The Development of a Proposed Learning Management System for Senior High Schools in the Philippines

Maria Salud M. Delos Santos*, Dennis C. Durano, and Arlene D. Hortillosa

***Abstract*—In the Philippines, one can find learning materials for various curriculum areas for all levels (Kindergarten up to Grade 10), which are already available online except for Grades 11 and Grade 12. This lack motivated the researchers to conduct the study that aimed to design and develop a learning management system (LMS) for senior high schools, specifically Grade 11, in selected regions in the Philippines. The study used the descriptive-survey method to acquire user requirements from 3072 stakeholders consisting of a cross-section of randomly sampled principals, teachers, and students. The researchers used the agile approach for the system development. The findings revealed that learning in senior high schools was done in large classrooms (according to the principals) that were not conducive to learning (as shared by the teachers). The students revealed that their teachers do not come to class prepared and do not make the lessons enjoyable. Based on the features desired by the principals, teachers, and students, an LMS is developed as the final output of the study. The study concludes that an LMS for senior high schools needs to be developed to make teaching and learning in senior high schools bearable, relevant, and ready for the Fourth Industrial Revolution. The study recommends evaluating the designed LMS regarding acceptability, functionality, and scalability.**

***Index Terms*—Agile development, K12 implementation, learning management system, senior high schools**

I. Introduction

In the Philippines, the government has constantly made efforts to improve Filipinos quality of education. Quality education at par with international standards was the primary aim of Republic Act No. 10533, passed on May 15, 2013, which established the K-12 program that added Grades 11 and 12 as the senior high school stage of the 13-year enhanced basic education system. Bermudez [1] reports that before this, the Philippines was the only country in Asia and one of the three countries in the world (the others were Angola and Djibouti) with a 10-year basic education program.

Whether the country is ready to embrace the K to 12 Program is already a thing of the past. The Department of Education, for the first time, implemented 2016-2017 the K-12 Basic Education Program (BEP) in the whole country. Everybody was a first-timer and groped his way in the implementation, from curriculum to infrastructure to budget. So much work still needs to be done. Unforeseen challenges along the way are to be expected, one of which is the monitoring and evaluating of the management of the K to 12 Program. Problems such as oversized classrooms not conducive to learning and teachers not coming to class prepared, and not making the lessons enjoyable enough is just among the concerns to address. Five years have passed, and it is along this premise that this research is undertaken. The five-year period between 2016 and 2021, often referred to as the K to 12 transition, presents significant challenges not just to the basic education sector but also causes a ripple effect on other sectors. It is also a once-in-a-generation window of opportunity for the reform of the country's entire education landscape (Commission on Higher Education [2]).

The Central Visayas region and the Negros Island region are two regions in the Philippines whose senior high school students have been greatly affected by the K-12 BEP implementation. It has been noted on the official website of DepEd that one can find learning materials for various curriculum areas for all levels (Kindergarten up to Grade 10), which are already available online except for Grade 11 and Grade 12 (given in Fig. 1), the start of senior high school since it is only on its first year of implementation. This lack of learning materials further strengthens the need for the study. Kindly refer to Fig. 1.

Source: http://lrmds.deped.gov.ph/k_to_12
Fig. 1. The K to 12 Grade Level Ladder.

This study aimed to design and develop a learning management system for senior high schools in two regions in the Philippines, specifically Grade 11. Specifically, it aimed to present a profile of the K to 12 Senior High School implementation experience in the two regions, identify the problems encountered by the principals, teachers, and students in the implementation, and determine the desired features of a sound learning management system (LMS) for senior high schools (SHS).

The design, development, and proposed implementation guidelines of the Learning Management System (LMS) for senior high schools in the Philippines were based on the study's findings. The impact of this LMS will be the basis for the senior high schools' future planning and effectively

Manuscript received June 16, 2022; revised August 6, 2022; accepted November 4, 2022.

M.S. Delos Santos is with the Cebu Technological University Main, Cebu City, Philippines.

D. C. Durano works with the University of Cebu, Cebu City, Philippines.

A. D. Hortillosa is with the Iloilo Science and Technology University, Burgos St., La Paz, 5000 Iloilo City, Philippines.

*Correspondence: marissalud.delossantos@ctu.edu.ph (M.S.M.D.S.)

doi: 10.18178/ijiet.2023.13.3.1823

implementing of a flexible learning delivery mode.

II. Learning Management Systems

A brief discussion of the available learning management systems is given in the succeeding paragraphs and ends with creating an LMS.

A traditional classroom-based method is becoming less and less effective as technology advances, digital materials become more widely used, and the needs of modern learners change. To address the problem, schools and colleges are implementing Learning Management Systems that enable teachers to implement various pedagogical methods, deliver personalized learning, and engage and connect students [3, 4].

According to Bradley [5], as schools integrate the usage of an LMS, it is suggested that LMSs are made a functional necessity. LMS administrative administration approaches should include enabling profile features, curriculum guidelines, assignment management guidelines, discussion boards, writing resources, and instructor updates. Users of the LMS should have synchronous or asynchronous access to material and information distributed by the instructor.

LMSs offer many advantages to the learning institution that uses them. Abogamous [6] said that LMSs help such institutions manage the information required for planning and making informed decisions. However, Abogamous cautioned that higher learning institutions remain hesitant to adopt LMS projects. Such systems are relatively recent additions to educational institutions; thus, there are inevitable roadblocks to adoption.

There are already several learning management systems out in the market. Some are free to use, while some are for a fee. A review of the most recent and utilized LMS is done to establish and differentiate the current study from what is already available.

One of the emerging and latest learning management systems is Canvas, a Web-based learning management system developed and published by Instructure, Inc., educational technology business with a website at www.instructure.com. CAO [7] reported that sixteen states in the United States, in August 2020, announced cooperation with Instructure to implement its Canvas LMS platform for their educational institutions as a statewide answer to the issues posed by the global COVID-19 pandemic, allowing educators and students to receive better support.

Blackboard Learn is another learning management system that is a cloud-based LMS that may be utilized in a classroom setting for students of all ages on PCs, tablets, and mobile devices. Blackboard Inc., an educational technology business, develops it. Additionally, it is a mobile communication tool for keeping parents updated on their children's progress. Rahmatullah [8].

Moodle, Belova [9] said, is a PHP-based (Hypertext Pre-processor is a general-purpose scripting language used to develop dynamic and interactive websites) learning management system (LMS) that is free and open-source. It is released under the General Public License. Moodle has pioneered several features that are now regarded as the standard for learning management systems, with a calendar and a gradebook as an E-learning tool. Schoology is a cloud-based learning management system founded in 2009 by three University of Washington undergraduate students in St. Louis. It includes resource folders, tracking systems, and communication applications that teachers and students in K-12 schools can use. Parents, instructors, and students can use Schoology accounts for free. However, Rojabi [10] states that "a license is necessary if a school wants to combine data from the platform with its other applications."

One of the favorite LMSs around is Google Classroom. According to Vasanth and Sumathi [11], it is a cloud-based learning management system that lets teachers create assignments, announcements, and even formative questions for students to respond to. Teachers can observe how students are doing on their projects in Google Classroom and provide real-time feedback to students while they are online. Furthermore, Google Classroom is free for all schools, whereas most LMS platforms are expensive. As a result, this is a significant benefit for schools that wish to become more digitally integrated and high-tech.

Emiroğlu [12] describes Edmodo as a free (open source) online platform emphasizing collaboration and social media to personalize learning. Specifically created for use in the classroom. Homework, evaluation, discussion, and mobile learning tools are all available on the platform. (K-12 Blueprint Learning Management System (LMS) Guide, 2014) Communities connect teachers to a global network of educators.

Chahal [13] states that the goal of a learning management system (LMS) is "to provide a smooth online teaching-learning environment for students and teachers, to create a value-based online platform that promotes the growth of all stakeholders and assists students in achieving success through skill development."

III. Theoretical and Conceptual Framework

This research utilized the learning management system framework applied by the Center for Educational Leadership and Technology (CELT) in Massachusetts. Phillipo and Krongard [14].

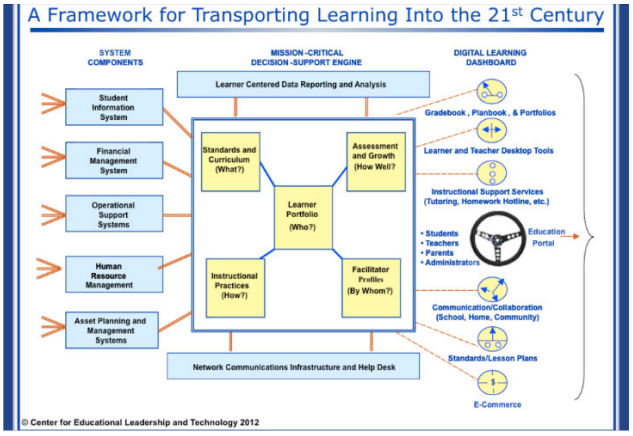


Fig. 2. Research Framework (A) of the learning management system.

A framework for transporting learning into the 21st century is depicted in Fig. 2. It joins system components, namely student information, financial management, operational

support, human resource management, and asset planning and management, with a mission-critical, decision-support engine. Learner-centered data reporting, analysis, and network communications infrastructure are visible on the dashboard.

The details of the decision-support engine in Fig. 2 are given in Fig. 3. It centers on the learner portfolio and revolves around the following interplaying factors: standards and curriculum (the "what"), instructional practices (the "how"), assessment and growth (the "how well"), and facilitator profiles (the "by whom").

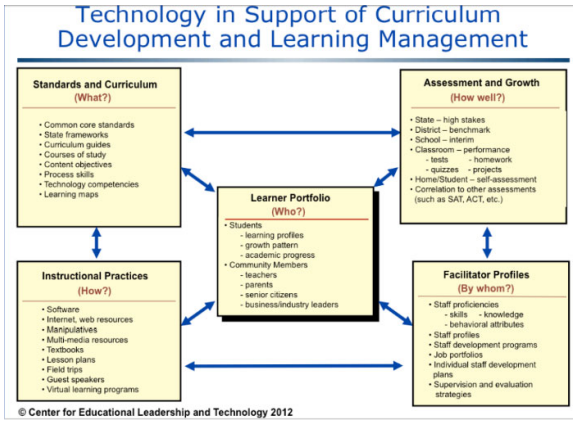
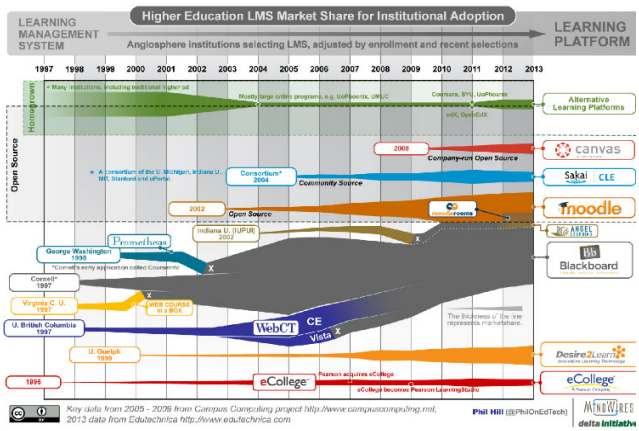


Fig. 3. Research Framework (B) of the learning management system.



Source: https://www.semanticscholar.org/paper/The-Current-Ecosystem-of-Learning-Management-in-and-Dahlstrom-Brooks/eb94303cad0416c2743d81e331b988db37f02e04

Fig. 4. Higher education LMS market share 2013.

Excellent literature on the learning management system is done by Dahlstrom *et al.* [15] of EDUCAUSE, a nonprofit association and the foremost community of IT leaders and professionals committed to advancing higher education. The study explored faculty and student perspectives on learning management systems in the context of current institutional investments. The study's key findings triangulate the experiences of the LMS user populations (students and faculty) with data from the CDS about reported institutional practices.

The study recommends that for those concerned with creating this customized world for LMS users, it is helpful to consider the current state of faculty and student LMS experiences, their interests, and how they interact with these systems. The analysis of the status and future of the LMS in higher education provides insight into the evolution of the LMS from the past to the present. It also projects the needs of these systems' features and operational functions in the near-term and long-term future.

In higher education, the ecosystem of LMSs is illustrated in Fig. 4. According to Dahlstrom *et al.* [15], on average, LMSs have been in place for eight years, and 15% of US higher education institutions are currently planning to replace their LMS within the next three years. The main motivations for updating these systems are to upgrade functions (71%), replace legacy systems (44%), and reduce costs (18%).6 With the LMS market more competitive than ever and increased consumer demand for enhanced features and operational functions, the industry is ripe for the next generation of digital learning environments to hit the market.

The conceptual framework of the study is illustrated in Fig. 5. It moves along the triangulation of the input coming from senior high school through the principal and the teachers, the students, and their parents into the design, development, and implementation of a good, relevant and timely learning management system for senior high schools.

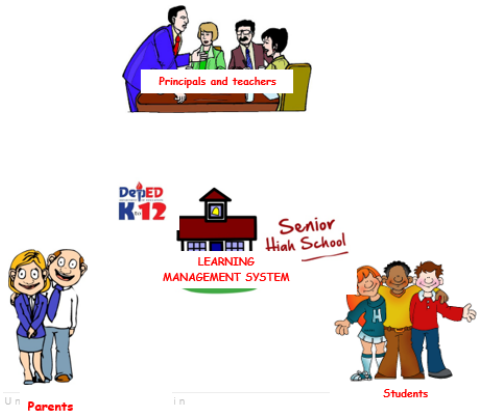


Fig. 5. Conceptual framework of the study.

It is along this conceptual framework that the study is guided and implemented.

IV. Research Methodology

The research utilized the descriptive-developmental method using questionnaires, interviews and focus group discussions, and agile software development. The study ran for two years in the following phases: the stakeholder's assessment phase, the software development phase, and the training on and implementation of the learning management system for senior high schools. The paper focuses on the first two phases.

A. Stakeholders Assessment Phase

Phase 1, the stakeholder's assessment phase, was the needs assessment period that was input to designing and developing the learning management system for senior high schools. It utilized the descriptive-evaluative-survey method using questionnaires, follow-up interviews, and focus group discussions among principals, teachers/ staff, and students who were chosen using stratified random sampling in each of the senior high schools in the two regions in the Philippines. A total of 3,072 respondents participated and were distributed among 208 principals, 876 teachers, and 1,988

students from both public and private senior high schools. Table I gives the details of the distribution by location.

TABLE I: DISTRIBUTION OF RESPONDENTS

LOCATION	STUDENTS	PRINCIPALS	TEACHERS	TOTAL
BOHOL	495	50	104	649
CAMOTES	47	4	25	76
CEBU PROVINCE	454	45	228	727
CEBU CITY	207	22	106	335
NEGROS ORIENTAL	398	49	228	675
NEGROS OCCIDENTAL	319	30	153	502
SIQUIJOR	68	8	32	108
TOTAL	1,988	208	876	3,072

The quantitative data gathered from the research instruments were analyzed using descriptive statistics, namely frequency counts and percentages, to determine the problems encountered and the desired features of a good LMS. On the other hand, qualitative data gathered from the interviews and focus group discussions were analyzed using thematic analysis, where transcripts were read and reread, significant statements were derived, and formulated meanings arrived. Finally, themes were generated.

B. Software Development Phase

Phase 2 of the research project is designing and developing the learning management system (LMS) for senior high schools. The results of the survey on the features desired by the principals, teachers, and students in Phase 1, were bases for the LMS development. The LMS has its web hosting. The user and system specifications of the LMS are anchored on the study's findings. These make the LMS unique and different from what is available in the market/online. It is not a "one-size-fits-all" creation. This also is the focus of the presentation of the research.

V. RESULTS AND DISCUSSION

The discussion focuses on the problems encountered by the stakeholders in implementing the K12 program, the desired features of a good LMS, and the design of the learning management system.

A. The Stakeholders' Assessment Phase on the Problems Encountered

One can see in Table II the results of the problems encountered by the senior high school principals, teachers, and students in their K12 implementation experience. Based on the data, principals revealed that large classrooms topped their list. Meanwhile, most teachers identified classrooms not conducive to learning as their foremost concern. Finally, the students indicated that their teachers must come to class prepared to make the lesson enjoyable. These could very well be addressed by the design of the LMS for senior high schools.

Findings of Ednave, Dizon, Calbi, *et al.* [16] stated that the implementation of the K to 12 programs presented the following challenges: a) lack of preparation and professional development; b) excessive academic burden on students; and c) integration of lessons in the real-life context. It would be a tremendous challenge for all teachers to engage in different training and pursue higher education to manage the changes and ensure that their growth corresponds to the demands of society.

TABLE II: PROBLEMS ENCOUNTERED BY THE STAKEHOLDERS

Stakeholder	Problems Encountered	%
Principals	Difficulty in dealing with tasks and managing school and personnel	20%
	Learning materials are not available or not enough	18%
	Oversized classes in a classroom	40%
	Lack of Classrooms	35%
	Delay in the delivery of learning materials	32%
Teachers	Learning materials are not available or not enough	20%
	Increase in teaching-related duties such as checking exams and works, computation of grades, and other related duties	30%
	Oversized classes in a classroom	34%
	Classrooms are not conducive to learning	38%
Students	Students don't have enough money for course materials	9%
	Classrooms are not conducive to learning	41%
	Delay in the delivery of learning materials.	12%
	Learning materials are not available or not enough.	20%
	Teachers do not make the lesson enjoyable.	47%
	Teachers come to class not prepared.	57%

B. On the Desired Features of a Learning Management System

TABLE III: DESIRED FEATURES OF A LEARNING MANAGEMENT SYSTEM

Stakeholder	Desired Features	%
Principals	Organizes learning content in one location	70%
	Unlimited access to learning materials	70%
	Easily tracks learner progress	
	Ease of delivery on a variety of assessments and other eLearning patterns	76%
	Course and personnel management	70%
		40%
Teachers	Organizes learning content in one location	49%
	Unlimited access to learning materials	59%
	Easily tracks learner progress	
	Ease of delivery on a variety of assessments and other eLearning patterns	61%
		71%
		34%
Students	Organizes learning content in one location	51%
	Unlimited access to learning materials	
	Easily track learner progress	47%

Given in Table III are the desired features of a sound learning management system suggested by the principals, teachers, and students in the different senior high schools in the two regions in the Philippines. The principals would want the LMS to track the learner's progress easily. Meanwhile, the teachers desired ease in delivering a variety of assessments and other eLearning patterns as their top features. The students identified unlimited learning materials as their most desired feature. This can be very well addressed in the design of the LMS. The details of the desired features are presented in Table III.

It can be gleaned from Table III that the principals and students agree on their top desired feature of an LMS, which

is "unlimited access to learning materials," with 76% of the principals and 51% of the students in favor. Meanwhile, the teachers considered "ease of delivery on a variety of assessments and other eLearning patterns" as their top desired feature of an LMS. These are being considered in the design and development of the LMS.

Chahal [13] (2021) states that the goal of a learning management system (LMS) is "to provide a smooth online teaching-learning environment for students and teachers, to create a value-based online platform that promotes the growth of all stakeholders and assists students in achieving success through skill development."

C. Design of the Learning Management System

The LMS is developed using agile software development based on the features desired by the principals, teachers, and students. The principals want the LMS to track the learner's progress easily; the teachers preferred ease in delivering various assessments and other eLearning patterns, and the students identified unlimited learning materials as their most desired features. The LMS developed has an administrator to manage, maintain and update the learning materials of the K12 Basic Education Program, specific to Grade 11. In addition, instructors can create and deliver content, monitor student participation, and assess student performance. The LMS also enables learners to upload assignments, and projects, take assessments and view their performance.

D. Computer System

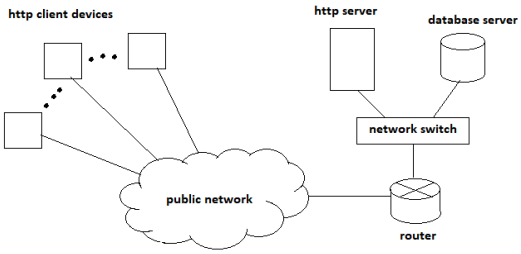


Fig. 6. Distributed network diagram.

The system is designed to be mounted on an HTTP server (webserver) with a complementing database service. Thus, it works on a distributed network (a data communication technology where clients and servers are not strongly dedicated to each other connectively), making it accessible to the broader service coverage. This is the primary intention of how the system will be deployed to enable delivering senior high school institutions to supplement their semi-automated teaching-learning-management processes through the internet. This is illustrated in Fig. 6.

E. Hardware Requirements

Due to the nature of the intended deployment platform, the hardware is specifically confined to the user for software development. The developers used regular personal computers such as laptops for mobility, pocket wifi routers for internet connection, printers to generate a hard copy of the codes for team review and documentation, and an LCD projector for presentation and team review.

Personal Computer Specifications

Processor	Intel Core i5 (latest stable generation) not less than 2.4 GHz
Memory	8 gigabytes or more
Wireless Network Adapter	IEEE 802.11 b/g/n
Removable Storage	USB Flash Drive or hard drive
Internal Storage	1 terabyte
Operating System	Windows 10 or higher

Pocket wifi Specification

Form	LTE Mobile wifi
Speed	LTE FDD 150 Mbps / LTE TDD 112 Mbps
Battery	1500 mAh
Communication System	LTE FDD / LTE TDD / UMTS / HSUPA / HSPA +GSM / GPRS / EDGE

Printer Specification

Printing Resolution:	720 x 720 dpi
Paper Formats:	A4, Letter, User defined, Legal
Printing Speed	ISO/IEC 24734: 8,5 pages/min Monochrome, 4,5 pages/min Colour

F. Software Requirements

The following software was used for the development of the codes, generation of the documents, localized testing, and deployment:

Operating System	Windows 10/Linux
Local Web Server	Node.js version 10+
Local Database	MySQL version 8.0
Database manager	MySQL Workbench 8.0
Version-control	Git
Image Management	Photoshop

G. Functional Decomposition Diagram

Given in Fig. 7 is the functional decomposition diagram. The learning management system for senior high schools is broken down into management, transaction, report, and notification. There are three accounts, namely, principal, teacher, and student. A class contains the class record, the activities, the assessment, and the assignment. Generation of reports is possible for grade sheets, attendance, and achiever's list.

H. Use Case

From Fig. 8 to Fig. 12, they are the details of the use case for the admin module, teacher module, student module, and all users of the module.

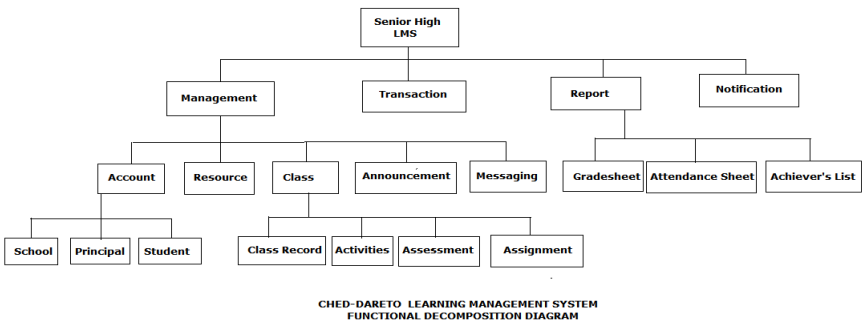


Fig. 7. Functional decomposition diagram.

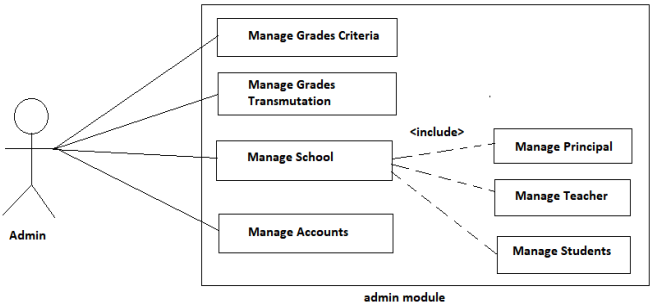


Fig. 8 Admin module use case.

The Admin module manages the school and the accounts for the principal, teacher, and students. It also works the grade criteria and transmutation. Refer to Fig. 8.

Likewise, the principal account manages the teacher, student, schedule loading, and class sectioning. This is seen in Fig. 9.

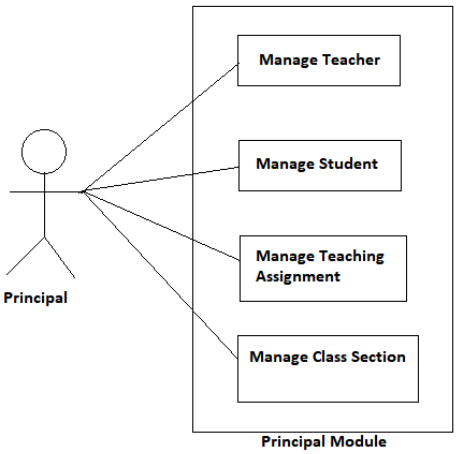


Fig. 9. Principal module use case.

The teacher account manages classes in terms of lessons, assessments, and assignments. Most importantly, it is the one in charge of the class record.

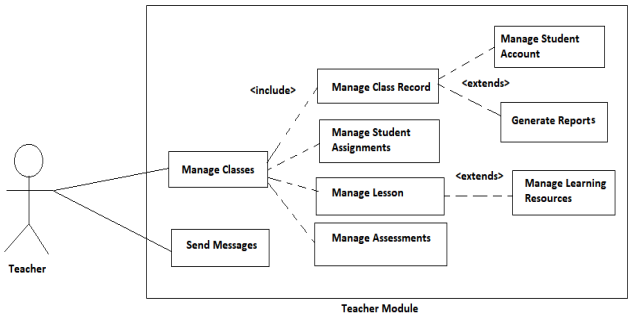


Fig. 10. Teacher module use case.

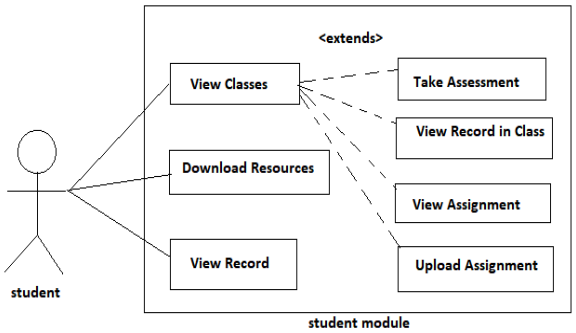


Fig. 11. Student module use case.

Meanwhile, in terms of the student account, a student can view his classes and take exams, view his grades, download resources and learning materials, and upload/ submit his assignments, as seen in Fig. 11.

All users can manage their accounts, post resource links, send messages and receive notifications. These are illustrated in Fig. 12.

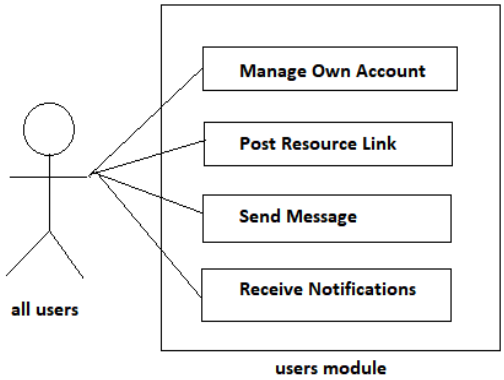


Fig. 12. All users use the case.

I. Database Design

There are twelve (12) tables in the system; due to the complexity of the entity relationship, the database design is presented in two figures. The user table consolidates the admin, principal, teacher, and student accounts. A principal is assigned to every school creation, and the system generates a separate schema. This contains the school calendar, assessment, class record, lessons, learning and teaching resources, and class sections. Student record tables and achievements are referred to as the shared repository that can be accessible to all other senior high school institutions.

The generated schema is directly accessible by the principal. Thus, each school can contain unique content as perceived by the assigned principal. However, some recommended standard information, such as standardized grading formats and policies, are referred to as the central repository, which can only be updatable by the admin, a person assigned by the Department of Education.

The system also allows communication among teachers, principals, and students. Enabling them to discuss topics, send notifications, and post important announcements. This conversation is stored on a table and can be moderated by principals and admin.

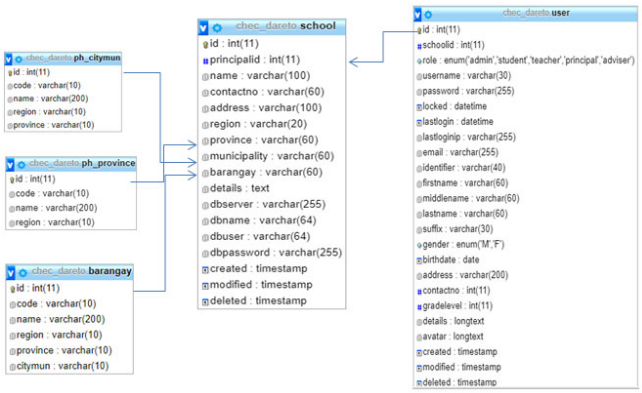


Fig. 13. ERD for school, subject, section, strand, and track.

The database design for the learning management system is given in Fig. 13 and Fig. 14.

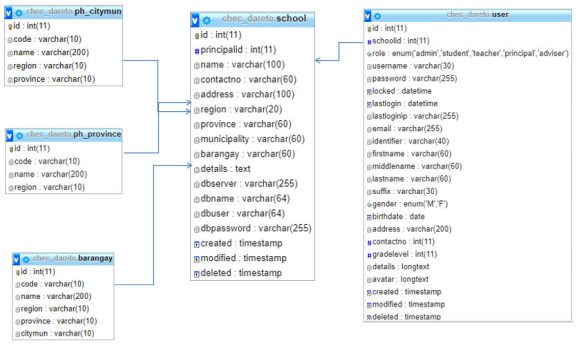


Fig. 14. ERD for school and user.

TABLE IV: FEATURES OF THE LMS THAT CAN POSSIBLY ADDRESS THE PROBLEMS ENCOUNTERED BY THE STAKEHOLDERS

Stakeholder	Problems Encountered	Solution/s (*LMS Features*)
Principals	Difficulty in dealing with tasks and managing school and personnel Learning materials are not available or not enough Oversized classes in a classroom Lack of Classrooms Delay in the delivery of learning materials	Online school management module. Online Learning Resource management module
Teachers	Learning materials are not available or not enough. Increase in teaching-related duties such as checking exams and works, computation of grades, and other related duties Oversized classes in a classroom Classrooms are not conducive to learning	Online Learning Resource management module Online assessment delivery, grade computation, and learner monitoring A provision for a blended learning feature
Students	Students need more money for course materials. Classrooms are not conducive to learning. The long delay in the delivery of learning materials Learning materials are not available or not enough Teachers do not make the lesson interesting Teachers come to class not prepared	Online Learning Resource management module Online Learning Resource management module Learning materials can contain various learning and teaching resources that can be shared among faculty teaching the same subject.

Table IV matches the problems revealed by the stakeholders in Table II with the features of the LMS desired by the stakeholders in Table III that can address such issues.

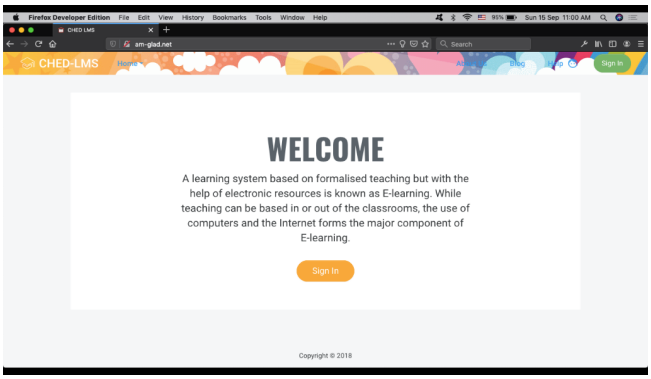
VI. CONCLUSION

There is a need for an LMS for senior high schools, which the researchers based on the problems with the K12 implementation and the desired features of a good LMS from the principals, teachers, and students. The LMS was designed and developed to make teaching and learning in senior high school bearable, relevant, and ready for the Fourth Industrial Revolution.

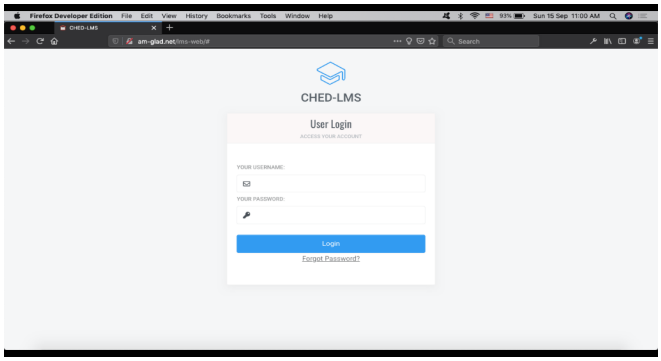
Recommendations for further study include monitoring and evaluation of the K12 program in terms of the attainment of its objectives, the satisfaction of the learners, the teachers, and administration, and improvement and enhancement of the current learning management systems being used, most especially in these pandemics and health crisis the world is in.

APPENDIX

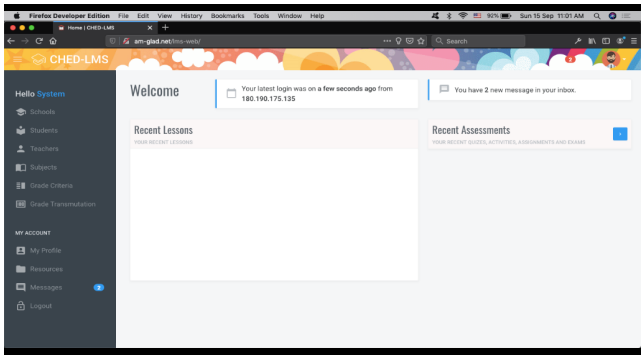
Screenshots of essential features of the learning management system are presented herein.



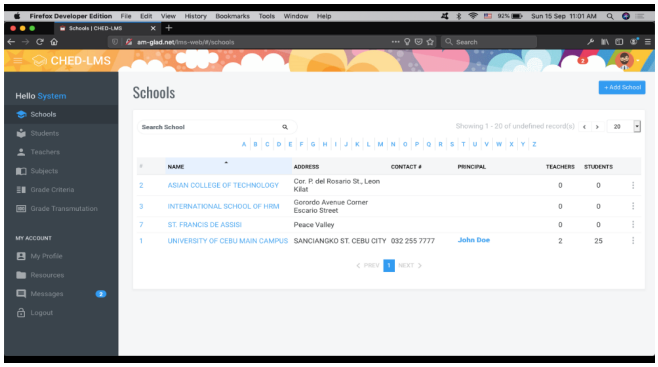
Screenshot 1. Landing Page



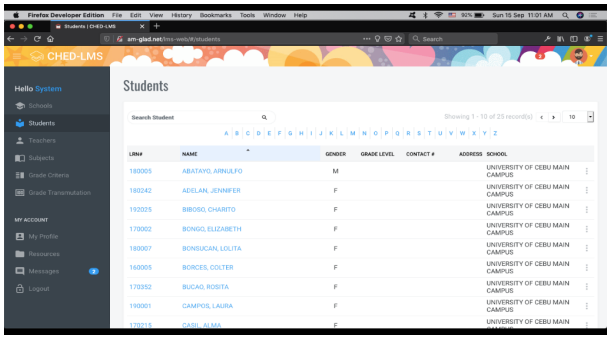
Screenshot 2. Log-in Page



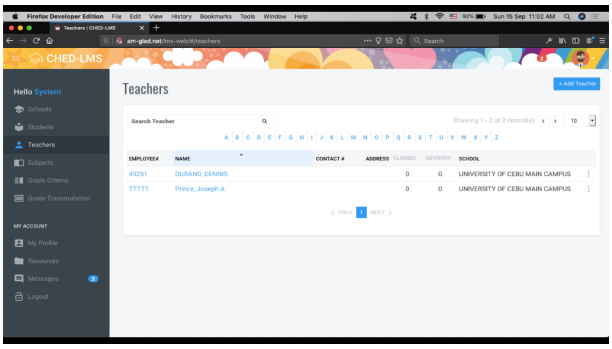
Screenshot 3. The Welcome Page



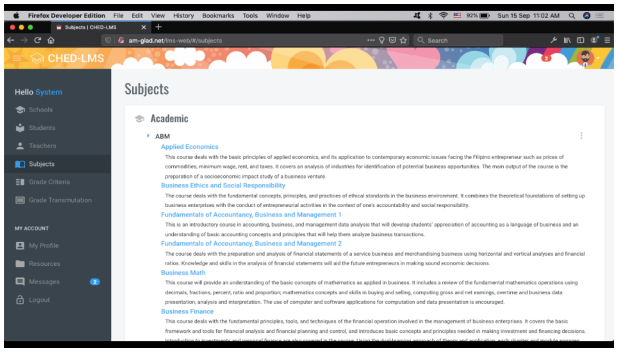
Screenshot 4. List School Page



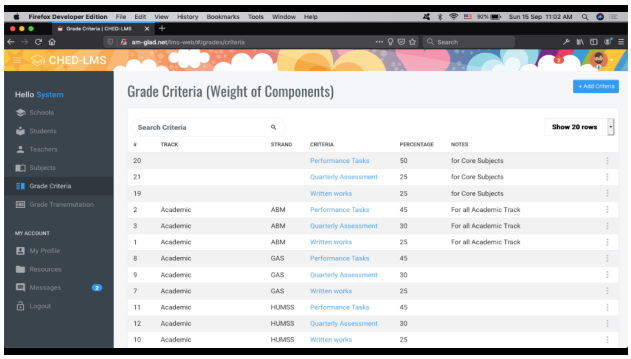
Screenshot 5. Student List Page



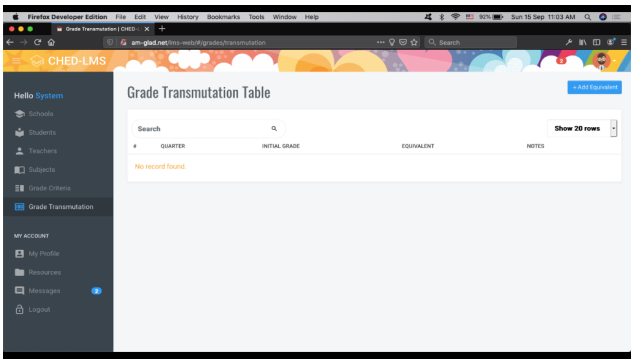
Screenshot 6. Teacher List Page



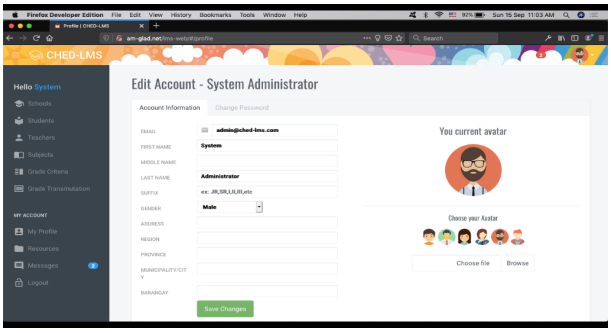
Screenshot 7. Subject List Page



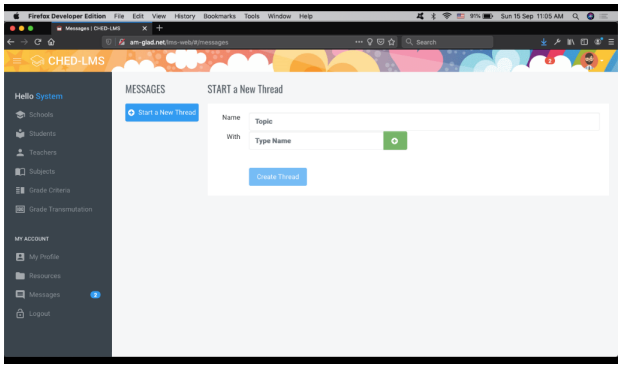
Screenshot 8. Grade Criteria



Screenshot 9. Grade Transmutation Table Page



Screenshot 10. User Profile Page



Screenshot 11. Message Page

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

Maria Salud M. Delos Santos conceptualized the study, processed, analyzed, interpreted data, and wrote the paper. Engr. Dennis Durano designed and developed the LMS. Dr. Arlene Hortillosa helped in the data gathering and analysis.

Funding

The Commission on Higher Education of the Philippines supported this work.

Acknowledgment

Maria Salud M. Delos Santos thanks Cebu Technological University-Main for the encouragement and drive in having the paper published. Engr. Dennis C. Durano is grateful to the University of Cebu for its support. Dr. Arlene D. Hortillosa thanks Iloilo Science and Technology University (ISAT U).

References

[1] B. Marianne. (April 7, 2018). *What Went before the K-12 Program.* Inquirer.net. [Online]. Available: https://newsinfo.inquirer.net/980733/what-went-before-the-k-12-program

[2] CHED K to 12 transition program. CHED. (December 27, 2017). [Online]. Available: https://ched.gov.ph/k-12-project-management-unit/

[3] P. L. Dressel, *Teaching, Learning, and Evaluation, Improving College and University Teaching*, vol. 8, no. 1, pp. 11-15, 1960, DOI: http://dx.doi.org/10.1080/00193089.1960.105340792

[4] N. Hativa, *Improving Teaching for Effective Learning, Teaching for Effective Learning in Higher Education*, pp. 329-344, 2000, DOI: http://dx.doi.org/10.1007/978-94-010-0902-7_21

[5] B.V. Malcolm, *Exploring Online Learning through Synchronous and Asynchronous Instructional Methods*, p. 28, 2020. http://dx.doi.org/10.4018/978-1-7998- 1622-5.ch006

[6] A. H. R. Abogamous, "A theoretical framework for the adoption of web-based learning management systems in Saudi higher educational institution," *International Journal of Information and Education Technology*, vol. 12, no. 7, pp. 589-598, 2022, http://dx.doi.org/10.18178/ijiet.2022.12.7.1658

[7] Y.-X. Cao, "An analysis of the application of interact function in higher education internet system — A case study of canvas learning management system," *DEStech Transactions on Economics, Business and Management*, 2021, DOI: http://dx.doi.org/10.12783/dtem/eeim2020/35206

[8] S. I. Rahmatullah, "Blackboard as online learning management system in Saudi context: Challenges and prospects," *SSRN Electronic Journal*, 2021, DOI: http://dx.doi.org/10.2139/ssrn.3874035

[9] E. E. Belova, *Management of Students' Independent Work through Moodle Learning Management System*, 2021, DOI: http://dx.doi.org/10.15405/epsbs.2021.02.02.15

[10] A. R. Rojabi, "Blended learning via schoology as a learning management system in reading class: benefits and challenges," *Jurnal Linguistik Terapan*, vol. 9, no. 2, p. 36, 2019, DOI: http://dx.doi.org/10.33795/jlt.v9i2.92

[11] S. Vasanth and C. S. Sumathi, "Learning management systems through moodle and Google classroom for education," *Advances in Research*, pp. 32-37, 2020, DOI: http://dx.doi.org/10.9734/air/2020/v21i1030249

[12] B. G. Emiroğlu, "Investigating faculty members' perceived usability of Edmodo learning management system," *Adıyaman Üniversitesi Eğitim Bilimleri Dergisi*, vol. 9, no. 1, pp. 159-176, 2019, DOI: http://dx.doi.org/10.17984/adyuebd.533131

[13] C. Kavita, "Features of learning management systems (LMS) for improving teaching and learning," *Journal of Interdisciplinary Cycle Research*, vol. 13, pp. 192-206, 2021.

[14] J. R. Philippo and S. L. Krongard, "Learning management systems (LMS): The missing link and great enabler," *Massachusetts ASCD Perspectives*, 2012.

[15] E. Dahlstrom, D.C. Brooks, and J. Bichsel. (2014). The current ecosystem of learning management systems in higher education: Student, faculty, and IT perspectives. [Online]. Available: https://www.semanticscholar.org/paper/The-Current-Ecosystem-of-Learning-Management-in-and-Dahlstrom-Brooks/eb94303cad0416c2743d81e331b988db37f02e04

[16] R. L. Dizon, J. S. Calbi, J. S. Cuyos, and M. Miranda, "Perspectives on the implementation of the K to 12 Program in the Philippines: A research review," *International Journal of Innovation and Research in Educational Sciences*, vol. 6, no. 6, pp. 2349–5219, 2018.

Copyright © 2023 by the authors. This is an open access article distributed under the Creative Commons Attribution License which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited (CC BY 4.0).

Maria Salud M. Delos Santos was born in Cebu city Philippines in August, 1965. She graduated Cum Laude with her BS mathematics for teachers degree as a DOST scholar from the Philippine Normal University, Manila, in 1986. She earned her master of science in mathematics in 1990 at the Ateneo de Manila University, Quezon City, funded by the FAPE-Ateneo scholarship. A BS in Information and computer science is an added degree earned in 1999. She also has completed the academic requirements for the master in information technology degree as a CHED-FDP scholar at Cebu Institute of Technology University, Cebu City. She has a FAPE-USC scholarship for her doctor of philosophy in education, majoring in research and evaluation at the University of San Carlos, Cebu City, Philippines, and graduated in 2002.

She is an instructor at the Cebu Technological University-Main in Cebu City, Philippines. She rendered 35 loyal years in the private sector, serving as dean of the College of Computer Science, graduate school dean, research director, and director for evaluation and statistics, among others, before joining public service. Her research interests are mathematics, mathematics education, computer science, and research.

Dr. Delos Santos is a member of the Philippine Society of Information Technology Educators (PSITE), the Philippine Association for Teacher Educators (PAFTE), and the Asia-Pacific Consortium of Researchers and Educators (APCoRE), among others. She received the CNU Presidential Citation for Outstanding Faculty in 2019.

Arlene D. Hortillosa is from Iloilo city, Philippines, born on April 25, 1965. She is a product of several state universities, starting from the West Visayas State University for her elementary (1978) and secondary education (1982) in her hometown, Iloilo City. She then pursued a BS mathematics for teachers course under the DOST-SEI scholarship and graduated "cum laude" from the Philippine Normal University (1986). She finished her Master of Arts in Mathematics at UP and her Ph.D. in Mathematics Education at UP Open University (2010) under the DOSE-SEI scholarship.

Being in government service as a mathematics teacher for 36 years, she is currently an associate professor and teacher educator at the Iloilo Science and Technology University (ISAT U). Her passion for teaching shows in her belief and practice to make learning fun, meaningful and relevant. Dr. Hortillosa's research interests include mathematics, mathematics education, and classroom management. Her research titled "Context-Based Mathematics Problem Solving: Cognitive and Affective Effects on BIT and BS Voc-Tech Students" was published in IAMURE International Journal of Education, 41-59 (2013).

Dennis C. Durano is from Busay, Cebu city Philippines. He is a college instructor at the University of Cebu - College of Information and Computer Science. He graduated with the BS in computer engineering at the same university.