Development of eSSUKwela: An Online Learning Management System in a University in Eastern Samar, Philippines

Gil G. Dialogo[1*] and Hershey R. Alburo[2]
[1,2]College of Computer Studies
Eastern Samar State University-Salcedo Campus
Salcedo, Eastern Samar, 6807, Philippines
https://orcid.org/0000-0002-5871-3279

Abstract

The paradigm shifts in education brought by the changes of the coronavirus disease prompted educational institutions to shift from traditional face-to-face classrooms to modular and distance learning. This move also drives institutions to utilize free learning management systems and even develop such. Thus, ESSU Salcedo, through the College of Computer Studies, developed a user-friendly learning management system (LMS) named e-SSUKwela, which serves as an online classroom where lectures, quizzes, assignments, and other assessments are done. This customized LMS provides an exchange of educational resources flexible, convenient, and engaging. This research follows a Waterfall model approach in developing the desired system, where requirement analysis, acceptance test, unit test, integration test, and coding are significant parts of the software development. The system had undergone three testing strategies: Benchmark, Alpha, and Beta Tests using the ISO/IEC 9126 metrics. Results showed that in terms of usability, the application scored 88.75, which is above average. After successful testing stages on the functionality of the developed LMS, the researchers concluded that it is ready for implementation. The results indicate consistent improvement from the various testing phases across all criteria. The steady progression suggests that usability, reliability, and maintainability were key focus areas during software development. As such, it is recommended that this LMS be part of the smart campus implementation of the university; an orientation be given to faculty and students who would utilize the system; and there should be a study on the effectiveness of the system in the blended learning environment.

Keywords: ESSU, learning management system, waterfall model

1. Introduction

The outbreak of the COVID-19 pandemic greatly affected human lives and even resulted in a widespread disruption. Most countries around the world have temporarily closed educational institutions to contain the spread of the virus and reduce infections [1]. Thus, it suspended face-to-face classroom learning engagements. In the Philippine setting, the country adopted a new normal form of education through the utilization of the Learning Management System (LMS) as a tool to ensure the continuity of education in the country.

At times like this, advanced technology has a huge role in developing practical solutions and in bringing changes in the educational landscape, particularly in the Higher Education Institutions (HEIs). Most HEIs are now shifting towards using the learning management system as a substitute pedagogy either in addition to regular classes or as a contingency plan in the event of an unexpected crisis like this pandemic. LMSs are designed to facilitate teaching

and learning operations. They comprise several components that allow faculty members to communicate learning materials as well as interact with their students. In fact, Dialogo [2] asserted that online learning is not the next big thing; it is the now big thing. LMS has brought increasing numbers and students to the online learning environment.

Currently, Eastern Samar State University (ESSU) Salcedo Campus utilizes flexible learning modalities through the development of course modules with the aid of online platforms. Every college in the university uses several open-source applications in the conduct of classes, such as Google Classroom, Edmodo, Schoology, Google Mail, Facebook, Messenger, and others. With these online platforms, students and teachers interact with each other. Teachers deliver classes, upload instructional materials, post announcements, quizzes, and assignments, while students can view posted announcements, download instructional materials, and submit outputs. However, with the various online platforms used, there is a scattered and unorganized submission of outputs. There is no uniformity and centralized repository tool where students can access and submit their outputs. As a result, submissions get lost and are sometimes hard for the teacher to retrieve. In addition, the features of the free and open-source platforms are limited, have restricted storage capacity, and do not allow customization based on the needs of the institution.

In response, this study is proposed to address said problems and complement the flexible learning modalities currently in place. This learning management system also aims to improve the delivery of instruction by integrating technology in the classroom. By doing this, the instructors can handle and tailor classes by posting course materials like course syllabus, course schedule, and course modules corresponding to specific lessons like copies of reading materials, PowerPoint presentations, and audio-video lessons, and monitor students' progress through assessment features, which allow teachers to administer quizzes and exams online, and an online gradebook, in which teachers can personally rate students' works. This proposed LMS capabilities would enable the teacher to create powerful, flexible, and engaging online learning experiences.

1.1 Objectives of the Study

The study primarily aims to design, develop, and test an Online Learning Management System to be utilized by Eastern Samar State University, Salcedo Campus, in the delivery of instructions.

Specifically, the study sought to achieve the following objectives:

- To design a user-friendly graphical user interface for the web-based Learning Management System.
- To develop a usable, flexible, and customizable Online Learning Management System.
- To evaluate the functionality of the Online Learning Management System using ISO/IEC 9126 standards.

1.2 Scope and Limitation of the Study

This learning management system aimed to improve the delivery of instruction by integrating modern technology. The teachers can add quizzes, assignments, activities, and course learning materials or modules so the students can answer all activities, submit their assignments, download learning modules at their convenience and desired time. Moreover, teachers can view the progress of their students while students can also view their scores for every submission. Lastly, this LMS will run using web browsers and is designed for online learning.

2. Methodology

2.1 Theoretical Framework

The Waterfall Model was applied as a System Development Life Cycle tool in developing the Learning Management System. It has been utilized because of its simplicity and ease of use [3]. From the first phase to the final phase of the waterfall model, every phase has to be finished before proceeding to the next phase, and there is no overlap in the phases. The gathering of requirements, analysis, and definition has to be conducted in order to design and develop a system. Once the system has been designed and developed, the researchers have tested the system along with some respondents. And finally, the maintenance and operation where it was carried out will also be tested there. And at the final phase, there could be some errors or design errors. So, modifications in all the errors have to be made in order for the system to remain helpful [4]. To change the system required repetition in part or the entirety of the past phase. Figure 1 indicates the Waterfall Model – Software Development Life Cycle theoretical framework. It consists of the following stages:

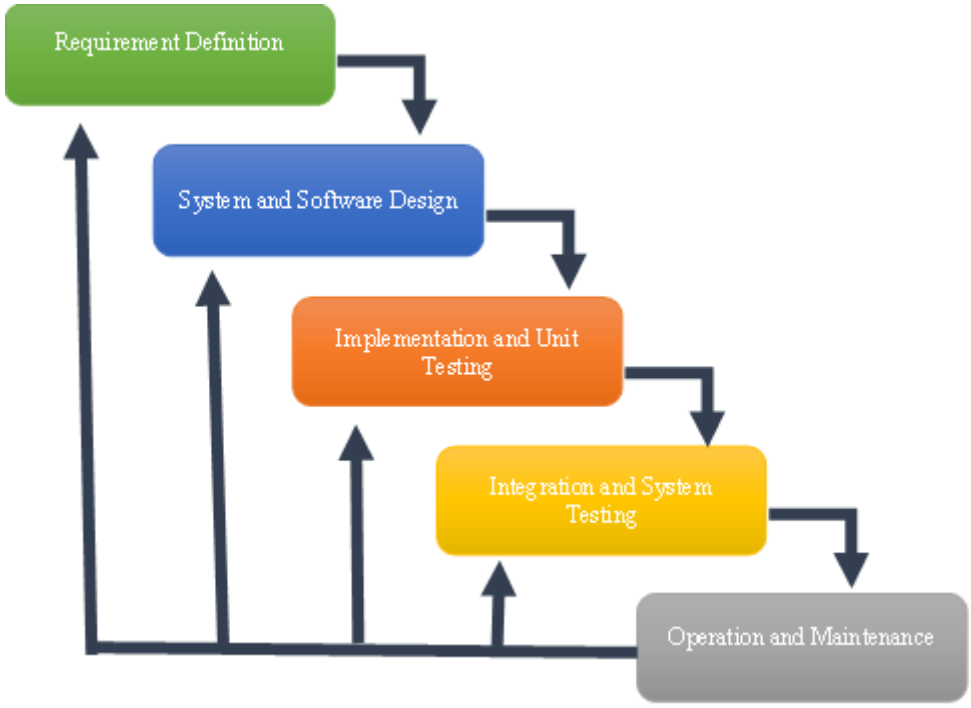

Figure 1. Waterfall Model

2.2 Data Flow Diagram

Figure 2 shows the activity flow and processes of the whole system. It shows how the system organizes the processes that the users can perform.

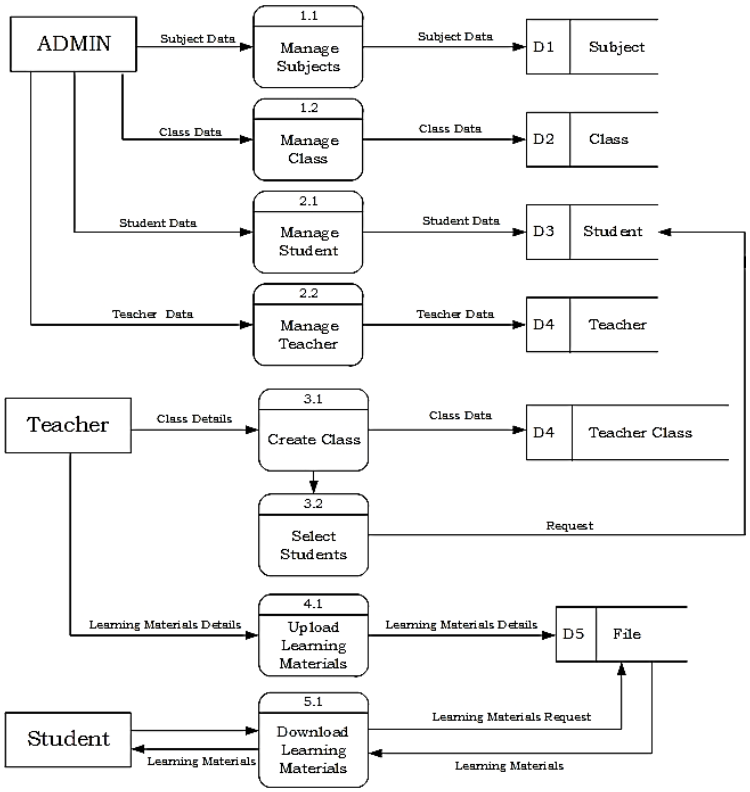

Figure 2. Explosion Zero of Data Flow Diagram

2.3 Hardware Specification

Table 1 displays the hardware requirements utilized in designing and developing the Learning Management System for ESSU – Salcedo. This included the following software specifications. In developing the system, the researchers needed a mouse and keyboard for a better experience and a personal computer with at least an Intel i5. In the deployment of the system, the researchers needed a processor at least 1.9 gigahertz (GHz) x86 or x64-bit dual-core processor with SSE2 instruction set and at least 2 GB of RAM, and at least Super VGA with a resolution of 1024 x 768 Display.

Table 1. Hardware Specification

Hardware Requirements	Minimum Requirements/Specification	Actual use in the System
Development		
Mouse	Any Mouse	MX Master 3
Keyboard	Any Keyboard	Microsoft Sculpt Ergonomic Keyboard
Laptop	Intel i5 CPU	Dell XPS 15
Deployment		
CPU	1.9 gigahertz (GHz) x86- or x64-bit dual core processor with SSE2 instruction set	3.3 gigahertz (GHz) or faster 64-bit dual core processor with SSE2 instruction set
Storage	2 GB RAM	4 GB RAM or more
Monitor	Super VGA with a resolution of 1024 x 768	Super VGA with a resolution of 1024 x 768

2.3 Software Specification

Table 2 presents the software requirements used in designing, developing, and testing the e-SSUKwela: An Online Learning Management System of Eastern Samar State University, Salcedo Campus. This will include the following software specifications.

In the development of the system, it required a Microsoft Operating system that would interact with the computer hardware. The researchers used WordPress and MySQL for their database.

In the deployment of the system, the user must use any web browser such as Google Chrome, Microsoft Edge, Mozilla Firefox, or Apple Safari to interact with the system.

Table 2. Software Specification

Software Requirements	Minimum Requirements/Specification	Actual use in the System
Development		
IDE	Weebly	WordPress
Database	MariaDB	MySQL
Deployment		
Web Browser	Mozilla Firefox, Google Chrome, and Apple Safari	Google Chrome

2.3 System Development

The development of the system began with problem identification why the study is being carried out. Next, it went to data collection where the researchers conducted some interviews with the client/end user and further research will be conducted which will be used as secondary data for the system. The researchers planned the system by creating data flow diagram and system flowchart. The researchers utilized the WordPress in developing the system. The research team employed MySQL as the system back end. The researchers then move on to system testing and assessment. In case the desired output will be accomplished then the system would be implemented. If otherwise, the process will return to system designing and coding.

2.3 System Deployment

The researchers deployed the system using the Google Chrome web browser. To run the system the user must utilize a laptop or a personal computer of at least a version of windows 8. The computer must at least have a RAM of 4GB and the processor of Core i3 as its minimum requirement.

3. Results and Discussion

3.1 Acceptance Testing

Following the application development stage, the resulting application was subjected to a series of tests to assess its quality. This enabled the researchers to identify whether the requirements as outlined in the development stage were met. Following every testing, the respondents indicate whether requirements are not met and which should be deleted, modified, or added due to emerging needs.

The initial test that was done was the benchmark test. The program was tested by the software development experts utilizing ISO Score Cards. Following the Benchmark testing, a Pilot test encompassing the Alpha test and Beta test ensued. Alpha test was conducted in the audio-visual room of the CCS building, where selected students of Computer Science provided a rating of the system using the same score card. The final test carried out was the beta test, wherein some Eastern Samar State University-Salcedo Campus faculty tested the application using the same score card.

The system was graded according to the ISO, which includes functionality, reliability, usability, efficiency, maintainability, and portability. The functionality aspect defined the quality of being properly suited to fulfill a purpose, in a practical sense. The reliability aspect defined the quality of being reliable or of consistently working well. The usability aspect defined the extent to which something is capable or qualified to be utilized. The Efficiency perspective established the state or condition of being efficient. The maintainability perspective is established as the chance of executing a successful repair action within a specified time. The portability established the degree of software ability to be transferred into the categories of a 5-point Likert scale, code, and its description are as indicated in Table 3:

Table 3. Five-point Likert Scale

Scale	Code	Description
4.20 – 5.00	1	Excellent
3.40 – 4.19	2	Very Good
2.60 – 3.39	3	Good
1.80 – 2.59	4	Poor
1.00 – 1.79	5	Very Poor

The data collected were analyzed using frequency counts and a weighted scoring system. Weighted means were computed from the frequency counts, while the total mean score was computed from the mean of the equivalent statistical interpretation.

Figure 3 displays the testing results of three different testing phases—Benchmark Test, Alpha Test, and Beta Test—across six evaluation criteria in the ISO/IEC 9126 software quality metrics.

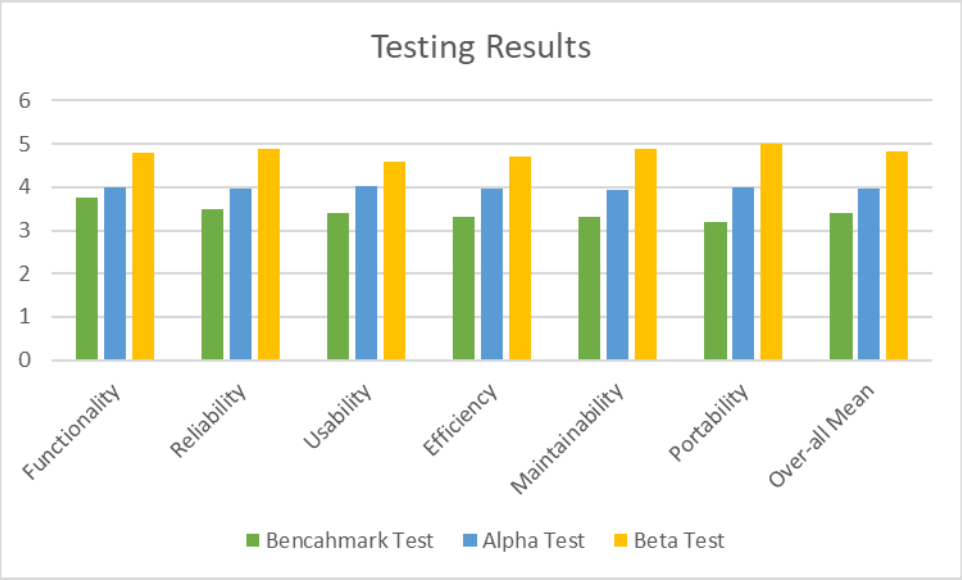

Figure 3. Acceptance Testing Results

Functionality. The Beta Test scored the highest with a perfect score of 4.80. The Alpha Test followed closely with a score of 4.01. On the other hand, the Benchmark Test scored the lowest at 3.75. This indicates that functionality improved significantly in later testing phases.

Reliability. Beta Testing again achieved the highest score of 4.90. Alpha Testing scored slightly lower at 3.98, while the Benchmark Test lagged at 3.50. Reliability shows a similar trend to functionality, with steady improvement over time.

Usability. Usability was rated highest during the beta test, with a mean score of 4.65. Alpha Testing scored 4.03, while the Benchmark Test scored 3.40. This suggests enhancements in user experience through iterative testing.

Efficiency. The Beta Test maintained its lead with a score of 4.70. Alpha Testing scored 3.97, and the Benchmark Test scored 3.30. Efficiency improvements align with other metrics, reflecting optimization efforts.

Maintainability. Beta Testing achieved a mean score of 4.90. Alpha Testing scored slightly lower at 3.95. Lastly, the Benchmark Test scored 3.30. This indicates that maintainability was prioritized and refined as testing progressed.

Portability. Similar to other metrics, portability scored highest in Beta Testing with a 5.0 mean score. Alpha Testing scored 3.99, while the Benchmark Test scored 3.2. This reflects enhanced compatibility and adaptability in later stages.

The results indicate consistent improvement from the Benchmark to Alpha and finally to Beta Testing phases across all criteria. The Beta Test achieved perfect scores in all categories, demonstrating that final refinements addressed earlier shortcomings effectively. The steady

progression suggests that usability, reliability, and maintainability were key focus areas during development. Overall, the testing results highlight a successful iterative process leading to a high-quality product by the Beta phase.

3.2 Usability Testing

The usability test came after the acceptance testing to verify that the developed system met the specifications and was ready for implementation. The System Usability Scale (SUS) of John Brooke [5] was utilized by the respondents to measure how well a product allows users to accomplish their goals. SUS has proven to be a reliable and robust assessment tool. It highly correlates with other random usability assessments. To get the SUS score, add the contribution scores of each item first before computing the SUS score. The score contributions on each item will be between 0 and 4. Scale position minus one is employed to derive the score contributions for items 1, 3, 5, 7, and 9. The contribution for items 2, 4, 6, 8, and 10 is 5 minus the scale position. To find the SU's total value, multiply the sum of scores by 2.5. Anything with an SUS score of 68 or more would be considered above average, while anything with a score of 68 or less would be below average. The faculty and students acted as the system usability test evaluators since they are the end-users of the system.

Table 6. System Usability Results of the Hazard Safety Tips Mobile Application

Statement	Mean	SUS Score
1. The user thinks that I would like to use the application frequently	3.5	2.5
2. The user found the application unnecessarily complex	1.0	4.0
3. The user thought the application was easy to use	3.5	2.5
4. The user thinks that I would need the support of a technical person to be able to use the system	0	5.0
5. The user found that the various functions in this application were all integrated	3.5	2.5
6. The user thought there was too much inconsistency in this system	1.0	4.0
7. The user would imagine that most people would learn to use this system very quickly	4.0	3.0
8. The user found the system very cumbersome to use	0.5	4.5
9. The user felt very confident using the application	3.5	2.5
10. The user needed to learn a lot of things before I could get going with this system.	0	5.0
SUS Score		**35.5**
Overall SUS Score (SUS Score *2.5)		**88.75**

3.3 Screenshots

Figure 3 shows the Login Form for the admin, which is the first Interface of the website. Here you can log in as an admin using the username and password.

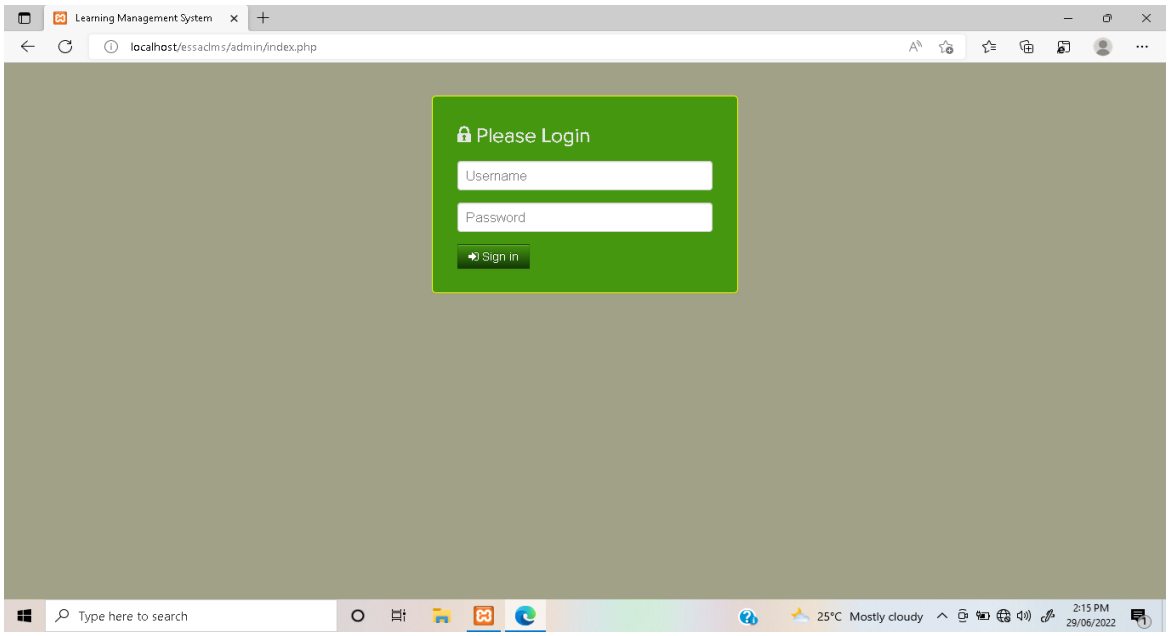

Figure 3. Login Form

Figure 4 shows the Dashboard. This interface shows the number of registered professors, professors, registered students, students, classes, downloadable files, and the subject

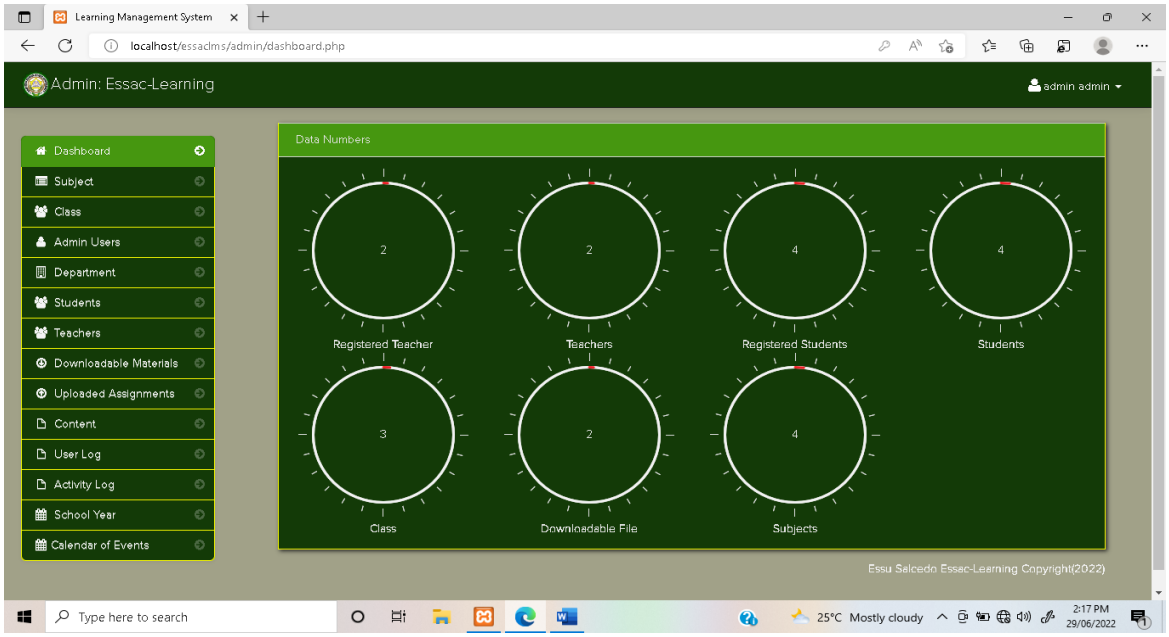

Figure 4. Dashboard

Figure 5 shows the student's page. In this interface, you can view the registered students, their student ID number, and the course and section that they belong to. You can also register here the student that you want to add.

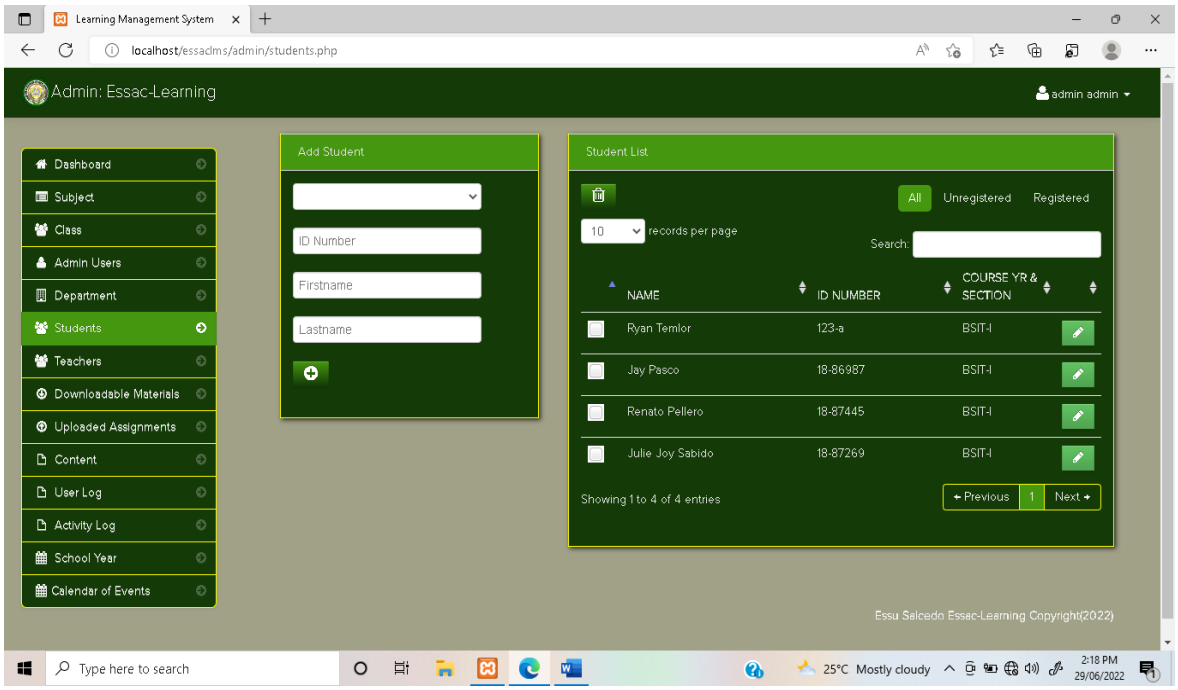

Figure 5. Students Interface

Figure 6 presents the classes of the teacher. The teacher can add a new class.

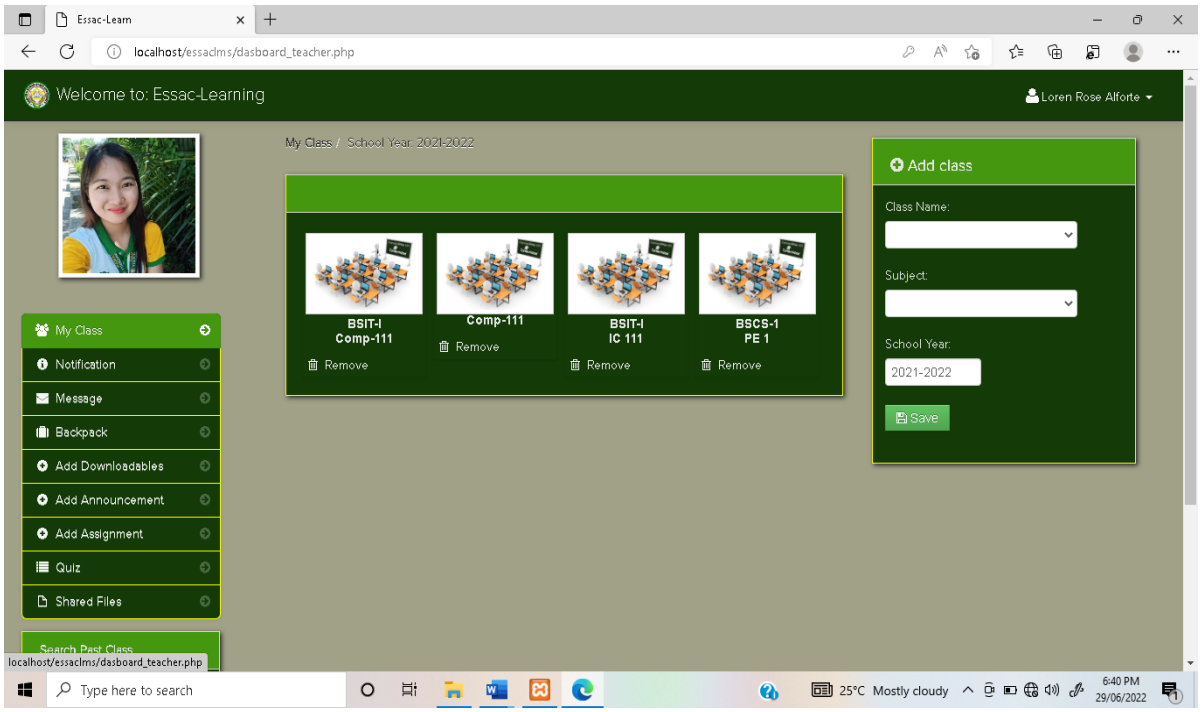

Figure 6. Class Interface

4. Conclusions and Recommendations

This study aimed to design, develop, and test an Online Learning Management System that would automatically produce management information. During development, the first phase was designing and developing the system. It is mainly presented using the system flowchart.

After the designing and the developing phase of the system, the testing of the system followed. The developed system had undergone a series of tests to evaluate the quality of the developed system using the scorecard by ISO 9126. The first test was the Benchmark Test, which was performed and evaluated by the researchers and the researcher's adviser as the first evaluator. The second test was the Alpha Test, which was evaluated by the 3rd year BSCS students as second evaluators. The third test was the Beta Test, which was evaluated by the CCS faculty members.

Lastly, a Usability Test was performed on the system to test if the system is usable. It was participated in by selected students of the university, who gave the study an SUS score of 88.75, which was interpreted as above average, meaning the system was ready to be implemented.

Based on the findings of the study, the researchers came up with the following conclusions:

1. The GUI of the LMS has been designed for an easy and user-friendly manner.
2. The developed LMS is usable for the students and teachers in the university.
3. The LMS has been evaluated to check its functionality using a standardized tool.

Recommendations:

1. The learning management system will be implemented at Eastern Samar State University and will be used by the faculty and students.
2. There should be an orientation for the faculty and the students who would utilize the learning management system.
3. The developed system may not replace the classroom face-to-face instruction, but may be used as a complementary tool.
4. There should be further studies on the effectiveness of the utilization of online/blended environments.

5. Acknowledgement

The authors owed their esteemed status to the following individuals who, in many ways, had helped in the conduct of the study: Dr. Mir-i-nisa Y. Boco, Engr. Renato A. Padullo, Ms. Charito B. Lacasa, and Dr. Arvin Anthony S. Araneta.

6. References

[1] J. Tria, "The COVID-19 Pandemic through the Lens of Education in the Philippines: The New Normal," International Journal of Pedagogical Development and Lifelong Learning, vol.1, n0.1, pp. 1-4, May 2020.

[2] G. Dialogo, "Mobile-Based Course Learning Modules in a University in Eastern Samar, Philippines". International Journal of Computer Science and Mobile Computing, Vol.12 Issue.1, January- 2023, pg. 14-23.

[3] G. G., D. . (2025). Development of a mobile-based application for leaf disease recognition in abaca (Musa textilis). Edelweiss Applied Science and Technology, 9(1), 620–627. https://doi.org/10.55214/25768484.v9i1.4187

[4] Gabry, O.E. (2017, March 17). Software Engineering – Software Process and Software Process Models (Part 2). Retrieved from https://www.medium.com

[5] J. Brooke, “SUS: A 'Quick and Dirty,” in Usability Evaluation in Industry, 1st ed., vol. 189, CRC Press, 1996, pp. 189-194.