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Learning Management System Satisfaction and Problem-Solving Skills in Mathematics of Grade 11 Students

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ABSTRACT

It was necessary for almost all schools to adapt and to sign up for a learning management system (LMS), which will help them manage students' outputs, provide learning materials and communicate in a virtual classroom. Numerous studies also showed that the problem-solving skills of students are declining. This study was conducted to determine if there was a domain in LMS satisfaction that significantly influenced their problem-solving skills in Mathematics of Grade 11 students. It also determined the level of LMS satisfaction and the level of problem-solving skills and if there was a significant relationship between the two variables. The researcher has utilized a descriptive correlation non-experimental method in quantitative research in a sample of 102 respondents using a stratified random sampling. An adapted and researcher-made questionnaire was given to the respondents. In addition, mean, Pearson-r and linear regression were the statistical tools employed. Results showed that the level of LMS satisfaction and the problem-solving skills of the students were very high and always evident. Two variables had a significant moderate correlation, and that communication quality and overall satisfaction significantly influenced their problem-solving skills. Students believe that LMS gives them accurate and complete mathematics content which allows them to perform well in solving problems in Mathematics. Teachers should continuously help students in using LMS for them to maintain their high problem-solving skills.

Keywords: Mathematics, Problem-Solving Skills, LMS Satisfaction, Communication Quality, Online Learning, Philippines

Introduction

The change in traditional classroom settings brought by the current pandemic makes it inevitable for many educational institutions not to use a learning management system (LMS) that will help them deliver distance learning. Students' satisfaction with its usage can positively or negatively affect their problem-solving skills in Mathematics. Like excellent book references, students also need a well-equipped LMS in today's classroom setting to help them achieve the required learning competency. It is then essential that students' satisfaction with LMS should be positively high to expect improved skills in problem-solving.

Rubin, Fernandez, and Avgerinou (2013) cited that students' satisfaction with the LMS used predicted their satisfaction with the offered course, especially those in the online program. Study shows that explicit and enough knowledge about how LMS are used can be correlated to high teaching success and students' cognitive and social presence in the online course. Another study also shows a strong positive

correlation of students' satisfaction to their academic achievement (Dhaqane & Afrah, 2016). In other words, satisfied students (in different aspects of the learning process) tend to gain higher academic achievement and better retention in learning.

A study in Saudi Arabia by Alenezi (2018) revealed that problems involving students' satisfaction with learning management system arise when universities provide insufficient technical support, have a negative attitude toward technology, and provide inadequate training on LMS platforms. Poor Internet connectivity and networking, a lack of infrastructure to support the LMS, a lack of technology and software to run the LMS, and difficulties with English language ability are only some of the issues and problems listed.

Furthermore, Choon, Mohamad, and Lee (2021) also studied the struggle of improving problem-solving skills in distance learning. Although students expressed favorable feelings about the lesson, few students had difficulty understanding the module or were experiencing physical interruptions interfering with their knowledge. The findings provided instructors with information that they might use to create a good learning course during the pandemic.

The different features it offers also affect student satisfaction with LMS. Although a commercial LMS is more expensive, it was proven that schools who subscribed have access to more assistance and more features (Obana, 2021). Moodle, Canvas, and Blackboard Learn are some of the most popular LMSs used in the Philippines, and each with its own set of capabilities. Even with the newly developed learning management systems today that the different universities/schools are using, the study on the Filipino-students' satisfaction about it starter years back.

In the Philippines, Garcia (2017) explored another challenge in students' satisfaction with the system, the behavioral acceptance of Filipino college students to use e-learning management systems. The concepts of the technology acceptance model (TAM) and Three-Tiered Usefulness Model (3-TUM) integrated multimedia instruction, perceived quality of work-life, system interactivity, internet connectivity experience, perceived ease of use, perceived usefulness, and social media influence were constructed. The study examined which factors influenced most Filipino college students' behavioral intention to use LMS as part of their education journey. It was noted that the original TAM predictors - "belief-attitude-intention-behavior relationship," which was first introduced by Davis in 1989 and the perceived quality work of life are the factors that most affect their behavior in using LMS (Garcia, 2017). The researcher also emphasizes the limitation of the study in which LMS is used in a blended learning environment where face-to-face interaction is still present and not in the current situation where full online set-up is embraced.

Higher education institutions in the Philippines started embracing full online or blended classrooms when the pandemic started. They advised schools and universities to offer alternative or flexible learning with on-campus learning (Commission on Higher Education, 2020). The Department of Education (2020) has adapted MOODLE for their LMS last July 2020, where it can be accessed through the website or mobile application.

There weren't many studies focusing on the students' satisfaction with the LMS and academic achievement since the complete online setup. In a report on the status of implementation of e-learning classrooms during the pandemic, it was found out that most professors used free application/platforms, like Google Classroom, Edmodo, Moodle, We chat, FB messenger, and Google Meet to deliver online discussion and send instructional materials (Reyes-Chua, Sibbaluca, Miranda, Palmario, Moreno & Solon,

2020). It was also reported that those who utilized free platforms for e-classroom, roots to lack of resources and led to poor achievement in learning.

The researcher's observation in their current school in Davao City, sees that the school has signed up for a paid LMS in which content materials are readily available for teachers. The researcher further observed that in the previous school year, students tend to leave and not bothered to answer problem-solving questions in their examination or even on activities assigned to them. Most of the students' reasons were the lacking materials or sometimes no materials uploaded in an accessible platform used by the teachers.

With the mentioned studies and related literatures, the researcher did not come across any research studying the correlation between LMS satisfaction and problem-solving skills of the students. The struggles faced by students nowadays in understanding complex mathematical skills like problem solving relies heavy on the materials they have received and this is what motivates the researcher to conduct this study.

This study determined the domains of learning management system (LMS) satisfaction that significantly influenced the problem-solving skills of Grade 11 students during 2021-2022. It sought to answer the following specific questions:

1. What is the level of the learning management system satisfaction of Grade 11 students in terms of:
   a. Information Quality
   b. System and Service Quality
   c. Perceived Ease of Use and Usefulness
   d. Communication Quality
   e. Overall Satisfaction
2. What is the level of problem-solving skills in Mathematics of Grade 11 students in terms of:
   a. Rational functions
   b. One-to-one Functions
   c. Inverse functions
   d. Exponential Functions
   e. Logarithmic functions
3. Is there a significant relationship between the learning management system satisfaction and problem-solving skills in Mathematics of Grade 11 students?
4. Is there a domain in learning management system satisfaction that significantly influenced the problem-solving skills in Mathematics of Grade 11 students?

Review of Related Literature

In this section, the researcher presents and discusses related literature, which will help the readers grasp and understand more information on the variables involved in the study. The first variable in the sequence of discussion is the independent variable followed by its indicators. Then the second significant discussion is its dependent variable with related existing studies as well.

Learning Management System (LMS) Satisfaction

In today's era, digital technology has always been a partner of educators in preparing and delivering instruction. According to the website Teach with Digital Technologies (2019), electronic tools, systems, devices, and resources that generate and process data are digital technologies. Thus, learning management

system is one of those digital technologies which notable studies have proven this already. Awad, Salameh, and Leiss (2019) believe that learning management systems offer many perks and features that help students study more effectively. Instructors will benefit from these characteristics as well, as they will be able to complete their mission. Testing, training, bookkeeping, and tracking all students' progress are all advantages of the system.

Additionally, students' confidence in using LMS affects their academic achievement as well. Most of the time, this confidence is not firm because of the main barriers to using LMS. Toro (2021) emphasized the process more than the result in guiding students to be independent problem-solver. And, in a distant classroom setting, the help of a platform that will let teachers check and provide feedback will surely increase students' achievement.

A study in Saudi Arabia by Alenezi (2018) revealed that universities provide insufficient technical support (referred as service quality), have a negative attitude toward technology, and provide inadequate training on LMS platforms. Poor Internet connectivity and networking, a lack of infrastructure to support the LMS, a lack of technology and software to run the LMS, and difficulties with English language ability are only some of the issues listed.

Moreover, studies measuring students' satisfaction with this LMS have also become vital for feedbacking and testing quality on the chosen system. For example, Ohliati and Abbas (2019) found that factors influence students' satisfaction with the learning management system. Such factors are system quality, usefulness, ease of use, information quality, service quality, and communication quality; the dominant factor is the service quality of the LMS. Chaw and Tang (2018) obtained the same result with this study, indicating a significant relationship of system use to students' learning achievement. But there are also related studies contradicting these results, which will be discussed in the following paragraphs.

Information Quality. Information quality (IQ), or others call it "quality information," is a multidisciplinary field that can be defined as a measurement of the value that information delivers to its users (de Lima, Bastos, & Bastos, 2020). According to Lin (2007, as cited in Al Samarraie, Teng, Alzahrani, and Alalwan, 2018), LMS content's currency, accuracy, and sufficiency is information quality. Therefore, IQ is all about the LMS's type of content to the learners from these citations.

Additionally, the alignment of learning outcomes and learning materials in the learning management system ensures information quality. De Lima et al. (2020) concluded that information quality is required for education because the information is so important in reaching these learning outcomes. Poor information quality-related issues result to lower learning platforms (LPs) reliability and lower user contentment both in teacher and students' experience. The study suggested that educational institutions ensure that LPs have high-quality information to deliver a better learning experience and maintain user pleasure. In addition, learning materials should attract students' interest daily. These platforms should be simple, have well-organized material and functionality, and encourage social presence by allowing user interaction in a collaborative environment.

Moreover, Lee and Jeon (2020) evaluated the resources that affect the users' happiness with an m-LMS using information system security model (ISSM) quality factors. The findings revealed that together with system quality, and service quality, information quality, had a favorable impact on user happiness. In contrast with Chaw et al. (2018), system quality and service quality and not information quality had a significant relationship with satisfaction with the system.

System and Service Quality. Numerous studies have defined system quality as a measure of an information systems' technical and design excellence. As a result, perceived system quality can be

characterized as a user's assessment of an information system from both a technical and a design standpoint. (Gable, Sedera, & Chan, 2008, as cited in Alla 2013).

On the other hand, numerous authors cited that service quality is used to assess the effectiveness of various management methods and cultures to benefit the organization's customers (Ali, Saleh, Akoi, Abdulrahman, Muhamed. Noori & Anwar, 2021). It indicates the support service quality the system is giving to the users. In addition, the main characteristics of system quality (Accessibility, Usability, Reliability, and Stability) are discussed in this Study of Alla (2013), which was found out the effects of these dimensions on the efficiency of an e-learning system are evaluated. The author further indicates that the efficiency of an e-learning system cannot be realized without a high level of system quality that encourages learners to use e-learning more frequently. Hence, this means that high access and usage rate and a reliable and stable LMS will improve students' experience, and meeting learning competency will be achieved.

Also, the service quality of LMS may affect the students' acceptance of using LMS. For example, several researchers found that the quality of service positively impacted students' satisfaction with e-learning systems (Roca, Chiu, & Martinez, 2006, as cited in Ghazal, Umar, & Aldowah, 2017). In other words, high service quality results in a more significant number of students being satisfied with LMS.

Pham, Limbu, Bui, Nguyen, and Pham (2019), studied how e-learning service quality affects students' satisfaction and loyalty. The researchers established that service quality has three factors: e-learning system quality, e-learning instructor and materials' quality, and administrative and support service quality. The essential feature of overall e-learning service quality was e-learning system quality, which e-learning instructor and course materials quality followed, and e-learning administrative and support service quality. Furthermore, the total rate of e-learning services was linked to e-learning student happiness, which influenced e-learning student loyalty. With this study, the researcher of this current paper highly believes merging system and service quality has a basis.

Perceived Ease of Use and Usefulness. The technological acceptance model (TAM) framework provided the first definition of perceived ease of use (PEOU) and perceived usefulness (PU) by Davis (1989, as cited in Enu-Kwesi, & Opoku, 2020). The model describes the factors that influence technology acceptability and utilization. It argues that technology utilization is controlled by users' attitudes, which are also influenced by perceived usefulness and ease of use. These two factors are later affected also by other external factors. For example, Venkatish and Davis stated that perceived ease of use determines how much work a person estimates it would take to use a given technology, and perceived usefulness measures how much a person believes that employing a given technology will help them perform better at work (2000; as cited in Enu-Kwesi and Opoku, 2020).

Indeed, students' belief in using technology in less effort and thinking of finishing a task better using the same technology has been an excellent predictor to their academic achievement. Alyoussef (2021) studied e-learning acceptance and its vital role in learning sustainability and task-technology fit, which influenced students' satisfaction and academic achievement. According to the result of the study, perceived ease of use (PEOU) has a good impact on perceived enjoyment and usefulness (PU). This favorable effect on task–technology fit and e-learning use in higher education, resulting in improved student satisfaction, academic achievement, and higher learning sustainability.

Communication Quality. Communication is the process of sending and receiving information between people for messages to be delivered effectively. Information technology has played a critical role in assisting an organization's communication efforts, such as schools adopting a learning management

system as argued by Turban, Mclean and Wetherbe (2007; as cited in Ohliati & Abbas, 2019). In this study, communication quality refers to the interactive quality feature of the LMS.

Although there has been little to no study focusing quality communication of a learning management system, the interaction between the tool and the user is as important as other factors involved in students' satisfaction with LMS regardless of how advanced the technology can be. Students who have a good background in how Information and Communication Technology (ICT) works are also skilled in navigating and maximizing LMS provided by their school or universities (Mantoro, Dewanti, Utami, Yudhi, & Ayu, 2017).

The quality of communication is determined by whether both parties are motivated to continue interacting. This engagement takes place using words and language. Walter claimed that learner can use language to obtain information and communicate their thoughts (1992; as cited in Ohliati and Abbas, 2019). This means that quality communication between the system and students should be mediated by the instructors/teachers brings positive points on students' satisfaction with LMS.

Overall Satisfaction. Dreheeb, Basir and Fabil (2016) defined users' satisfaction with information systems as a metric for determining how well they collaborate. It's the extent to which students believe the information system satisfies their needs. Thus, users' happiness with the information system will improve if it fits their requirements, such as students learning the most effortless way using LMS.

Emerging researchers consider user satisfaction as an evaluation construct or way of measuring the success and effectiveness of the system used. Several studies have used 'user satisfaction as an outcome. Their common predictors are the mentioned variables above (information quality, system quality, service quality, perceived ease of use, usefulness, and communication quality). In addition, scholars argue that service quality (SERVQUAL) positively affects user satisfaction along with different social capital factors formed, namely – structural, cognitive, and relational. (Sun, Fang, Lim, & Straub, 2012).

Aside from service quality, information quality was also used as a predictor in few studies to measure user's satisfaction even in hospital information systems. Buchan, Winn, and Bishop sated that information availability and information understandability of the system is relies heavily on the user satisfaction of the said system which could result to deciding whether they will continue to use the said system (2009; as cited in Kalankesh, Nasiry, Fein & Damanabi, 2020). Research of this scenario was conducted in some systems, such as patient care. Any problem with the quality of incoming information might jeopardize outcomes and even be fatal. Kuipers suggests that the quality of information affects information system utilization and, as a result, user satisfaction with the system (2016; as cited in Kalankesh, Nasiry, Fein & Damanabi, 2020). Hence an enhanced information quality is detrimental in achieving user satisfaction.

Another study also shows that instructional quality strongly predicted LMS satisfaction for all study participants irrespective of their perceived LMS usage frequency or type of LMS employed (Koh & Kan 2020). Thus, the study's findings show that more careful instructional techniques could improve students' views of online course instructional quality, enhancing their LMS satisfaction. This could be crucial for improving student retention in online classes.

Problem-Solving Skills in Mathematics of Grade 11 Students

The National Council for Teachers of Mathematics defines "problem-solving" as mathematical assignments that increase students' mathematical learning and development by posing intellectual

challenges. These involve the ability to find a solution to an issue which requires first identifying the problem, then arranging a strategy or plan for problem-solving, implementing the plan, and finally evaluating the outcome (Siregar, 2017)

For over 40 years of study, it has been proven that mathematical problem-solving is well-known for its importance in classroom management. Challenges that arise in our daily lives are a type of problem, and problem-solving abilities assist individuals in solving these common issues. As a result, problem-solving skills, which are vital not only in mathematics but also in everyday life, should be incorporated into one of the twenty-first century's teaching techniques as proposed by Ocak and Eğmir (2014; as cited in Özreçberoğlu & Çağanağa, 2018).

This call for enhancing teaching technique on problem-solving skills has been the center of studies in mathematics education over the years. Boonen, Koning, Jolles and Shoot (2016) on the other hand calls for reading comprehension skills training for students to be able to represent word problems into mathematical symbol and equation. According to these multiple authors, solving mathematical word problems successfully involves both mental representation and reading comprehension skills. Students learn to employ the first of these skills (representational skills) in the context of word problem solving in Realistic Math Education (RME). Given this, it is reasonable to expect that students who have completed an RME curriculum have difficulty solving semantically complicated word problems. Their study shows that even proficient word problem solvers performed poorly on semantically complicated word problems, despite having adequate performance on semantically less complex word problems. They argued that reading comprehension abilities should be given a (larger) emphasis during RME word problem solving teaching (Boonen et al, 2016).

It is not just a must to consider it in our teaching nowadays. It is also an effective technique to develop 21st-century skills and provide learners with cross-curricular experiences that have real-world relevance. We can use several methods to teach problem-solving skills to our learners, one of which was the first developed by Polya in 1945. It gives two futuristic perspectives of how teachers should view this skill (Szabo, Körtesi, Guncaga, Szabo, & Neag, 2020).

First, due to technological disruption, globalization, and climate change, the environment is rapidly changing, thus requiring new transversal skills through teaching. In simpler words, the world is in constant change; teaching problem-solving skills last ten years is not the same today. The concept of getting to the final answer might be the same, but the process could be developed to incorporate advanced technologies nowadays. A similar study by Peciuliauskiene and Dapkus (2015) shows that problem-solving-based learning (PBL) focused on cross-curricular content created favourable conditions for improving problem-solving skills. Such scenarios are contextualized examples connected to another discipline, for instance solving speed problems using functions application.

To add further, students can build their conceptual knowledge and procedural fluency by using problem-solving to teach mathematical ideas. It will assist students in understanding when and how to apply a particular concept to situations they may meet in the future. Their achievement and ability to solve difficulties in their lives and the end will reflect this awareness (Sawalha, 2018).

Consequently, as defined by the Department of Education's (2015) learners' material for General Mathematics, a function is a relation in which each element in the domain is associated to only one value in the range by some rule. Leibniz coined the term "function" to describe curves such as the gradient at a point in 1692. Bernoulli coined the term "function" to represent an expression made up of a variable and some constants in the early 18th century: As Kleiner calls here Function of a variable an amount built in

any manner whatever of this variable and of constants (1989; as cited in Bardini, Pierce, Vincent, & King, 2014).

In 1989, Kleiner pointed out that Euler popularized the term by considering calculus as a formal theory of functions. After then, so many definitions of functions have emerged in these concepts. Although many function types are being studied and explored, the researcher will focus only on the five mentioned in Most Essential Learning Competencies provided by the Department of Education (2020). The five functions that will be discussed in the following sections are the following, rational, one-to-one, inverse, exponential, and logarithmic functions.

Solving Rational Functions. A rational function is a fractional function with both a polynomial numerator and a denominator. In other words, if R(x) = p(x) / q(x) and p(x) and q(x) are both polynomials, then R(x) is a rational function. A polynomial function is a function that may be written as a polynomial expression. A polynomial equation definition can be used to obtain the definition. P is the most common symbol for a polynomial (x). The degree of P(x) is the highest power of the variable. The degree of a polynomial function is significant because it tells us how the function P(x) behaves when x is huge. A polynomial function's domain is the complete real numbers (R) In symbols, if $P(x) = a_n x^n + a_{n-1} x^{n-1} + \ldots\ldots\ldots\ldots + a_2 x^2 + a_1 x + a_0$, then for $x \gg 0$ or $x \ll 0$, $P(x) \approx a_n x^n$. Thus, polynomial functions approach power functions for tremendous values of their variables (Oronce, 2016).

Application of rational function is everywhere in our daily lives. To cite some, we have percentage-related problems and average cost applications. Rational functions come in handy when calculating specific ratios or percentages, such as sports statistics or academic accomplishments. Multiple authors (Zorilla, Partible, Bagano, Banza, Cabrera, & Ganir, 2016) provided examples such as a cell phone company providing a new phone for P35 000 with a monthly plan of P 1,560. The amount needed to use the phone and the including the accumulated cost of the phone can be solved using the rational function.

Solving One-to-One Function. A one-to-one function is one in which the responses do not repeat themselves. A typical function can accept two different input values and return the same result, but a one-to-one function cannot. For example, the function $f(x) = x^2$ is not a one-to-one function since it returns 4 when you enter both a two and a -2. However, the function f(x) = x - 3 is a one-to-one function because it returns a different result for each input (Sirug, 2017).

In a teaching guide written by Versoza, Crisologo, Hao, Miro, and Ocampo (2016), they explained that one-to-one (or 1:1) partnerships can be found almost anywhere to put into contextual learning. It refers to a situation in which one object can only be matched with another. But, for a relationship to be one-to-one, it must be able to be flipped so that it is true both ways. One student, for example, has only one teacher. However, that teacher is likely to have a large class of students, making the relationship one-to-many rather than one-to-one. Thus, it's more accurate to say that each student has their backpack and that each bag belongs to a single student.

Another definition of one-to-one function is one in which the responses do not repeat themselves (Zorilla et al., 2016). A typical function can accept two different input values and return the same result, but a one-to-one function cannot. For example, the function f(x) = x^2 is not a one-to-one function since it returns 4 when you enter both a 2 and a -2, however the function f(x) = x - 3 is because it returns a different result for each input.

Solving Inverse Function. A function that reverses the operation of another function is known as an inverse function. When y=f(x), then x=g, a function g is the inverse of a function f. (y). To put it another way, applying f and then g is equivalent to doing nothing. This can be written as g(f(x))=x in terms of the

composition of f and g. A function f has an inverse function only if there is only one value of x in its domain for which f(x)=y for every y in its range. This inverse function is one of a kind, and it's often abbreviated as f^{-1} and referred to as "f inverse." (Albay, Batisan, & Caraan, 2016.)

To understand the concept of an inverse function, teachers may explain in the following example. "Students begin by investigating a P50 million savings problem before moving on to an investment function and observing the relationships between a function and its inverse using graphs and tables". Students will make broad generalizations about critical characteristics such as domain and range and connect their past knowledge of function definition to a new viewpoint on the meaning of an inverse function (Chester, 2013)

Solving Exponential Functions. In his book in General Mathematics, Sirug (2016) defined exponential functions as functions in a form of $f(x) = b^x$ where b is the base which can be any real number not equal to one. The trend of this graph is either increasing or decreasing rapidly. Functions like $f(x) = x^2$, where the variable x is the base and the number 2 is the power is not considered exponential but functions like $g(x) = 2^x$. The base is a fixed integer, and the power is a variable.

The division of the cell, population increase, half-life, bodily medication, and compound interest are all examples of exponential functions in our universe. Exponential functions become meaningful and essential when students investigate, discuss, and create exponential equations to reflect these scenarios. This method will assist pupils in comprehending, appreciating, and connecting it to their own lives. If they memorized and applied the rule, this would not be possible. Students should be taught exponential functions through problem-solving and real-life situations to assist them in understanding the concept (Sawalha, 2018).

Solving Logarithmic Functions. Logarithmic functions are known to be inverse of the exponential function. In logarithmic form, any exponential expression may be recast. If $6^2 = 36$ for example, the base is 6, the exponent is 2, and the result is 36 will be $36 = 2$ if rewritten in logarithmic form. The base is the subscript on the logarithm, and the exponent is the number on the left side of the equation. The result is the number next to the logarithm. Authors have cited that the logarithmic function is written in a form of $g(x) = log\ (b, x)$ where b is base greater than zero but not equal to one and x can be any real number. (Versoza, et al., 2016).

Furthermore, Oronce (2016) wrote that the basis for logarithms that is most used is e and the common logarithmic base 10. Natural logarithms, or base e logarithms, are essential in calculus and several scientific applications. The base e logarithm, x has its notation, ln (x). The majority of ln(x) values can only be obtained with a calculator. The main exception is that ln 1 = 0 since the logarithm of 1 is always 0 in whatever base. The ln key, found on most scientific calculators, can solve other natural logarithms. Using the inverse feature of logarithms, we can also compute the natural logarithm of any power of e

The ability of logarithms to solve exponential equations accounts for a large part of their potency. Sound (decibel measurements), earthquakes (Richter scale), star brightness, and chemistry are all examples of this (pH balance, a measure of acidity and alkalinity) (Zorilla et al., 2016)

Synthesis

The different studies cited above helped the researcher mapped the possible correlation between the two variables involved. LMS satisfaction can be further discussed in specific domains of information quality, service and system quality, perceived ease of use and usefulness, communication quality and the overall satisfaction. These indicators best described the level of LMS satisfaction of Grade 11 students.

Learning more about functions can best achieved when students uncover its different types and applications in real-life as well. Testing the problem-solving skills in Mathematics of the Grade 11 students can be evaluated in specific topics of rational, one-to-one, inverse, exponential, and logarithmic function. It can also be observed that even with multiple studies looking for the effectiveness and student's satisfaction with the learning management system in education, only a few focused on its usage and help in teaching and learning Mathematical skills.

Theoretical/Conceptual Framework

This study stemmed from the theory of Technological Acceptance Model which was originally authored by Davis in 1989. According to the Technology Acceptance Model (TAM), two criteria affect whether a computer system will be adopted by its potential users: (1) perceived usefulness and (2) perceived ease of use. The emphasis on the potential user's perceptions is a fundamental component of this strategy. That is, while the inventor of a technology product may believe it is valuable and user-friendly, potential users will not accept it until they share those sentiments. The potential users of the learning management system are the students; hence their satisfaction is important in determining if the LMS is effective and if it serves its purpose. The creator may view it materially capable for learning, and think that LMS provides enough context to students. In the point of view of the students, these "features" are only evident if they will be able to improve their academic performance (Nguyen, Do, & Wu, 2021) such as their problem-solving skills in learning Mathematics.

Another supporting theory of this study is the Cognitivist Learning Theory as proposed by Piaget in the 1950s. It examines how the mind processes, organizes, stores, and retrieves knowledge. Cognitivism considers learning as an internal mental process rather than observable behavior, as cited by Ouadoud, Nejjari, Chkouri and El-Kadiri (2018). Cognitivism also believes in the three aspects of knowledge as declarative, procedural, and conditional. The basic features in navigating the system are first taught to students, which is considered declarative knowledge. Afterward, they are trained how to use each feature, a procedural knowledge. This concept is also applicable to solving problems in mathematics. They first need to know the recall and understanding domain of the lesson, then apply, evaluate, and judge their final answers. Hence, using LMS and improving skills in problem-solving need a what, how, and when & why knowledge, as mentioned by Ouadoud et al., (2018).

Moreover, this study is also anchor on the Diffusion of Innovation Theory proposed by Everett Rogers (1962, as cited in Mkhize, Buthelezi, & Mtsweni, 2016). The diffusion of innovations theory describes how new technical and other developments move throughout civilizations and cultures, from introduction to widespread adoption. The innovation of hypothesis explains how and why new ideas and practices are embraced over time, with timescales potentially spanning decades. This is also suited and is connected to the study since there involves the adaptation of innovation, which is to be assessed using students' satisfaction level in using LMS.

The conceptual framework of the study is shown in Figure 1. As seen in the figure, the independent variable is LMS satisfaction with five indicators: information quality, system and service quality, perceived ease of usefulness, communication quality, and overall satisfaction. The dependent variable is students' problem-solving skills in learning function with five indicators: solving rational process, solving one-to-one function, solving inverse function, solving exponential function, and solving logarithmic function. The arrow connecting the two variables signifies the assumed relationship.

Method

Methods and procedures that were done in conducting this study are discussed in this chapter. This section thoroughly explains research design, respondents, research locale, research instrument, data gathering procedures, and data analysis.

The researcher utilized the descriptive correlation non-experimental in the quantitative research design. According to many authors, descriptive correlational studies are used to describe variables and the natural correlations that exist between and among them. The study variables are categorized as independent (predictor) and dependent (outcome) in the same way that experimental designs are (Davis, 2021). The data in this type of study are collected without making any changes or manipulating the study subject, unlike in experimental studies. As the researcher sought to study the relationship between the satisfaction of Grade 11 students in the learning management system and their problem-solving skills in Mathematics, the researcher also believed that employing a descriptive correlational non-experimental research design is suited to answer the research questions crafted.

The study respondents were from one of the private schools in Davao City offering basic education. Academic and technical vocational livelihood (TVL) tracks are offered in their senior high school program. There are one thousand Grade 11 students in the current academic year coming from different public and private junior high schools also in the city. From this population a stratified sampling technique was used to choose the respondents of this study. The school was established in 1948 and serving for over 73 years, the school continues to produce quality graduates of today's generation. Appendix A shows a geographical map of this school.

The target number of respondents were 102 students. The sampling procedure that the researcher has used was the stratified random sampling techniques. It is a method for sampling from a population in which the population is divided into subgroups and units are randomly picked from the subgroups (Frey, 2018). To get this number, the whole population of Grade 11 students in the chosen research locale were divided into subgroups according to their track and strand to avoid bias and proper representation of the population. There were five (5) subgroups, namely the Accountancy Business and Management (ABM) strand, General Academic Strand (GAS), Humanities and Social Sciences (HUMSS) strand, Science, Technology, Engineering and Mathematics (STEM) strand & Technological Vocational Livelihood (TVL) track.

The population to each subgroup was also computed. Each percentage was multiplied by the target number of respondents to get the desired number for each subgroup. For instance, ABM strand has 227 Grade 11 enrolled students, this digit was divided by the number of overall Grade 11 students (925) and in this it was approximately 0.25 then multiplied to 102 desired respondents; hence there were 27 students who was invited to be the respondents from ABM strand. The number of invited respondents from the other strands was also computed in the same manner.

All Grade 11 students were considered to be part of the respondents based on this sampling, regardless of the chosen strand or track, as long as enrolled in General Mathematics, as one of their core subjects. Hence, the process of selecting the sample has been free of any form of partiality and poor judgment.

An adapted survey questionnaire from a similar study on students' satisfaction with the learning management system by Ohliati & Abbas (2019) was used to gather data for the independent variable. In determining the level of LMS satisfaction of Grade 11 students, the following ranking was used for the

respondents to answer the questionnaire: 5 as strongly agree; 4 as agree; 3 as neutral; 2 as disagree; and one as strongly disagree. The Likert scale was used to interpret the results as well afterwards.

A crafted test questionnaire was used to measure the problem-solving skills in Mathematics of Grade 11 students. There were 5 topics that were used to measure their problem-solving skills. There were 5 items ranging from understanding to real-life problems. A rubric was utilized to ensure students' solutions to check and free from any bias. Three inter-raters who are Mathematics teachers were invited as well to check the students' submitted solutions.

After the dependent variable was checked and tabulated, a range of means was used to describe the students' level of problem-solving skills in mathematics of Grade 11 students.

The independent variable research instrument was composed of 25 questions, five questions in each indicator. There were 25 questions, or five problems in each topic for the dependent variable. In summary, there were 50 questions or items to be answered. The pilot testing was administered to 17 respondents in which they were not part of the subject of the study as respondents. The instrument both for independent and dependent variable were found out to be reliable with the internal consistency of excellent and good respectively. This designed test examined the consistency of respondent responses in the given items reflected in the questionnaire.

Thus, the overall reliability test rating with Cronbach's Alpha of 0.913 with an equivalent internal consistency rating of excellent. The overall validator's rating is also 4.28.

The following steps and procedures were done to gather the data necessary in this study.

Asking permission to conduct the study. By following proper health guidelines to fight against COVID-19, the researcher requested an endorsement letter from the Dean of Graduate School of the Holy Cross of Davao College after securing an approval from the research ethics committee and with the guidance of the thesis adviser to conduct the study in learning management system satisfaction and problem-solving skills of Grade 11 students in learning mathematics. Afterwards, the researcher sent a request letter to the principal of the school chosen to seek consent to conduct the study in the school as the chosen research locale.

Administration and retrieval of questionnaires. With the approval of the school principal to conduct the study, the researcher prepared Google forms to gather students' satisfaction with the learning management system and asses the problems solving skills in of Grade 11 students in learning mathematics. The Google forms include the proper explanation of what the form is all about including the informed consent/assent with the Likert scale questions for their satisfaction in LMS, and the problem-solving questions guided by the rubrics. The respondents were given 2 days to accomplish the form. The retrieval of the answers was done after the respondents submitted their responses.

Gathering and tabulation of data. With the help of the features given by Google form. The data sheet was downloaded easily. The data gathered for independent variable were tabulated. The responses for the second variable were checked by the use of the rubric mentioned in the research instrument, and with the expertise as well of the three inter-rater, which were also tabulated afterward.

The following statistical tools were utilized to analyze and interpret the result of the study.

Mean. This a descriptive statistical tool which was employed to determine the level of learning management system satisfaction and the level of problem-solving skills of the Grade 11 students in Mathematics.

Pearson Product Moment Correlation of Coefficient. This inferential statistical tool was utilized to determine the relationship between LMS satisfaction and problem-solving skills of Grade 11 students in Mathematics.

Linear Regression. This inferential tool was used to identify which among the indicators of LMS satisfaction significantly influence the problem-solving skills of Grade 11 students in Mathematics.

Results and Discussion

The analysis and interpretations of the data gathered by the researcher are presented in this chapter. The discussions are organized according to the order in which the statement of the problem is presented in the first chapter.

Level of Learning Management System (LMS) Satisfaction of Grade 11 Students

The first statement of the problem sought to determine the level of students' satisfaction with the learning management system they are using during blended learning. Table 1 presents the answer to this question.

Table 1. Summary on the Level of Learning Management System Satisfaction of Grade 11 Students

Indicators	Mean	Description
Information Quality	4.32	Very High
System and Service Quality	4.18	Very High
Perceived Ease of Use and Usefulness	4.17	Very High
Communication Quality	4.30	Very High
Overall Satisfaction	4.01	High
Overall	**4.20**	**Very High**

The level of LMS Satisfaction in terms of information quality, system and service quality, perceived ease of use and usefulness, communication quality and overall satisfaction is presented in Table 1.

Among the five indicators of the learning management system satisfaction, the respondents believed that the "*information quality"* with a mean of 4.32 and described as very high, should come first. This indicates that the LMS satisfaction of students on its information quality is always evident. This result is supported by Al Samarraie, Teng, Alzahrani, and Alalwan (2018). Information quality speaks for the current content, accuracy and sufficiency of the LMS which they further wrote that every LMS in e-learning should have these elements for the learning to be meaningful.

As teachers work hard to accomplish the learning outcomes, information and content in LMS should be aligned with those expected learning objectives. Poor information or content may result in students not learning enough and may lead to users' dissatisfaction with the LMS (De Lima, Bastos, & Bastos, 2020).

The second highest indicator of LMS satisfaction is the "*communication quality"* with a mean of 4.30 and is still described as very high and is always evident. This further means that the current LMS they are using has excellent communication features which helps them communicate with their teachers. For an LMS to be effective enough, users should be able to communicate very well with each other, especially in the learning-teaching process in the online learning environment.

Communication is defined as the process of sending information between two parties for messages to be delivered effectively. As emphasized by Ohliati and Abbas (2019), information technology has played major role in assisting organization communication effort like the schools adopting a learning management system. Hence, this makes this indicator, "*communication quality"*, very important in the satisfaction level of students in using the LMS. It makes them feel interactive with the system and with the teacher.

This finding is also supported by the study of Mantoro, Dewanti, Utami, Yudhi, and Ayu (2017) which explained that student who understands well and has good background of ICT can navigate and communicate well with the system provided by the school. This indicates that when it is easier for learners to communicate (such as to respond and to answer to activities or posted quiz) through the LMS, the better learning happens in the part of the student.

"*System and service quality"* is the third highest of LMS satisfaction with a mean of 4.18 and understood as high. With this average, the learners still believed that this indicator is as important as the other aforementioned indicators which implies that service and system quality is often evident.

The study of Alla (2013) about the system quality supports this finding which stated that the efficiency of an e-learning system can be achieved as long as there is a high level of system quality helping the users and encouraging them to use it more which will later result in achieving learning competency. Pham et al., (2019) also indicated that high-level in-service quality (like administrative and support services) makes students more loyal to the system, it encourages more time usage and makes them learn more as well.

The fourth indicator in LMS satisfaction is the "*perceived ease of use and usefulness*" with a mean of 4.17 and is understood as high which implies that it was often evident. Students' view and attitude on how easy and useful the LMS also affects their learning.

This result is in consonance with the TAM (Technological acceptance model) framework which was studied by Enu-Kwesi and Opoku (2020) but was originally introduce by Davis in 1989 which they argue that the users' attitude on how to use the LMS was influence by their perceived ease of use and perception of how useful the tool is. To put it into simple words, their interaction with the system was affected by how they think of that particular system, in this case the use of a learning management system.

The lowest indicator in LMS satisfaction is the "*overall satisfaction"* with a mean of 4.01 or high and is often evident. Although this is the lowest mean in the five indicators, this still shows that respondents believed that they are still overall satisfied with the LMS. Students' user satisfaction is important as well to look closely. User satisfaction is based as well on the four indicators mentioned. The high description indicates students' loyalty to the LMS employed which will also imply high retention in online classrooms (Dreheeb, Basir & Fabil, 2016).

As presented in Table 1 the overall mean for students' satisfaction level of LMS is 4.20 or very high. This clearly shows they have a high level of learning management system satisfaction provided by the school, and that because of this, they believe that they are learning even when they are not sitting in a traditional classroom.

This finding was also mentioned by Koh and Kan (2020) who stated that high levels of LMS satisfaction also improved online course instructional quality. In a lighter sense, respondents' satisfaction with LMS also has a big role in academic performance of the learners.

Level of Problem-Solving Skills in Mathematics of Grade 11 Students

The second statement of the problem is to determine the level of problem-solving skills of grade 11 students in learning Mathematics Table 1 presents the answer to this question. It has five indicators, which are the topics chosen in General Mathematics to measure problem solving skills of Grade 11 students. Their corresponding mean value and equivalent verbal description is also included.

Table 2. Summary of the Level of Problem-Solving Skills in Mathematics of Grade 11 Students

Indicators	Mean	Description
Rational Function	4.24	Very High
One-to-one Function	4.23	Very High
Inverse Function	4.33	Very High
Exponential Function	4.40	Very High
Logarithmic Function	3.88	High
Overall	**4.21**	**Very High**

As shown in Table 2 the item with highest level of mean is the "*exponential function"* with numerical value of 4.40 and description of very high. This data shows that the respondents have a very high level of problem-solving skills in exponential function which is always manifested. Just like any other type of functions, exponential functions can also model real-life situations which students can understand and learn from.

The high level of problem-solving skills in this item simply implies students have understood clearly and comprehensively the abstract and applied concepts of this type of function. Sawalha (2018) stated that students should be taught with exponential function through problem-solving and contextualized examples in real life to help them gasp and learn this specific item.

Examples of real-life situations which can be modeled by exponential function are the division of cells, population growth, half-life, bodily medication and compound interest in business mathematics. This specific item will let students explore more on different fields which shows growth and decay (Sawalha, 2018)

The second item with the highest level of students' problem-solving skills is all about solving "*inverse function*" with a mean value of 4.33 and a descriptive value of very high. This suggests that students learning on inverse function specifically in their problem-solving skills is always manifested. Inverse function can also be used to represent things in our day-to-day life. An example is the exchange rate of pesos and US dollar. They can understand this scenario easily if modeled in an inverse function.

With this finding, Chester (2013) suggests that examples should start at simple ideas before giving complex ones. The said author further stated that it is important that students have mastered finding the domain and range of a given function for them to be able to understand clearly how inverse function will be solved and can be applied in the real world. The very high level of problem-solving skills of the students implies that they have understood that certain things around them can be explained using inverse functions.

Solving "rational *function*" is the third item under problem-solving skills that has a very high description and with a mean value of 4.24. This data implies that the respondents also have a high level of problem solving in rational functions which is always evident. Numerous events also in the real world can be explained using rational function and with this result, it does mean that students have understood these events.

As defined by Oronce (2016) rational function with both a polynomial numerator and a denominator. In other words, if $R(x) = p(x) / q(x)$ and $p(x)$ and $q(x)$ are both polynomials, then $R(x)$ is a

rational function. Average related problems such rate, speed and average cost in business are examples of application of this type of function.

The fourth item that has the very high level of problem-solving skills of students is the item "*one-to-one function"*. It has a mean value of 4.23 which is described as very high. This description means that respondents' problem-solving skills are always manifested. This further implies that students have understood and can solve applied problems involving one-to-one function.

With the high level of problem-solving skills manifested by the students it simply means they have understood how to illustrate one-to-one function. As one numerous authors stated that these one-to-one relationships can be found all over the place. One of the most common examples of a one-to-one relationship that we witness in our daily lives is when one individual has only one passport, which is only to be used by that one person. (Albay, Batisan, & Caraan, 2016). With the numbers shown in the result it clearly implies that students have learned and understood this topic.

The item with lowest mean in determining the problem-solving skills of the respondents is solving "*logarithmic functions"* which has a mean value 3.88 and a descriptive meaning of high. Although it has the lowest mean, with its corresponding value, it can still be argued that respondents' level of problem-solving in logarithmic type of function is often manifested. In a lighter sense, students have understood concepts about logarithmic function and probably one of the reasons why their level of problem-solving is also high.

The result in this item of problem-solving skills in learning mathematics gives the additional fact that students are still learning even in the midst of a pandemic. They have understood this concept and that and they can make representation of real-life examples using logarithmic functions. Just like the other type of function mentioned in this study, problems-solving skills in logarithmic function need to be improved further.

This result of high level in solving logarithmic function somehow refutes with the study of Choon, Mohamad, Lee (2021) who stated that teachers have struggles in improving the problem-solving skills of students in distance learning. According to these authors, students have difficulty in understanding modules. It was not mentioned what type of system they have in administering their lessons, but it could be possible because of the limitation of printed materials.

Significance on the Relationship between Learning Management System Satisfaction and Problem-Solving Skills in Mathematics of Grade 11 Students

The third objective of this study is to determine if LMS satisfaction is significantly correlated to Problem-Solving Skills of Grade 11 students. Table 3 presents the answer to this objective: the corresponding value of Pearson r, significance value and decision on null hypothesis.

Table 3. Significance on the Relationship between Learning Management System Satisfaction and Problem-Solving Skills in Mathematics of Grade 11 Students

	Problem-Solving Skills in Mathematics of Grade 11 Students			
	r	p value	Decision on Ho	Interpretation
LMS Satisfaction	0.588	0.00	Reject Ho	There is a significant moderate correlation

It can be seen in Table 3 that there is a significant relationship between the LMS satisfaction and problem-solving skills in Mathematics of the Grade 11 students at p-value of 0.00. The null hypothesis is therefore rejected. It can be noted that there is a moderate positive correlation at r value of 0.588, between LMS Satisfaction and problem-solving skills in learning mathematics of the respondents.

This finding is supported by the main theory of this study, the technology acceptance model (TAM) authored by Davis in 1989 and which was comprehensively reviewed by Nguyen, Do, and Wu (2021). Accordingly, the technological acceptance of a user about a system (here is understood as their LMS satisfaction) is connected with how they perceived to use it and how much they believed it can help them, like enhancing problem-solving skills. In this study, the data shows a positive moderate correlation between the two variables, LMS satisfaction and problem-solving skills of students. In other words when there is a change in LMS satisfaction, there will be a change in the same direction in the level of problem-solving skills of students. If students are highly satisfied with the learning management system, then it is also possible that there is a high level of engagement of students in e-learning which can include proficient problem-solving skills.

Additional citations that support the relationship between the two variables are given in the study of Ouadoud et al., (2018) about cognitivism theory. It considers learning as an internal mental process rather than observable behavior. This theory also believes in the three aspects of knowledge as declarative, procedural, and conditional. The basic features in navigating the system are first taught to students, which is considered declarative knowledge. Afterward, they are trained how to use each feature, a procedural knowledge. And from time to time, questions like when and why a particular feature is to be used to help them develop conditional knowledge. This concept can be applied to solving problems in mathematics. They first need to know the recall and understanding domain of the lesson, then apply, evaluate, and judge their final answers. With this connection, LMS satisfaction and problem-solving skills make them more interrelated variables.

Regression Analysis on the Significant Influence of the Indicators of Learning Management System Satisfaction on Problem-Solving Skills in Mathematics of Grade 11 Students

The last objective of this study sought to determine which domain in LMS satisfaction of grade 11 students which significantly influences their problem-solving skills in Mathematics. Shown in Table 4 the summarized answer to this objective. It includes 5 indicators with the value of beta, significance value and decision on null hypotheses, whether each factor significantly predicts students' level of problem-solving skills.

Table 4. Regression Analysis on the Significant Influence of the Indicators of Learning Management System Satisfaction on Problem-Solving Skills in Mathematics of Grade 11 Students

	Problem-Solving Skills in Mathematics of Grade 11 Students						
LMS Satisfaction	Unstandardized Coefficients		Standardized Coefficient	t	Sig	Decision on Ho	Interpretation
	B	Std. Error	Beta				
Constant	1.630	.499		3.264	.002		

Information Quality	.159	.084	.174	1.895	.061	Fail to Reject	Not Significant
System and Service Quality	-.073	.095	-.080	-.769	.444	Fail to Reject	Not Significant
Perceived Ease of Use and Usefulness	-.032	.086	-.037	-.373	.710	Fail to Reject	Not Significant
Communication Quality	.219	.085	.229	2.585	.011	Reject	Significant
Overall Satisfaction	.347	.062	.510	5.632	.000	Reject	Significant

R=.642 R^2 =0.412 F-value=13.437 p-value=0.000

As presented in Table 4, a linear regression was used to determine the indicators of LMS satisfaction that significantly influence the problem-solving skills of Grade 11 students. The analysis showed that LMS satisfaction significantly influenced the problem-solving skills of Grade 11 students, with an F value of 13.437, and overall p -value of 0.000.

Moreover, looking into specific domains, it was found out that "*communication quality*" significantly influenced problem-solving skills of Grade 11 students with a beta value of 0.219 and "*overall satisfaction"* significantly influences students' problem-solving skills as well, with a beta value of 0.347. Therefore, the null hypothesis is rejected. The rest of indicators (information quality, system and service quality and perceived ease of use and usefulness) did not significantly predict students' problem-solving skills. Also seen in the table is the R^2 of 0.412, hence only 41.2 percent of the predictors explains the problem-solving skills of the students, the other 58.8 percent is attributed to other factors.

The obtained finding has similar results with the studies of Dreheeb et al (2016) and Ohliati and Abbas (2019). High satisfaction level of communication quality brings high LMS satisfaction and enables them to perform well in an e-learning environment. As well as users' satisfaction (overall satisfaction) predicts users' happiness and makes students learn more systematically.

However, this finding contradicts to one study that proved the perceived ease of use and usefulness of LMS influence academic achievement of the learners (Alyouseff, 2021). It also negates the study of Alla (2013) which stated that high access and usage rate, a reliable and stable LMS (system and service quality) will improve students' experience, and meet more learning competency. In the same manner, this finding rejects as well the claim of De lima et al (2020) that high satisfaction of users in information quality of LPs (learning platforms) results to high standards met in academic performance of the students.

Conclusions and Recommendations

This chapter summarizes the findings, makes inferences based on the findings, and presents recommendations based on the findings and conclusions. In this study, learning managements system satisfaction is the independent variable. On the other hand, the problem-solving skills in Mathematics of Grade 11 is the dependent variable.

The purpose of this study were to determine if there was a domain in learning management system that significantly influenced the problem-solving skills of Grade 11 students. This study also sought to

determine the level of learning management satisfaction and the level of problem-solving skills in Mathematics of Grade 11 students, the significance relationship between the learning management system satisfaction and problem-solving skills of Grade 11 students. The researcher used the descriptive correlational non-experimental method of quantitative research and invited 102 participants. To answer the main objectives, the researcher administered an adapted survey questionnaire and employed a self-crafted problem-solving test to the chosen respondents. The statistical tools used in analyzing the data were the mean, Pearson Product Moment Correlation Coefficient or Pearson r and Linear Regression.

The findings of the study are as follows:

The level of LMS satisfaction of the students was very high which is always evident. Consequently, the summarized findings are as follows: information quality, and communication quality both has very high level of satisfaction which indicates that these indicators are always evident in students LMS satisfaction, system and service quality, perceived ease of use and usefulness, and overall satisfaction has high level description which means that these indicators are often evident in LMS satisfaction of Grade 11 students.

The overall mean for problem-solving skills of Grade 11 students was very high and further indicates that the students' skills in mathematical problems is always evident. Among the 5 items being used, it was found out that when solving rational, one-to-one, inverse, and exponential function students has very high level of problem-solving skills meaning also that it almost all the time evident, and in solving logarithmic functions students problem-solving skills is often times evident.

The Pearson Moment Correlation Coefficient analysis revealed a significant relationship between LMS satisfaction and problem-solving skills of the Grade 11 students in learning Mathematics. The researcher then was able to reject the null hypothesis as a result of this.

The Linear Regression analysis showed that communication quality and overall satisfaction influences problem-solving skills of Grade 11 students in Mathematics. The researcher then was able to reject the null hypothesis that there are no indicators under the LMS that affects problem-solving skills of the Grade 11 students.

The following conclusions are provided based on the study's findings:

Students are satisfied with the accurate and complete concept provided by the LMS in their mathematics subjects and that they are enjoying the forum chats in the LMS that helps them communicate with their teachers. They also perceived that the system provides them flexible ways of learning and services that can be accessed anytime and anywhere. They highly feel that e-learning is effective with the help of LMS.

It can be noted as well that students understand and can solve rational functions specifically in solving for x variable in the rational equation. Students exhibits profound understanding in graphing exponential function and solving exponential inequality. They also excel in determining which function is one-to-one and solving the inverse of it. Moreover, they showed excellent applied skills in solving the solution sets of logarithmic inequalities.

Similarly, it can be concluded that their contentment on the given mathematical concepts and features in LMS is related to their problem-solving skills in rational function and exponential function, which they were able to graph the trend evidently. When students feel that the tool is clear and understandable to use, their problem-solving skills in graphing logarithmic functions will surely increase. Furthermore, when they feel that LMS enables them to accomplish more task easily because of its features, their understanding and applied skills in solving real-life problems like deriving formula of temperature

when the other quantity is unknown and solving equivalent value of currency in one-to-one functions will also improve. Hence, increasing overall satisfaction experience by students also increases their problem-solving skills in logarithmic function.

Lastly, communication quality and overall satisfaction influences and predicts student's problem-solving skills in learning Mathematics. The results implied that when students are satisfied with LMS because of the forum chats, feedback features which they received from their teachers, and when a LMS has video conferencing, they can perform well their solving skills on problems involving inverse and exponential functions. Data shows also that the more they believe in the effectiveness of LMS satisfaction the better they perform on their problem-solving skills in Mathematics.

The following recommendations are made to those involved beneficiaries based on the results and conclusions:

The Department of Education officials may use the results of this research to launch webinars for teachers and stakeholders on how to best improve students' problem-solving skills in both public and private schools in a distance learning specifically giving more emphasis on the focus of the curriculum in learning more examples of logarithmic functions. May they also consider including a technological acceptance curriculum in the basic education which will help private and public students to fully understand the help of technology in today's education. An example would be adding subtopics about LMS in the computer subjects.

The school heads may also utilize this to encourage and support their IT personnel and teachers, they may use the finding of this study to do school-based research and surveys which will maintain the students LMS satisfaction. They may also focus on conducting study about the domains of perceived ease of use and usefulness, on the information quality and system and service quality of the LMS satisfaction since these domains showed no influence on the problem-solving skills of Grade 11 students.

Teachers can benefit from this research by contributing more to improving LMS user experience and developing high-level problem-solving abilities. They may serve as technical support of the students to achieve these talks. Additionally, teachers may use the results of this study to create and improvise a learning plan or activity in a way for students to be highly motivated even in a distant learning. This is to address the statement with lowest mean which is "contentment on academic performance during online learning" in LMS satisfaction. They may use the findings of this study as well to look back on the discussion delivery for topic logarithmic function and for solving applied problems in this type of function which has the lowest mean in the test. May the teachers address and find best solutions for students to be happy and motivated to learn more.

Through this study, the students will be helped by their teachers, which will be able to acquire the needed learning competency, significantly improving their problem-solving skills on applied word problems in logarithmic function. They may also use this as their reference to maintain their level of trust in the learning management system used by their respective school.

Moreover, the parents, who are one of the stakeholders, may use the results of this study as a basis for them to be continuously involved in their child's education. This study may serve as another proof for them to engage in widening their knowledge of how learning management systems work so that they may be able to guide them and assist them when making assignments and interacting with their teachers to always improve their child's academic performance.

Future Researchers. For individuals/groups of individuals who seek constant learning in the field of research, they may use the findings of this study as reference in searching answers for any potential

questions they may find interesting in adapting learning management systems in education nowadays. They may also use this study as a basis to look for other factors attributed to the problem-solving skills of students.

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