

# STUDENTS PERCEIVED SATISFACTION AND ACADEMIC PERFORMANCE UTILIZING A GAMIFIED LEARNING MANAGEMENT SYSTEM FOR SENIOR HIGH SCHOOL

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**ABSTRACT** *The advancement of technology has made wider opportunities for educators to use various online platforms in delivering instruction amidst the Covid 19 pandemic. One of these is developing a gamified learning management system (LMS) for Senior High School students. Hence, this study aimed to determine the student's perceived satisfaction and academic performance upon utilizing the gamified learning management system. A pre-experimental one-group pretest-posttest design was used to investigate the effects of gamified LMS. A quantitative-descriptive design was used to gather students' perceived satisfaction. Using the purposive sampling method, students possessing android mobile phones were used as subjects for the study. The study revealed that (1) the use of gamified learning management increased students' academic achievement in learning Physical Science; (2) students have a positively perceived satisfaction with using the gamified LMS. Consequently, physics teachers are encouraged to adopt this learning modality for teaching Physical Science, and school administrators should consider introducing this learning modality to physics teachers as an alternative way of teaching Physical Science, especially to students enrolled in the Open High School Program.*

**Keywords:** gamification, multimedia elements, game elements, e-learning

## . INTRODUCTION

The Covid 19 pandemic has brought a great challenge to the education sector. Conventional ways of teaching and learning are no longer applicable and practical because of health restrictions [1]. However, Zhao [2] argued that Covid 19 pandemic is a catalyst for educational change. With this notion, the Department of Education in the Philippines is adapting to the new normal form of education [3]. Teachers were encouraged to seek ways to provide for learners' needs and found that using technology as a tool or learning support allows learners to actively receive information remotely [4].

In this regard, instruction advances to meet student's needs in this digital era and the rise of e-learning, where learning can be done anytime and anywhere. According to Bexheti et al. [5], e-learning is identified by using a learning management system (LMS), which is a system that is focused on the delivery and support of learning opportunities. LMS is a software environment designed to manage user learning interventions and deliver learning content and resources to students [6]. It facilitates packaging interactive multimedia, teaching materials, lecture assignments, online discussions, learning videos, and even interactive video conferences [7]. It reinforces the learning process through online classroom environments. It supports an inclusive learning environment for academic progress with interceding structures that promote online collaborative groupings, discussions, and communication among other LMS users [8].

Multimedia refers to various digital media types, such as text, images, sound, and video, into an integrated multi-sensory interactive presentation to convey a message or information to an audience [9]. Multimedia elements such as images, videos, texts, icons, and sounds facilitate the learning process and have become increasingly prevalent in educational settings, according to Fenesi [10].

The study of Rabiman et al. [11] revealed that using a learning management system in education increases satisfaction and quality of learning. A study demonstrated that using a mobile LMS positively influenced online students' academic achievement [12]. Further, an LMS can increase student

learning activities even online. Through LMS, student learning activities can be carried out well without any constraints on the limitations of face-to-face classes [13]. On the other hand, game elements were added to the LMS to increase students' motivation to achieve a learning goal [14]. Gamification involves using game design elements in non-game contexts [15]. It includes elements of competition, engagement, and immediate reward [16], [17]. It allows students to engage with the subject matter and information in classroom disciplines with real-world applications [18]. Researchers Cheng et al. [19] found that an LMS with gamified learning activities enhanced students' academic performance and the competencies gained, provided more diversified learning methods and motivation, and offered easy modifications for different learning needs. Similarly, Lister [20] found that incorporating gamification elements can motivate students and support student achievement, increasing class attendance and participation, which positively correlated with improved student performance. Plass et al. [21] described the incentive system of a game as a pack of motivational elements that aim to encourage players to continue their efforts and feedback that attempts to modify their behavior appropriately. Incentives can consist of scores (points), stars, badges, trophies, power-ups, and many other rewards.

Due to the unprecedented pandemic, the community lockdown and community quarantine of many countries, including the Philippines, led students and teachers to study and work from home, which led to the delivery of lessons in different modalities, i.e., modular, online, and blended learning [22]. This challenge of delivering instruction is a great motivation to develop a gamified learning management system for students learning Physical Science. Hence, this study aimed to determine the perceived satisfaction and performance of the developed gamified learning management system (LMS) in learning Physical Science. Specifically, it sought to answer the following questions:

1. What is the student's perceived satisfaction in utilizing a learning management system for Physical Science?

2. What is the student's performance level before and after utilizing the Learning Management System?

**2. Methodology**

**Research Design**

This study utilized a pre-experimental one-group pretest-posttest design similar to the study of Halim [23] to investigate the effects of a gamified learning management system on Physical Science students' academic achievement. The design included a pretest measure, an integration, and a posttest for a single group of students with no control group. A quantitative-descriptive research design similar to the study of Navarro et al. [24], [25] was used to gather students' perceived satisfaction in utilizing the gamified learning management system for senior high school.

**Population and sample size**

The study was conducted at a school in the Division of Misamis Oriental, Philippines. The study was entirely conducted online. The study used a purposive sampling method, which is a non-probability sampling method. The 35 academic track senior high school students were studied and treated as one group. The study participants officially enrolled in Physical Science during the second semester of 2021-2022.

**Data Collection and Instruments**

After developing, validating, and beta testing the gamified learning management system for Physical Science, the LMS is ready for utilization. This gamified LMS was developed and aimed to be utilized as a new learning modality for public school students. It was designed to provide a phenomenal learning experience and to increase learners' interest in learning Science anytime, anywhere.

The gamified LMS known as Phyci-Zone was installed on the students' Android cellphones. Students were given sign-in credentials, and an embedded pretest was administered to determine their initial level of academic performance.

Three experts in the field content validated the 60-item test, which was revised accordingly. The test item was pilot tested by Grade 12 students from the same school and subjected to item analysis, yielding a reliability coefficient of 0.705, suggesting that the test was good with few items to improve. Participants were required to do the task weekly, as reflected in the calendar feature. Every module starts with a 10-item pretest followed by instructional videos, module reading, and activities to perform, and ends with a posttest. There were eight modules embedded in the LMS. These were Module 1 - Models of the Universe, Module 2 - Investigating Principles Governing Motion, Module 3 - Reflection of Light, Module 4 - Phenomena of Light, Module 5 - Wave Properties of Light, Module 6 - General Relativity, Module 7 - Exploring the Consequences of Special Relativity Postulates, and Module 8 - Expanding Universe. These modules were taken from the DepEd Central Office. Participants who completed each module were given rewards and badges, as shown in Figure 1. All activities in the module have time limits based on their complexity. After each activity, feedback on participants' scores was displayed, and the leaderboard was updated, as shown in Figure 2.

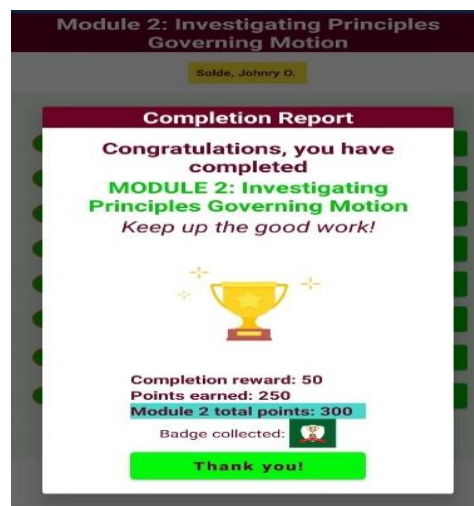


Figure 1. Rewards and Badges



Figure 2. Leaderboard

A perceived satisfaction questionnaire adopted from Navarro et al. [24] obtained a Cronbach's alpha of 0.948, indicating high internal consistency was also administered after completing the whole learning package of the gamified learning management system. The constructs were perceived enjoyment, usefulness, ease of use, behavioral intentions, the content of the learning management system, technology characteristics, task characteristics, individual characteristics, task technology fit, and perceived satisfaction.

A validated embedded pretest administered before being exposed to a gamified learning management system served as the posttest given to participants. The embedded gamified evaluation questionnaire and perceived satisfaction were also administered after the posttest. The analysis was then interpreted using the table below.

**Table 1. Range and description for perceived satisfaction of students.**

Range	Description
5.00 - 4.21	Strongly Agree
4.20 - 3.41	Agree
3.40 - 2.61	Neither Agree nor Disagree
2.60 - 1.81	Disagree
1.80 - 1.00	Strongly Disagree

Using a gamified learning management system, descriptive statistics were used to determine the mean and standard deviation of students' academic achievement and perceived satisfaction in learning Physical Science. A paired sample t-test at the 0.05 level of significance was used to determine the significant difference in the student's academic achievement before and after learning Physical Science using the Physci-Zone, a gamified learning management system.

**3. RESULTS AND DISCUSSION**

**Students' Perceived Satisfaction in Utilizing Gamified Learning Management System**

Table 2 depicts the students' perceived satisfaction in utilizing the learning management system for Physical Science. Ten constructs were used to determine the students' perceived satisfaction with the gamified learning management system. These constructs include perceived enjoyment, usefulness, ease of use, behavioral intentions, the content of the learning management system, technology characteristics, task characteristics, individual characteristics, task technology fit, and perceived satisfaction. Among the ten constructs, the respondents rated six as Strongly Agree. These were technology characteristics (4.33), perceived enjoyment (4.33), perceived satisfaction (4.31), the content of the learning management system (4.27), perceived usefulness, and individual characteristics (4.22). This means that students were satisfied with utilizing the LMS because it can be accessed through a mobile app and can perform assessment tasks virtually anywhere and at any time. The LMS was also enjoyable, entertaining, and fun, making academic learning more interesting and exciting. The LMS was also found to satisfy students' educational needs because of its up-to-date, helpful content and sufficient content for the topic.

Further, students found that the LMS made them efficient, productive, and confident using its content and operating its functions, thus, enhancing their academic performance. Previous studies shed light on these research outcomes, such as the study of Navarro et al. [24] found that task characteristics positively influence task technology fit, subsequently leading to perceived satisfaction. Duygu et al. [26] found that enjoyment is another significant predictor of students' intention toward LMS use. Lee [27] found that satisfaction positively affects continuance intention to use e-learning applications. Lin and Wang [28], Farahat [29], and Premchaiswadi et al. [30] discovered that intention to use an online learning system to learn is positively affected by perceived usefulness. Further, it indicates how important it is for the system to be perceived as user-friendly and easy to use to be perceived as useful by its users. This means that if students consider it easy to use an LMS, they feel that using an e-learning system is more useful [26]

In different circumstances, four constructs were rated Agree by the respondents. These constructs were perceived ease of use (4.0), technology characteristics (4.09), behavioral intention (4.12), and task technology fit (4.14). This means that students found the app easy to understand, flexible, and effortless during online education. The LMS's tasks were not replicated and has no routine task. However, it requires collaboration with others in their coursework. Further, students found that the LMS was well suited to the way they study because the LMS was user-friendly and easy to learn. Thus, they suggest LMS during online education in the future. Recent studies supported these outcomes, such as the work of Abdel-Maksoud [31], where he found that perceived ease of use and perceived usefulness are significant predictors of satisfaction. He further discussed that ease of use of new technology is the more important determinant of the acceptance of this new technology, which stresses the need to design user-friendly technologies that do not require any physical or mental effort on the part of users. Hilmi *et al.* [32] discussed that to better understand students' behavioral intention to use the LMS for their e-learning activities, the LMS must be easy to use, thus increasing their learning potential. McGill and Klobas [33] study results supported the importance of task-technology fit, which directly and indirectly influenced the perceived impact on learning via the utilization level. It also strongly influenced the perceived impact of the LMS on learning. It only had a weak impact on outcomes in terms of student grades. Lin and Wang [28] results reveal that the information quality and task technology fit to influence the confirmation of system acceptance. Similarly, Isaac et al. [34] found that task technology fit positively influences performance, mediates associations between satisfaction and practical usage in one case and performance in another.

Generally, the Physci-Zone gamified learning management system for senior high school was able to meet its primary goal of giving students an alternative way of learning. Since the respondents were coming from a public school, learning through an LMS was new to them, unlike students from private schools. Through the LMS, students found their learning meaningful because they were in charge of their learning. They were satisfied with utilizing the Physci-Zone and responded positively to the new way of learning, thus, giving this research project a huge success.

**Student's performance level before and after utilizing Gamified Learning Management System**

A paired t-test was performed to test if there was a significant difference in the students' performance before and after utilizing the gamified LMS. Table 3 shows the result of the paired sample t-test where the students' performance before utilizing was  $M=18.2, SD=10.4$ , and after utilizing the learning management system was  $M=32.6, SD=16$ . This proved that the performance of the students after utilizing the gamified learning management system was statistically higher than before utilizing the learning management system. Therefore, utilizing the gamified LMS in learning Physical Science significantly increased students' performance.

**Table 2. Students' perception in utilizing the gamified LMS for Physical Science**

<b>Constructs and measures</b>	<b>Mean</b>	<b>SD</b>	<b>Description</b>
<b>Perceived Enjoyment</b>			
Using LMS is enjoyable.	4.54	0.505	Strongly Agree
Using the LMS system is entertaining.	4.43	0.558	Strongly Agree
Using the LMS system is fun.	4.4	0.695	Strongly Agree
Using the LMS system makes academic learning more interesting.	4.26	0.505	Strongly Agree
Overall, I find the system exciting.	4.03	0.954	Agree
<b>Sub - Mean Perceived Enjoyment</b>	<b>4.33</b>	<b>0.442</b>	<b>Strongly Agree</b>
<b>Perceived Usefulness</b>			
Using the Learning Management System (LMS) will enhance my academic performance during online education.	4.23	0.598	Strongly Agree
Using the Learning Management System (LMS) will enhance my efficiency during online education.	4.14	0.692	Agree
Using the Learning Management System will enhance my productivity during online education.	4.06	0.725	Agree
Using the Learning Management System will be beneficial for me during online education.	4.26	0.657	Strongly Agree
Using the Learning Management System provides new ways of learning.	4.43	0.558	Strongly Agree
<b>Sub-Mean Perceived Usefulness</b>	<b>4.22</b>	<b>0.504</b>	<b>Strongly Agree</b>
<b>Perceived Ease of Use</b>			
Learning to use the Learning Management System during online education is easy.	4.17	0.707	Agree
Using the Learning Management System during distance online education was easy to understand	3.94	0.838	Agree
Using the Learning Management System during online education was flexible.	3.97	0.857	Agree
It is effortless to use the Learning Management System during online education.	3.69	1.25	Neither Agree nor Disagree
This Learning Management System improves the quality of learning.	4.23	0.69	Strongly Agree
<b>Sub-Mean Perceived Ease of Use</b>	<b>4</b>	<b>0.681</b>	<b>Agree</b>
<b>Behavioral Intention</b>			
I will use a Learning Management System during online education in the future.	3.94	0.765	Agree
I would suggest using a Learning management system during online education in the future.	4.11	0.718	Agree
Learning management is of benefit to me.	4.29	0.622	Strongly Agree
I have no objection to using a Learning Management System for educational learning.	4.14	0.692	Agree
<b>Sub - Mean Behavioral Intention</b>	<b>4.12</b>	<b>0.58</b>	<b>Agree</b>
<b>Content of the Learning Management System</b>			
The Learning Management System provides up-to-date content on the provided topic, quiz, assignment, discussions, etc.	4.31	0.631	Strongly Agree
The Learning Management System provides helpful content for the topic, quiz, assignment, discussions, etc.	4.11	0.963	Agree
The Learning Management System provides sufficient content for the topic, quiz, assignment, discussions, etc.	4.26	0.701	Strongly Agree
The content in the Learning Management Systems is relevant.	4.23	0.646	Strongly Agree
The content in the Learning Management Systems is readable.	4.57	0.558	Strongly Agree
The content in the Learning Management Systems is accurate.	4.26	0.657	Strongly Agree
The content in the Learning Management Systems is concise and to the point.	4.11	0.993	Agree
<b>Sub-Mean Content of the Learning Management System</b>	<b>4.27</b>	<b>0.556</b>	<b>Strongly Agree</b>
<b>Technology Characteristics</b>			
This Learning Management System offers me the ability to receive information and perform assessment tasks from virtually any location.	4.51	0.562	Strongly Agree
This Learning Management System offers me the ability to receive information and perform assessment tasks from virtually any location at any time.	4.31	0.583	Strongly Agree
This Learning Management System can be accessed on mobile devices through a mobile app to represent information in ways appropriate to me.	4.46	0.561	Strongly Agree
Learning Management Systems can also be subject to frequent problems and crashes.	4.34	0.539	Strongly Agree
<b>Sub - Mean Technology Characteristics</b>	<b>4.41</b>	<b>0.485</b>	<b>Strongly Agree</b>
<b>Task Characteristics</b>			
Using this Learning Management System, I frequently deal with different assessment tasks.	4.37	0.547	Strongly Agree
Some tasks given to me have never been replicated before	4.2	0.632	Agree
The task problems I cope with often involve more than one assessment task	4.2	0.677	Agree
I frequently deal with no routine task problems.	3.91	0.818	Agree
I have to collaborate with others in my coursework.	3.83	1.1	Agree
My coursework requires frequent coordination with the efforts of others.	4	0.874	Agree
<b>Sub - Mean Task Characteristics</b>	<b>4.09</b>	<b>0.627</b>	<b>Agree</b>

<b>Individual Characteristics</b>			
Using a Learning Management System (LMS) in my studies is pleasant.	4.23	0.646	Strongly Agree
My frequent use of LMS is good.	4.2	0.632	Agree
All things considered, the Learning Management System (LMS) in my studies is beneficial.	4.2	0.677	Agree
Using this Learning Management System in my studies is great.	4.17	0.618	Agree
I feel confident using the Learning Management System.	4.17	0.707	Agree
I feel confident operating the Learning Management System functions.	4.2	0.677	Agree
I feel confident using Learning Management System contents.	4.34	0.639	Strongly Agree
<b>Sub - Mean Individual Characteristics</b>	<b>4.22</b>	<b>0.563</b>	<b>Strongly Agree</b>
<b>Task Technology Fit</b>			
The Learning Management System (LMS) is well suited to the way I have to study.	4.11	0.758	Agree
The Learning Management System (LMS) is well suited to all aspects of my study.	4.09	0.702	Agree
The Learning Management System (LMS) is easy to use.	4.14	0.879	Agree
The Learning Management System (LMS) is user-friendly.	4.29	0.622	Strongly Agree
Using the LMS is easy to learn.	3.86	0.845	Agree
Using the LMS provides me with updated information.	4.14	0.733	Agree
This Learning Management System (LMS) provides the information I need in time.	4.09	0.887	Agree
This Learning Management System (LMS) provides output about exactly what I need.	4.09	0.612	Agree
The Learning Management System (LMS) is appropriate in assisting me in accomplishing my academic assignments.	4.23	0.598	Strongly Agree
The Learning Management System is necessary for my academic tasks.	4.37	0.598	Strongly Agree
<b>Sub-Mean Task Technology Fit</b>	<b>4.14</b>	<b>0.539</b>	<b>Agree</b>
<b>Perceived Satisfaction</b>			
The LMS satisfies my educational needs.	4.2	0.632	Agree
I learned new things in this LMS.	4.4	0.553	Strongly Agree
This LMS fulfilled my expectations.	4.29	0.622	Strongly Agree
I am overall satisfied with this LMS.	4.37	0.598	Strongly Agree
<b>Sub - Mean Perceived Satisfaction</b>	<b>4.31</b>	<b>0.526</b>	<b>Strongly Agree</b>

**Table 3. Paired sample t-test for the student's performance before and after utilizing the Physic-Zone LMS for Senior High School**

Students' Performance	Mean	SD	SE Mean	d	T	df	p
Pretest	18.2	10.4	1.76	-	-	3	< .001
Posttest	32.6	16	2.7	0.76	4.5	4	

\*significant at p < .05 level

This result was consistent with the study findings of Arulchelvan [35] and Fernandez-Soriano et al. [36], which found that the overall performance of a student using an e-LMS significantly increased. Bere et al. [37] study revealed that eLearning using LMS is more effective than traditional instruction methods concerning improving the performance of teaching and learning in higher education. Zhang et al. [38] concluded that the LMSs could be used to predict students' success and stimulate better results during the study. Similarly, Bester and Brand [39] stated that using a technology environment in teaching and learning helped maintain student concentration, which likewise increased their academic achievement.

**4. CONCLUSIONS AND RECOMMENDATIONS**

It was evident that the students positively perceived satisfaction with using the gamified PhySci-Zone Learning Management System and an increased students' academic

achievement in learning Physical Science. Hence, physics teachers are encouraged to adopt this learning modality for teaching Physical Science, and school administrators should consider introducing this learning modality to physics teachers as an alternative way of teaching Physical Science, especially to students enrolled in the Open High School Program.

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