technology and Society, 14*(4), 253–265.

Buckner, E., & Kim, P. (2014). Integrating technology and pedagogy for inquiry-based learning: The Stanford Mobile Inquiry-based Learning Environment (SMILE). *Prospects, 44*(1), 99-118. https://doi.org/10.1007/s11125-013-9269-7

Chunyang, L., & Long, F. (2014). *The discussion of traditional teaching and multimedia teaching approach in college English.* Department of Foreign Language, Harbin University of Commerce Harbin.

Craig, E. M. (2007). Changing paradigms: Managed learning environments and web 2.0. *Campus-Wide Information Systems, 24*(3), 152-161. https://doi.org/10.1108/10650740710762185

Cuban, L., Kirkpatrick, H., & Peck, C. (2001). High access and low use of technologies in high school classrooms: Explaining an apparent paradox. *American Educational Research Journal, 38*(4), 813-834. https://doi.org/10.3102/00028312038004813

Drent, M., & Meelissen, M. (2008). Which factors obstruct or stimulate teacher educators to use ICT innovatively? *Computers & Education, 51*(1), 187–199. https://doi.org/10.1016/j.compedu.2007.05.001

Duffy, T., & Cunningham, D. (1996). *Constructivism: Implications for the design and delivery of instruction*: MacMillan.

Engestrom, Y. (2008). *Activity theory: Framework for analyzing, redesigning work*. Taglar and Francis Ltd.

Faizal, A., & Jamil, A. (2014). Vocational education readiness in Malaysia on the use of e-portfolios. *Journal of Technical Education and Training, 6*(2), 157–171.

Falvo, D. A., & Johnson, B. F. (2007). The use of learning management systems in the United States. *Tech Trends, 51*(2), 40-45. https://doi.org/10.1007/s11528-007-0025-9

Fernández-Ferrer, M., & Cano, E. (2016). The influence of the internet for pedagogical innovation: using Twitter to promote online collaborative learning. *International Journal of Educational Technology in Higher Education, 13*(22). https://doi.org/10.1186/s41239-016-0021-2

Ford, K., & Lott, L. (2011). *The impact of technology on constructivist pedagogies.* Boise State University. https://bit.ly/3AbcXgm

Forster, M., & Washington, E. (2000). A model for developing and managing distance education programs using interactive video technology. *Journal of Social Work Education, 36*(1), 147–158. https://doi.org/10.1080/10437797.2000.10778996

Ghilay, Y. (2017). *Online learning in higher education*. Nova Science Publishers

Govender, I., & Govender, D. (2012). A constructivist approach to a programming course: Students' responses to the use of a learning management system. *African Journal of Research in MST Education, 6*(2), 238-252. https://doi.org/10.1080/10288457.2012.10740742

Gunawan, G., Suranti, N. M. Y., & Fathoroni, F. (2020). Variations of models and learning platforms for prospective teachers during the COVID-19 pandemic period. *Indonesian Journal of Teacher Education*, *1*(2), 61–70.

Hasan, L. (2014). Evaluating the usability of educational websites based on students' preferences of design characteristics. *International Arab Journal of E-Technology, 3*(3), 179–193.

Heirdsfield, A. (2011). Blackboard as an online learning environment: What do teacher education students and staff think? *Australian Journal of Teacher Education, 36*(7), 1-16. https://doi.org/10.14221/ajte.2011v36n7.4

Hennessy, S., Ruthven, K., & Brindley, S. (2005). Teacher perspectives on integrating ICT into subject teaching: Commitment, constraints, caution, and change. *Journal of Curriculum Studies, 37*(2), 155-192. https://doi.org/10.1080/0022027032000276961

Hew, K. F., & Brush, T. (2007). Integrating technology into K-12 teaching and learning: current knowledge gaps and recommendations for future research. *Educational Technology Research and Development, 55*(3), 223–252. https://doi.org/10.1007/s11423-006-9022-5

Jung, S., & Huh, J. H. (2019). An efficient LMS platform and its test bed. *Electronics, 8*(2), 154. https://doi.org/10.3390/electronics8020154

Karasavvidis, I., & Kollias, V. (2014). Technology integration in the most favorable conditions: findings from a professional development training program. *Research on e-learning and ICT in education* (pp. 197–224), Springer. https://doi.org/10.1007/978-1-4614-6501-0_14

Kehrwald, B. A., & Parker, B. (2019). Implementing online learning: Stories from the field. *Journal of University Teaching & Learning Practice, 16*(1), 1-5. https://doi.org/10.53761/1.16.1.1

Kimmons, R., Hunsaker, E. W., Jones, J. E., & Stauffer, M. (2019). The nationwide landscape of K–12 school websites in the United States. *The International Review of Research in Open and Distributed Learning, 20*(3). https://doi.org/10.19173/irrodl.v20i4.3794

Kulshrestha, T., & Kant, A. R. (2013). Benefits of learning management system (LMS) in Indian education. *International Journal of Computer Science & Engineering Technology, 4*(8), 1153-1154.

Librero, F. (2004, December 11-13). *Digital learning environments in the Philippines: Perspective from the U.P. Open University* [Paper Presentation]. Symposium on Digital Learning, Keio University, Japan.

Lim, E. C. H., Seet, R. C. S., Oh, V. M. S., Chia, B. L., Aw, M., Quak, S. H., & Ong, B. K. C. (2007). Computer-based testing of the modified essay question: the Singapore experience. *Medical Teacher, 29*(9–10), e261–e268. https://doi.org/10.1080/01421590701691403

Lonn, S., Teasley, S. D., & Krumm, A. E. (2011). Who needs to do what where?: Using learning management systems on residential vs. commuter campuses. *Computers & Education, 56*(3), 642–649. https://doi.org/10.1016/j.compedu.2010.10.006

Lunenberg, F. (1998). Constructivism and technology: Instructional designs for successful education reform. *Journal of Instructional Psychology, 25* (2), 75-81.

Magno, C. (2017). Facilitating student learning in schools through a learning management system: An action research. *The International Journal of Research and Review, 12* (12), 85-110.

Mayer, R. E. (2004). Should there be a three-strikes rule against pure discovery learning? *American Psychologist*, *59*(1), 14–19. https://doi.org/10.1037/0003-066X.59.1.14

Murphy, E., Rodríguez-Manzanares, M., & Barbour, M. K. (2011). Asynchronous and synchronous teaching and learning in high school distance education: perspectives of Canadian high school distance education teachers. *British Journal of Educational Technology, 42*(4), 583-591. https://doi.org/10.1111/j.1467-8535.2010. 01112.x

Mwalumbwe, I., & Mtebe, J. S. (2017). Using learning analytics to predict students' performance in Moodle learning management system: A case of Mbeya University of Science and Technology. *The Electronic Journal of Information Systems in Developing Countries, 79*(1), 1-13. https://doi.org/10.1002/j.1681-4835.2017.tb00577.x

Nazzal, N. (2014). *Modern vs traditional teaching methods. A look at the teaching methods being adhered to in schools*. Gulf News, UAE Education.

Noorulhasan, Q., Muhammad, A., Sanober, S., Rafik, M., & Shah, A. (2017). A mixed-method study for investigating critical success factors (CSFs) of e-learning in Saudi Arabian universities. *International Journal of Advanced Computer Science and Applications*, *8*(5), 171-178. https://doi.org/10.14569/IJACSA.2017.080522

Oliver, A., Osa, J. O., & Walker, T. M. (2012). Using instructional technologies to enhance teaching and learning for the 21st century preK-12 students. *International Journal of Instructional Media, 39*(4), 283-295.

Piaget, J. (1971). *Psychology and epistemology: Towards a theory of knowledge*. Grossman

Pishva, D., Nishantha, G., & Dang, H. (2010). A survey on how Blackboard is assisting educational institutions around the world and the future trends. In Y. Park (Ed.), *Proceedings of the 2010 International Conference on Advanced Communication Technology* (pp. 1539–1543)*.* National Information Society Agency of Gang Won South Korea.

Quinn, R., & Gray, G. (2020). Prediction of student academic performance using moodle data from a further education setting. *Irish Journal of Technology Enhanced Learning 5*(1), 1-19. https://doi.org/10.22554/ijtel.v5i1.57

Rahimi, F., & Abadi, A. T. B. (2020). Practical strategies against the novel coronavirus and COVID-19—the imminent global threat. Archives of Medical Research, 51(3), 280–281. https://doi.org/10.1016/j.arcmed.2020.03.005

Rigby, B. (2008). *Mobilizing generation 2.0 A practical guide to using web 2.0 technologies to recruit, organize, and engage youth.* Jossey-Bass.

Sarfo, F., & Yidana, I. (2016). University lecturers experience in the design and use of MOODLE and blended learning environments. *The Online Journal of New Horizons in Education, 6*(2), 143-154.

Shukla, V. K., & Verma, A. (2019). Enhancing LMS experience through AIML base and retrieval base chatbot using R language. In *Proceedings of the 2019 International Conference on Automation, Computational and Technology Management* (pp. 561-567). IEEE.

Siemens, G. (2005). Connectivism: A learning theory for the digital age. *International Journal of Instructional Technology and Distance Learning*, *2*(1). 3-10.

Sulisworo, D., Rohmadheny, P. S., Fatimah, N., & Arif, D. B. (2020). Learning analytics to predict student achievement in online learning during COVID- 19 mitigation. *International Journal of Psychosocial Rehabilitation*, *24*(10), 1844–1861.

Taha, M. H., Abdalla, M. E., Wadi, M., & Khalafalla, H. (2020). Curriculum delivery in Medical Education during an emergency: A guide based on the responses to the COVID-19 pandemic. *MedEdPublish*, *9*(1), 1-12. https://doi.org/10.15694/mep.2020.000069.1

Thongmak, M. (2013). Social network system in classroom: Antecedents of Edmodo adoption. *Journal of e-Learning and Higher Education, Vol. 2013* (2013), 1-15. https://doi.org/10.5171/2013.657749

Thyagharajan, K. K., & Nayak, R. (2007). Adaptive content creation for personalized e-learning using web services. *Journal of Applied Sciences Research, 3*(9), 828–836.

Turnbull, D., Chugh, R., & Luck, J. (2019). *Learning management systems: An overview.* Springer Nature. https://doi.org/10.1007/978-3-319-60013-0_248-1

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly, 27*(3), 425-478. https://doi.org/10.2307/30036540

Vord, R., & Pogue, K. (2012). Teaching time investment: Does online really take more time than face-to-face? *International Review of Research in Open and Distance Learning, 13*(3), 132-146. https://doi.org/10.19173/irrodl.v13i3.1190

Wagner, N., Hassanein, K., & Head, M. (2008). Who is responsible for e-learning success in higher education? A stakeholders' analysis. *Educational Technology & Society, 11*(3), 26- 36.

Waycott, J., Bennett, S., Kennedy, G., Dalgarno, B., & Gray, K. (2010). Does Digital divide? Student and staff perceptions of information and communication technologies. *Computers & Education, 54*(4), 1202-1211. https://doi.org/10.1016/j.compedu.2009.11.006

Wu, Y.-L., Tao, Y.-H., & Yang, P.-C. (2009). The discussion on influence of website usability towards user acceptability. In R. Reid (Ed.), *Proceedings - International Conference on Management and Service Science (MASS 2009)* (pp. 1–4). IEEE eXpress Conference Publishing. https://doi.org/10.1109/ICMSS.2009.5304443

Zaharias, P., & Poylymenakou, A. (2009). Developing a usability evaluation method for e-learning applications: Beyond functional usability. *International Journal of Human-Computer Interaction, 25*(1), 75–98. http://doi.org/10.1080/10447310802546716