

Development of a Learning Management System for Instructors, Students, and Administrators

Mellanie S. Gambe¹

College of Computer Studies St. Peter's College
Iligan City, Philippines

Andrew P. Ponte²

College of Information Technology Liceo de Cagayan University Cagayan de Oro City, Philippines

Abstract:- This study aimed to develop a Learning Management System that addressed the learning gap at St. Peter's College. The Rapid Application Development framework was used for the development of the study. Furthermore, the Technology Acceptance Model (TAM) was utilized by the instructors and students to evaluate the learning platform's acceptance level and effectiveness. Also, the standard ISO 9126 Quality Model was used to determine the quality of the system being developed by an expert. A survey was conducted among 100 St. Peter's College instructors, 100 Bachelor of Science in Information Technology students, and seven (7) identified experts to gather feedback. It was found that most of the instructors and students of St. Peter's College strongly accept the Learning Management System. Most experts who have been in the field for more than nine (9) years highly accept the system's software quality standard. Therefore, the Learning Management System is ready for implementation.

Keywords: ISO 9126; Learning Management System; Rapid Application Development; Technology Acceptance Model.

I. INTRODUCTION

One of the challenges in teaching is how to address the different needs of the students. Instructors primarily incorporated lectures to deliver their lessons; lecture notes, whiteboards, presentation slides, and liquid crystal display projectors facilitate the learning delivery approach. The downside is that students need help coping with their left-behind lessons whenever they cannot attend class. Along with the problem mentioned in the schedule conflict, whenever instructors plan remedial classes, an issue arises regarding the availability of venue and equipment where lectures could be done. Another problem is that lectures cannot be eventually carried out whenever there is a disturbance in classes due to holidays and other school activities. Thus, to address the issues cited, the researchers developed a Learning Management System, which assessed both the instructors and students to access, retrieve, and understand various information on time, which would then serve as an alternative process to discuss aside from the lecture method that was commonly used.

Learning Management Systems (LMSs) have different application tools, such as Moodle and ATutor, which various learning institutions utilize. Furthermore, LMS's concept was for the instructors to conduct online courses using a system that allowed them to post lecture notes and slides, assessments, forums, and announcements and provide facilities for electronic submissions and exercises related to the course. The Learning Management System (LMS) would increase the sense of community among students, help them learn communities, and enhance student engagement and performance. Therefore LMSs have become a core business component in many universities [18].

In conjunction, [8] pointed out that LMS provides an inclusive learning environment for academic success. The use of LMS resources, active learning, and certified curricular standards should all be balanced by the instructor. An LMS enables the instructor to create online activities, guide and model dialogues, establish learning objectives, provide students with options, and support problem-solving through decision-making procedures. The presence of an instructor in an LMS fosters a stimulating environment. Using an LMS, students can maintain their independence, excitement, and motivation.

The researchers aimed to improve the classroom discussion of students and instructors by improving the Learning Management System using new features such as recorded audio or video for student assessment and SMS notification. The researchers also implemented the Reinforcement Q-Learning Algorithm for the notification to set an appropriate time to notify or alert the instructor once the student had obtained and downloaded the instructor's uploaded course materials. The instructor would also receive another notification once the student has submitted the course assessment that has been taken. Once the student and instructor had successfully obtained the login details, the administrator would also receive a notification. The platform of the study for developing Learning Management was CodeIgniter. This CodeIgniter was designed to deliver a stable, safe, and optimized framework for instructors, administrators, and students to build customized learning environments. It is also PHP's best open-source development platform.

This research paper offers a unique approach to students' academic learning outcomes. Implementing and using a learning management system of the institution improve the students' knowledge acquisition skills.

A. Theoretical and Conceptual Framework

This section contained the conceptual paradigm, the proposed structure of the study, and the theory, which was utilized to evaluate the user's acceptance level and the system's efficacy.

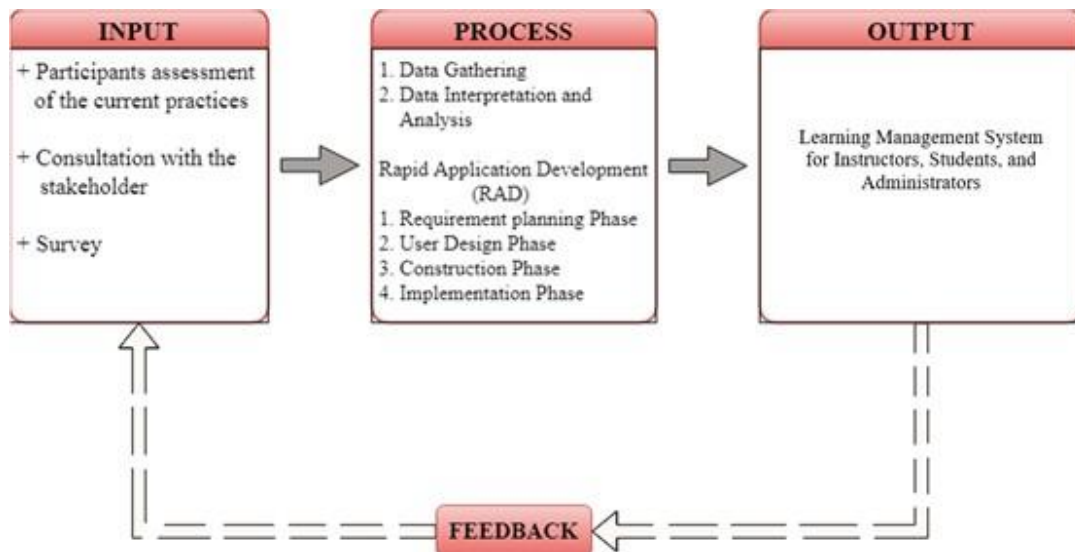


Fig 1 Conceptual Paradigm Using IPO Model

Fig 1 shows the research's conceptual paradigm using the Input-Process-Output model. The Input included a review of existing practices by all participants, stakeholder consultation, and a survey. Data collection, data interpretation, and analysis were involved in the Process. The researchers also used Rapid Application Development to create and develop the proposed study. The Output included the system which was developed.

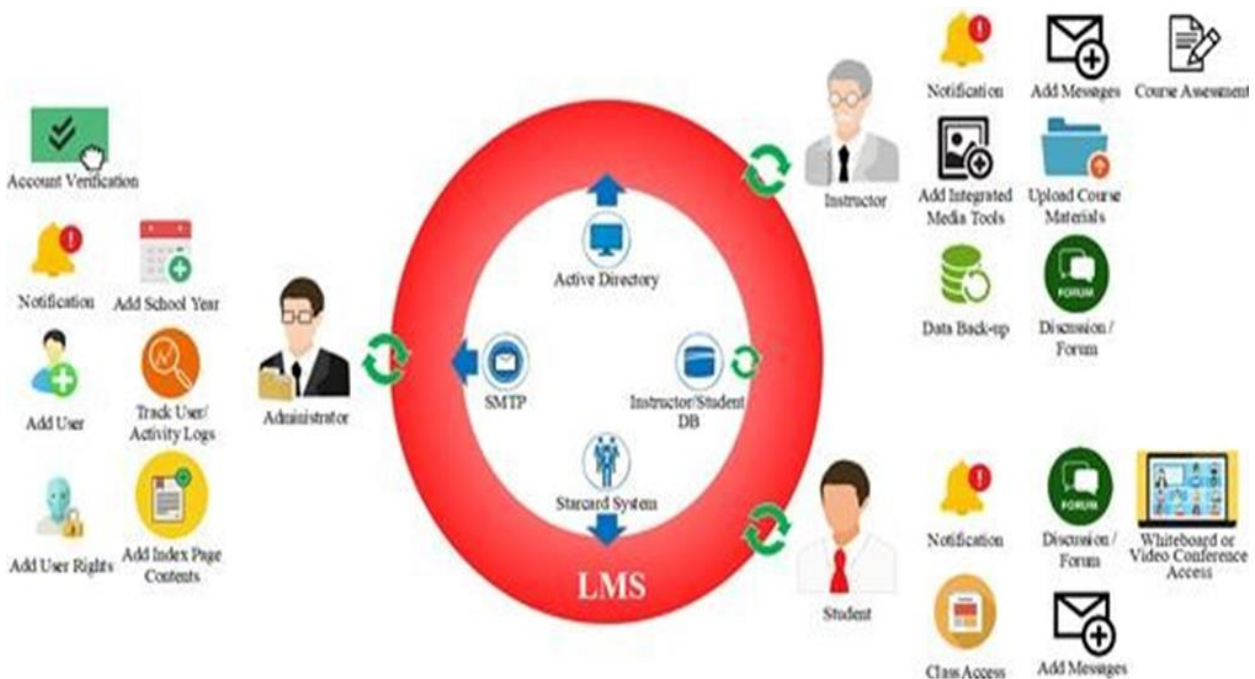


Fig 2 Learning Management System for Instructors, Students, and Administrators' Framework

Fig 2 above shows the researchers' Learning Management System framework with three entities directly connected to the system: the administrator, instructor, and student.

- *The Admin Module Comprised Several Data-Centered Activities and Processes, and it was Intended for the System Administrator:*
- A system user was added – the ability to add system users is allocated in this module.

- *The school year was added* – the ability to add school year and semester is allocated in this module.
 - *Notification* – the ability to notify if the users successfully received the account login details and if there is new user registration.
 - *Accounts verification was added* – the ability to verify a new user's registration by the administrator.
 - *The index page content was added* – the ability to add the school's mission, vision, objectives, announcements of the school's/college's upcoming events, and user's manual are allocated in this module.
 - *Users/ Activity Log was adding* – the ability to track the users/activity log is allocated in this module.
 - *System user rights are added* – the ability to set privileges for the instructors and students is allocated in this module.
- *For the Instructor's Rights, the following were Cited below.*
- ✓ Notification
 - ✓ Message
 - ✓ Data Back-up
 - ✓ Integrated Media Tools (recorded audio/video for the student requirements assessment, whiteboard/video conferencing)
 - ✓ Adding Course Assessments (examinations, quizzes, and assignments)
 - ✓ Upload Materials
 - ✓ Discussion/Forum
- *For Student Rights, these are the following:*
- ✓ Notification
 - ✓ Messages
 - ✓ Students Class (course syllabus, downloadable materials, course assessment, course announcement, and course activity calendar)
 - ✓ Internal email/messaging notification from the instructor
 - ✓ Data Back-up
 - ✓ Discussion/Forum
 - ✓ Whiteboard/Videoconferencing
- *The Instructor Module was Composed of Class-based Activities:*
- *Notification* – the ability to access or view the announcement from the administrator. The instructor received information if the student successfully took up the course assessment and downloaded the course materials uploaded by the instructor.
 - *The message is adding* – the ability to add or create a message for all the students or selected students in the course is allocated in this module.
- *Data Back-up is added* – the ability to copy or archive the data is allocated in this module.
 - *Integrated Media Tools are adding* – the ability to add or create recorded audio or video for the student requirements assessment and provide a room id notification for whiteboard or video conferencing with the students or specific students allocated in this module.
 - *Course Assessment is adding* – the ability to add or create examinations, quizzes, and assignments is allocated in this module.
 - *Upload Course Materials* - the ability to add or create course materials/resources allocated to this module.
 - *Discussion/Forum* – the ability to access discussion/forum among instructors and students to collaborate on learning ideas is allocated in this module.
- *The Student Module was Composed of the following Activities:*
- *Notification* – refers to the ability to access or view announcements from the instructor.
 - *Message* – the ability to add, create, access, or view an announcement from the instructor and co-student allocated in this module.
 - *Student class access* – the ability to access or view the course syllabus and downloadable course materials, take course assessments such as examinations, quizzes, and assignments, and see the course activity calendar allocated to this module.
 - *Whiteboard or Video conferencing access* – the ability to access/view the room id and password notification for whiteboard or video conferencing from the instructor is allocated in this module to join a particular room name.
 - *Discussion or forum* – The ability to access the discussion/forum from the instructor is allocated in this module to join a particular room name.
- The active directory module was used to allow single-sign-on users accessible through the system portal.
- The Simple Mail Transfer Protocol (SMTP) section required admission to the system's SMTP architecture and enabling system-generated responses to the system administrator or instructor activities.
- The Star card module was the facility that accessed instructor and student identification information in the central database.

B. *The Theory used in the Study*

This study was anchored on the various views which illustrated the usage and usefulness of the proposed study.

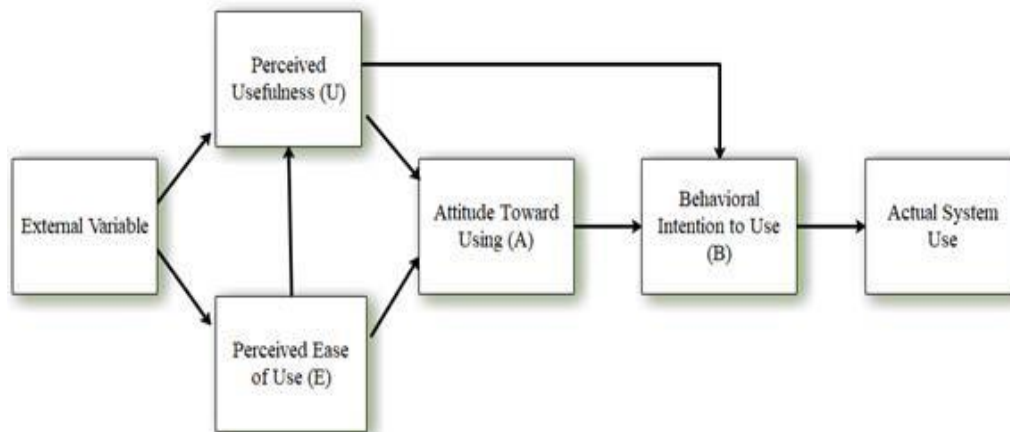


Fig 3 Technology Acceptance Model (TAM)

The tremendous advances in information and communication technology and the growing use of the internet brought lots of opportunities in various fields, particularly instructional technology. Technology Acceptance Model has proved to be a theoretical framework to assess whether it can help explain students' behavioral intentions to embrace and use it. It was adapted from the Theory of Reasoned Action (TRA) Model. In 1985 Davis created TAM. It focuses on why users accept or reject IT and how to boost acceptance while offering support to predict and clarify acceptance.

This research was therefore evaluated based on TAM, which included perceived usefulness (PU), perceived ease of use (PEOU), and attitudes towards using (ATU).

In [10] described perceived usefulness (PU) as "the degree a person believes will improve their job performance by using a particular system. The students and instructor find the Learning Management System's use beneficial in this research, especially in terms of efficiency and producing better results.

Perceived ease of use (PEOU) is the degree to which a person believes using a specific program should be effortless [10]. In this research, users only need a little time and energy commitment to learn the Learning Management System.

In [10], they described the attitude towards using the person's positive or negative thoughts using the system. Attitude toward using the Learning Management System in the sense of this study should evaluate the student's and instructor's attitudes and whether they are open to it or not.

In evaluating the level of acceptance and efficiency of the Learning Management System, Perceived usefulness (PU), perceived ease of use (PEOU), and attitude towards using (ATU) are the basis of analysis. TAM model has been applied to assess user acceptance of IT within an organization in various studies [13], [17], [2]-[3].

The users must determine whether the program being developed is acceptable. This will ultimately influence whether a user keeps or stops using the system. The following two (2) hypotheses were determined using TAM:

H1: There is a strong relationship between the user's perceived usefulness, ease of use, and attitudes toward using the Learning Management System.

H2: The user's perceived usefulness and ease of use positively impact their attitude toward using the Learning Management System.

C. Research Objectives

In this section, the researchers identified both the general and specific objectives.

➤ General Objective

This study aims to develop a Learning Management System. This study used the Technology Acceptance Model (TAM) to evaluate the Learning Management System's acceptability level and effectiveness, which served as a virtual classroom extension for students and instructors. Finally, ISO 9126 was used to assess the quality characteristics of the system.

➤ Specific Objectives

Specifically, this study aims to:

- *Develop A Learning Management System Which Includes The Following Functionalities:*

- ✓ Registration and enrolment of instructors and students
- ✓ Adding/updating courses by the system administration
- ✓ Set the different user roles/rights and user account
- ✓ Content repository
- ✓ Setting the course calendar
- ✓ Setting the users and admin logs
- ✓ Setting the school year and semester
- ✓ Uploading/downloading and retrieving examinations, quizzes, assignments, and resources
- ✓ Online checking and scoring for the students' exams, quizzes, and assignment
- ✓ Discussion or Forum

- ✓ Integrating Media Tools (video or audio recorded for assessment/feedback of the student's class requirements and whiteboard/video conferencing)
- ✓ Internal mail/messaging notification
- ✓ Email/SMS notification

• *Evaluate the Learning Management System's Acceptance Level and its Efficacy Using the Technology Acceptance Model by the Instructors and Students.*

• *Evaluate the Software Quality Level of the System as Perceived by the Experts in Terms of the following:*

- ✓ Functionality
- ✓ Reliability
- ✓ Usability
- ✓ Efficiency
- ✓ Maintainability and
- ✓ Portability

D. *Scope and Limitation of the Study*

This study aims to develop a Learning Management System which was conducted within St. Peter's College in Iligan City, situated at Barangay Saray, Sabayle St., Iligan City, specifically for the Bachelor of Science in Information Technology (BSIT) students along with the participation of the St. Peter's College instructors.

In the present study, the external variables were excluded. Behavioural Intention to Use and Actual System Use from Figure 3 in Technology Acceptance Model (TAM) [10]. In evaluating the level of acceptance and efficiency of the Learning Management System, Perceived usefulness (PU), perceived ease of use (PEOU), and attitude towards using (ATU) are the basis of analysis. Furthermore, ISO 9126 was used to assess the quality features of the program.

The researchers limited herself to developing a Learning Management System comprising the major processes or functionalities cited in the previous section of the study. Furthermore, the researchers implemented a notification Reinforcement Q-Learning algorithm to set the time to notify or alert the instructor once the student received and downloaded the uploaded course materials and submitted the course assessment. Therefore, once the student and instructor successfully receive the login details, the administrator will also receive a notification. Also, the researchers used a third- party agent Cron-Job to set an appropriate time for the instructor and administrator to receive the scheduled notification.

Graphic analytics reporting and annotations were not included in the study. Moreover, the video or audio recorded for assessment or feedback of the students' class requirements run on the specified browsers, Firefox and Chrome.

E. *Significance of the Study*

This study would be significant to students, instructors, and school administrators.

➤ *Students and Instructors*

This would benefit them since they can use it as an alternative venue for their discussions and sharing of resources because it is a virtual extension of the classroom accessible via the internet.

➤ *School Administrators*

This would implement tighter control on course content and delivery since they can also access the site.

F. *Definition of Terms*

To understand the study better, the following terms were operationally defined:

Attitude Towards Using refers to a person's perspective towards using that technology.

CodeIgniter refers to an open-source, easy-to-use, object- oriented application framework for application development.

➤ *CronJob refers to a third-party agent to set up a suitable time for the instructor and administrator to receive the timetable's notice.*

- *Database refers to a structured set of data held in a computer.*
- *Efficiency refers to a system resource used when providing the features concerned with these characteristics.*
- *Experts refer to someone who evaluates the system developed to determine the program's quality features.*
- *Functionality refers to the main objective of every product or service.*

➤ *Google Calendar refers to a scheduling and time management service developed by Google Calendar, allowing users to create and edit events.*

- *Hypertext Preprocessor (PHP) is a scripting language used to create dynamic and interactive HTML Web pages.*
- *ISO 9126 refers to the software assessment universal standard.*
- *JavaScript (JS) is a programming language widely used in webdevelopment.*
- *JQuery refers to a library allowing web developers to add functionality to their websites.*

➤ *Learning Management System is a software application or Web-based technology used to prepare, execute, and analyze a specific learning process.*

- *Maintainability refers to an ability within a software function to detect and correct a fault that these features address.*

- *Perceived Ease of Use refers to the degree to which a person believes it would be effortless to use a particular system.*
- *Perceived Usefulness refers to the degree a person believes will improve their job performance using a particular system.*
- *Portability refers to how well the software can adapt to changes in its context or needs.*
- *Reliability refers to once a designed and distributed software system is running. The consistency attribute determines the system's ability to sustain service delivery over defined periods under defined conditions.*
- *SMS Twilio API refers to a well-defined software interface. That allows code to send short messages via an SMS Gateway.*
- *Usability refers to the ease of use for a given function.*
- *Technology Acceptance Model (TAM) refers to a theory of an information system that describes how users adopt and use it.*

Web Real-Time Communication (WebRTC) is a free, open-source project offering real-time communication to web browsers and mobile applications.

II. REVIEW OF RELATED LITERATURE AND STUDIES

The studies and literature in this chapter provided background and theory relevant to the proposed study.

A. Learning Management System

The usage and rising improvement of the Learning Management System give a new way to enhance classroom education. It is also a driving force in education today. It has reshaped how instructors teach and how students learn. Also, LMSs are centralized, online platforms that commodify instruction and distribution and reception evaluations [24].

For over fifteen years, the LMS has supported organizations and institutions. Since then, the LMS has developed from accomplishing administrative tasks associated with e-learning and content support to representing the many aspects in which digital content and just-in-time learning are now comfortably available.

A few terms and associated acronyms refer to e-learning platforms that are similar yet conceptually different. Thus, LMS refers to structured cloud-based or client-based software primarily intended to support or set up teaching and learning. An LMS is an online system with a collection of software that enables the teaching-learning process.

In [34] claimed that the LMS is an automated, collaborative platform that enables instructors and students to share data and to give access to the content and administrative features of specific courses. [7] clarified that LMS offers an online and interactive learning assessment.

In [12], the active learning management system promotes teamwork and coordination, facilitating group activities and a constructive approach to information acquisition. Assessments of the learning management system are essential for the students on how useful, desirable, and reliable such a learning platform is. Increased use of the multimedia feature will draw student interest and increase the students' attractiveness, engagement, and retention. The management will also consistently monitor and enhance instructor sensitivity and student inquiries [32].

In [27] listed the LMS as an instruction delivered on a computer that provides learning-related content, uses instructional strategies such as examples or practice activities to aid in learning, uses a range of media elements to deliver content and processes, and builds new knowledge and skills linked to the improved establishment.

LMS typically provides the instructor the means to develop and deliver content, track student engagement, and assess student completion. Further, it enables students to use collaborative features such as discussion threads, video conferencing, and discussion forums [20]. [6] explored how content is distributed. The underlying learning methods also play essential roles in the Learning Management System, including tools for analyzing and managing learning information [31].

In [21], LMS is a strategic, creative method designed to deliver teaching and learning effectiveness. LMS plays an essential role in helping students to learn and grow in a wide array of different subject areas online. It also enables instructors to give their students access to high-quality educational content from anywhere, collaborates remotely on class topics and assignments, and allow them to view, store, and submit content as required. He also identified the following functional areas of LMS to include: delivery of course content, registration, and administration of students, certification of curricula, management of skills and competencies, assessment and recording, reporting, and evaluation.

Furthermore, [28] stated that LMS is commonly used throughout higher education to provide various instructional resources, including content delivery, discussion boards, shared workspace, assessment methods, and grade book functions.

In [14], the purposeful use of educational technology in today's schools plays a vital role in teaching and learning. LMSs can be used asynchronously or synchronously to facilitate online, classroom-based, and hybrid learning, incorporating face-to-face and online instruction. A significant process is selecting a suitable LMS for a college, university, or state higher education system.

Several factors determine the results of the learning management system. As [15] figured out, the critical problems that influence the consistency of the learning management system are classified into four primary levels: administration, availability, instruction, and involvement.

The LMS's effectiveness is believed to depend not so much on information technology but on how the instructor uses it [12]. The primary instructor characteristics influencing the Learning Management System's performance are IT skills, teaching style, and attitude. These should be demonstrated through the efficient management of a course based on LMS and the use of encouragement of feedback and two-way contact with the students.

In [5], they aimed to systematically address the characteristics and efficiency of technical equipment on learning outcomes for students using advanced learning platforms. Investments in learning technologies are moving toward teaching modes of low cost tailored to the student's speed and ideal for lifelong continuous training. Educational institutions can change projects' nature by combining e-learning and management processes relevant to conventional training/learning/evaluation systems, increasing the capacity for lifelong learning. The policy of the LMS is vital in ensuring the quality of distance learning. An excellent learning platform must meet specific technical standards associated with the used hardware and software and, simultaneously be combined with unique content to ensure the best learning outcomes.

On the other hand, [19] cited that institutions should find numerous ways to maximize LMS use within their facilities for an LMS to deliver the expected benefits. The following are some approaches that can be used to improve the use of LMS: enhancing the accessibility of LMS, creating and uploading quality learning materials, improving LMS usability, developing and uploading quality learning materials, raising awareness of LMS; making use of mobile applications and complementing public network.

Simultaneously, to promote effective teaching and to learn for the student's benefit, school administrators will continue to support the instructor in incorporating technologies. [32] found that to boost the instructor's willingness, it is essential that overall support, such as the available instruction on how to use knowledge or resources, and administrative support be identified as critical factors influencing the use of instructional technologies in teaching.

B. Notification Algorithm

Significantly, [15] researched a notification timing approach as a Reinforcement Q-learning algorithm and suggested a notification timing selection technique in which the system can alert the user on time. Alerts (including emails, mobile/desktop push notifications, and SMS) are potent and useful online service platforms for user engagement [35], [25]. The unregulated rise of alerts, however, is known to cause unnecessary interruptions and discomfort and even impact the lifestyle of users. It may

have adverse effects and be ineffective and even annoying if they prompt or divert the user's attention at an inappropriate or wrong time [35], [25], [15]. Numerous earlier efforts to address some of the issues were made. [16] concentrated on solving the "when" problem to send a notification causing minimal disruption (i.e., choosing appropriate moments to alert users). [25] derive features such as the hour of the day based on the time when a notification is released.

C. Technology Acceptance Model

Davis Technology Acceptance Model (TAM) (1985), in particular, discusses user acceptance of technology based on user expectations. As stated, the purpose of the model is to tell the determinants that capture the attitude and behavior of a broader range of users of information technology and the influence of its determination on how and when to use the instructional materials. Thus, the instructor developed teaching skills and instructional methodology using such technology.

Similarly, [17], [13], [22], [2], [29] applied the TAM model to analyze and classify the determinants of students and their intentions to use the Learning Management System to identify factors that may impede or influence students' use of LMS. In this context, the TAM model can be used as a useful theoretical basis for understanding students' intentions to use the Learning Management System, highlighting the students' positive attitudes toward LMS. Also, the student's perception of ease of use, usefulness, attitudes towards online learning, and the social influence of the referent group of students was established as significant as significant determinants of the intention of students to pursue online education.

D. International Organization for Standardization (ISO) 9126

ISO/IEC 9126 was defined in 1991 by the International Organization for Standardization (ISO) as the standard for software quality assessment [30] and was adopted in 1991. This norm can decide the software quality model and guidelines for measuring the related characteristics.

Also, ISO/IEC 9126 has been used extensively in work undertaken to assess the quality of a system [4], [23], [1], [9]. ISO/IEC 9126 specifications comprise six (6) quality features, i.e., functionality, reliability, usability, efficiency, maintainability, and portability. These characteristics represent a detailed software system evaluation model [9].

E. Review of Available Learning Management System

Table 1 Available Learning Management System

Features	Learning Management System						
	ATutor	Claroline Connect	Dokeos	Ilias	Moodle	Sakai	Proposed Study
Real-Time Chat	☑	☒	☒	☑	☑	☑	☑
Discussion/Forum	☑	☑	☑	☑	☑	☑	☑
Internal Mail	☑	☒	☑	☑	☑	☒	☑
Whiteboard	☑	☒	☒	☒	☑	☒	☑

Video Conferencing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Video/Audio Recorded (Assessment/ Feedback)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Email Notification	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
SMS Notification	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Assignment Manager	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Content Repository	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Calendar	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Table 1 above compares the existing open-source Learning Management System (LMS) with the proposed system. The table presented the differences and similarities between each available Learning Management System based on the modules each provider had given. In general, the difference between the proposed study and the available open-source LMS was the whiteboard, video conferencing, video or audio captured

F. Review of Available PHP Framework

Table 2 Available PHP Framework

Features	PHP Framework				
	Proposed Study	CakePHP	Zend	Yii	Symfony
Model-View-Controller Based System	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Extremely Light Weight	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Full Featured database classes with support for several platforms	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Query Builder Database Support	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Form and Data Validation	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Security and XSS Filtering	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Session Management	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Email Sending Class. Supports Attachments, HTML/Text email, multiple protocols (Sendmail, SMTP, and Mail), and more.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Image Manipulation Library (cropping, resizing, rotating, etc.). Supports GD, ImageMagick, and NetPBM	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
File Uploading Class	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Large library of "helper" functions	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Search-engine Friendly URLs	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

The comparison of the current PHP framework with the proposed CodeIgniter PHP framework is shown in Table 2. Table 2 displays the differences and similarities of each available PHP framework based on each vendor's supplying modules. The difference between the proposed PHP framework and the open-source was its incredibly lightweight, full-featured database classes with support for several platforms, a vast library of "helper" functions, and search- engine-friendly URLs.

III. METHODS

The researchers used the following methods and procedures to support the design and construction of the proposed system.

For the class specifications of the students, and the SMS notification.

A. Research Setting

The study was conducted at St. Peter's College (SPC), the school year 2019-2020, an academic institution in Iligan City, Lanao del Norte. Students from the College of Computer Studies, specifically the Bachelor of Science in Information Technology and St. Peter's College instructors were the primary users of the system. They were the initial survey questionnaire participants.

B. Research Design

Rapid Application Development (RAD) is a system design software development methodology. The main objective of the term 'rapid' is to shorten development time and implement it much quicker. (Sasmito et al, 2020; Delima et al., 2017)

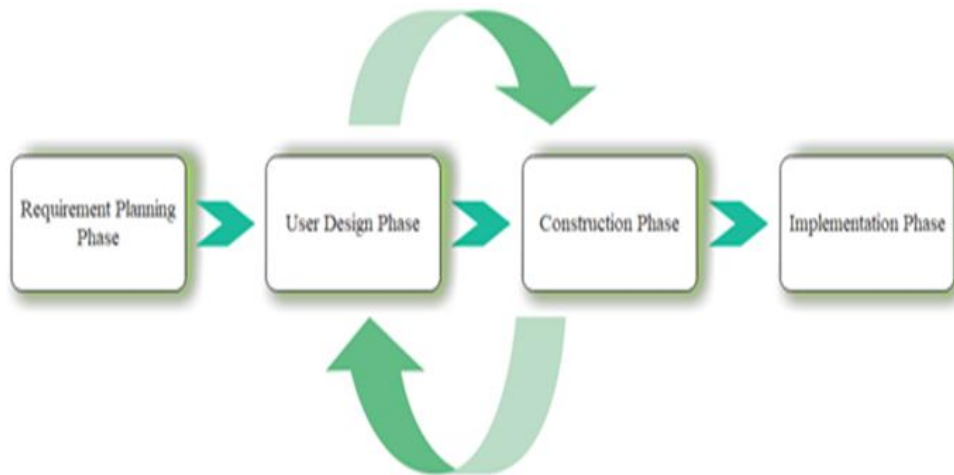


Fig 4 RAD Framework ([26], [11])

The proposed system was developed using Rapid Application Development (RAD), shown in Fig 4, to develop the system faster. Also, RAD is comprised of four distinct phases. These are:

➤ *Phase 1: Requirements Planning Phase*

To address the proposed system's specifications and project scope, the researchers consulted with those responsible for developing a learning management system (LMS). The researchers also defined the main procedures or features of the suggested system. Also, the researchers' ability to assess the demands and specifications of both students and instructors was aided by this stage.

• *These were the Procedures Observed:*

- ✓ Identification of individuals involved in creating the St. Peters' College Learning Management System. These are the Executive Officer for Administration or Registrar, Executive Officer for Academic Affairs, and College Dean.
- ✓ Conducted a discussion with the persons involved in creating the Learning Management System to create the appropriate system functions.

➤ *Phase 2: User Design Phase*

Based on the specifications acquired in Phase 1, the researchers produced a system prototype, including the database design structure. A system prototype includes the user interface, such as the forms and reports that will be designed, whereas the database design includes a graphical representation of the database entities and relationships.

• *These were the Procedures Observed:*

- ✓ *Developed the Prototype of the Proposed Learning Management System*
 - Designed the system administrator dashboard, which contained the system's major processes.
 - Designed the dashboard for the instructors and students, which includes the modules
 - Designed the database structure for the proposed Learning Management System.

- Define the relationship and primary keys
- Database normalization
- Finalize the database structure

➤ *Phase 3: Construction Phase*

The researchers created the Learning Management System's physical application system based on the prototypes and database structure generated in Phase 2. This involved the creation of reports and the formation of stored procedures. The researchers used CodeIgniter, a PHP framework, to create the proposed study, which served as the front end, and MySQL as the system's back end.

• *These were the Procedures Observed:*

- ✓ *System design and creation of the proposed Learning Management System.*
- ✓ *Actual testing of the proposed Learning Management System per major system functionalities or processes cited in the previous section. These are:*
 - *Unit Testing* – was carried out by the researchers and the user for each finished program to find and fix execution issues that could lead to an unexpected program termination. Actual student and instructor data were used for the test.
 - *Integration Testing* – link testing is conducted when a certain module is associated with another. Since each module in Learning Management System was intimately related to the others, it follows that when student and instructor processes are followed, the results of the previous process will be accurate and accessible.
 - *System Testing* – during this test, the system went through all the usual processing scenarios compared to the anticipated performance for different users. The system is fed with real test data to imitate real processing. Users check processes and outputs to ensure the system is operating properly.

➤ *Phase 4: Implementation Phase*

In this step, the program developed was incorporated into the school's learning process by the researchers. Also, this process included an evaluation of the level of acceptance and its effectiveness of the system to be

performed by the St. Peter's College instructors and the students of the College of Computer Studies, which involved Perceived Ease of Use (PEU), Perceived Usefulness (PU) and Attitude Towards Use for the user acceptance testing and effectiveness of the system, end-user training, and creation of the user's manual. Student and instructor questionnaires were a standard and pilot question from the study [2], [17], and ISO 9126 for System Quality Characteristics questionnaire for expert assessment is a standard and pilot question from the study of [9] to assess its overall performance.

- *These were the Procedures Observed:*
- ✓ *Creation of a user manual for the Learning Management System.*
- ✓ *Learning Management System for pilot run testing at St. Peter's College.*
- ✓ *Evaluation of the students' and instructors' acceptance and efficacy of the Learning Management System.*
- ✓ *Evaluation of the Learning Management System by the identified experts*

C. *Physical Environment and Resources*

This section presented the Learning Management System hardware and software specifications.

➤ *Hardware Requirements*

Table 3 shows the following hardware specifications that fit the system to run.

Table 3 Hardware Requirements for Server

Server Hardware and System Configuration	
Processor	Intel i5/ i7/ Xeon recommended
Memory	16 GB of RAM, 40 GB HDD Free Space.
Other Hardware	GPU that is compatible with OpenGL 3.2.(integrated graphic cards Intel HD 4000 or above)
Operating System	Any Microsoft OS
Database Server	MySQL
Web Server	Apache

➤ *Software Requirements*

Web Server

Learning Management System was developed using open source technologies integrating free and available server-installed software, including:

- *PHP framework, which is the CodeIgniter3.1.7, Bootstrap, and other standard libraries enabled or installed*
- *PHPMyAdmin – a graphical interface for handling MYSQL transactions*

D. *Architectural Design*

This section presented the architectural design and the tools and techniques, including the Context Diagram, Use Case Diagram, and Entity Relationship Diagram (ERD).

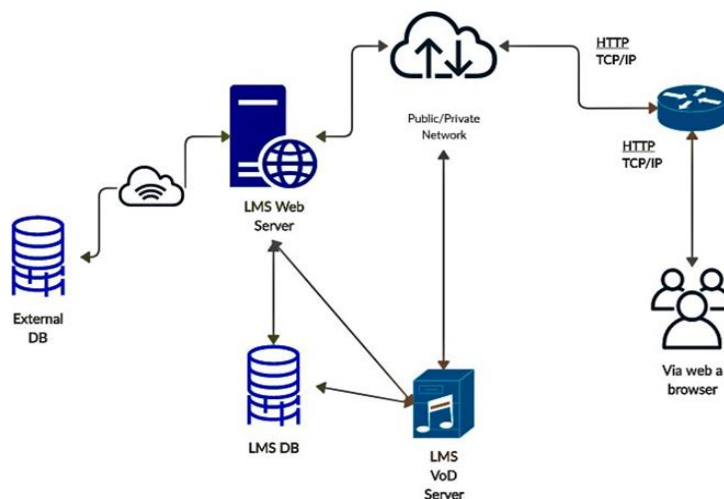


Fig 5 Architectural Design

As shown in Fig 5, the LMS system consists of one LMS web server, one LMS DB, and one LMS VoD server. If these three network components stopped working, the LMS service wouldn't be available.

➤ *Context Diagram*

Context Diagram, also known as the scope of the study or research, depicts the full area of studied activity.

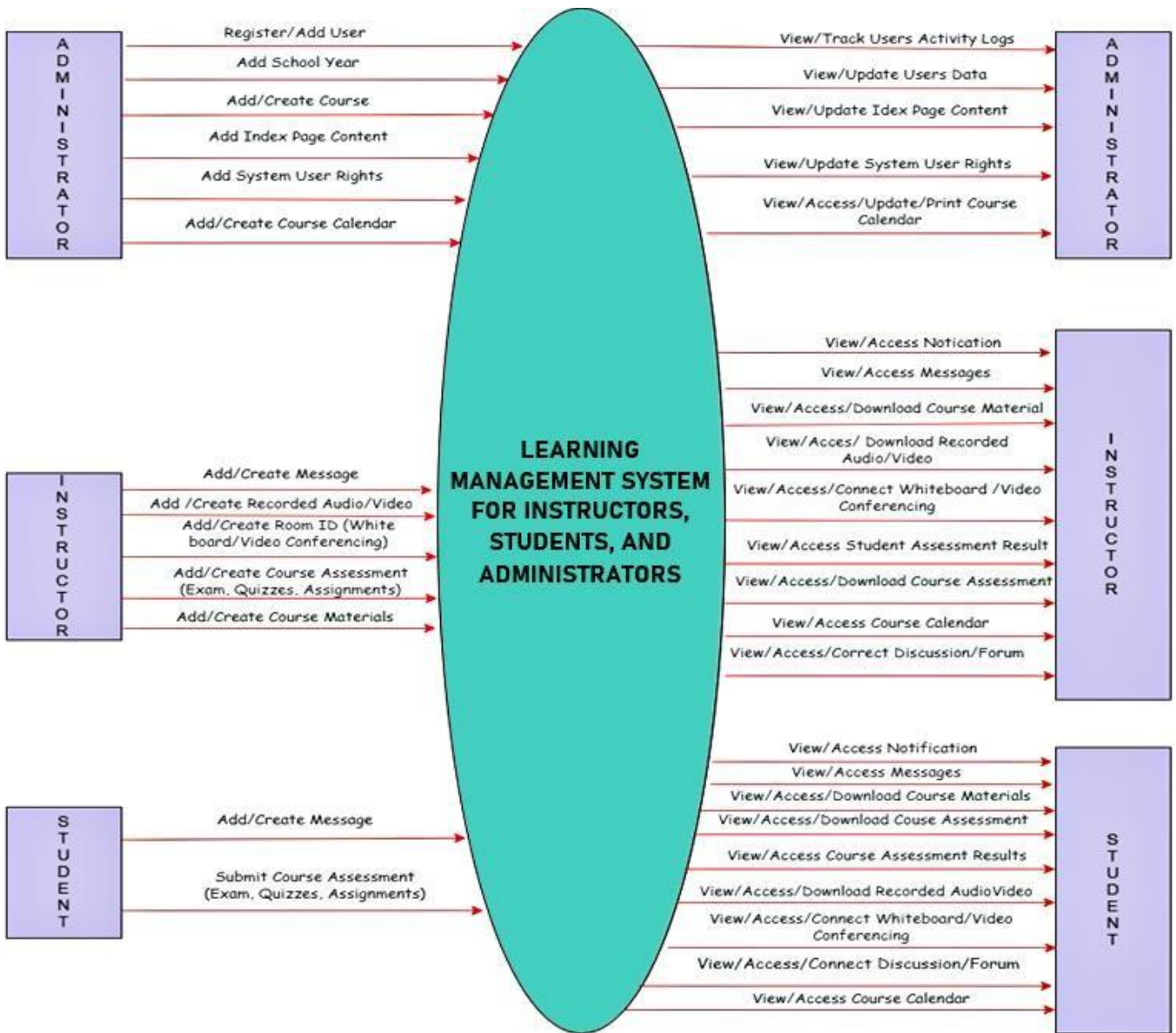


Fig 6 Context Diagram

The high-level view of the system is shown in Fig 6. This included all the user flow, which shows the relationship with the other external entities that the Learning Management System has.

➤ *Use Case Diagram*

A use case depicts a capability (a particular system usage) that the system offers and shows how the actor (the system behavior as the user views it) perceives it externally. It does not, therefore, explain how the system provides functionality.

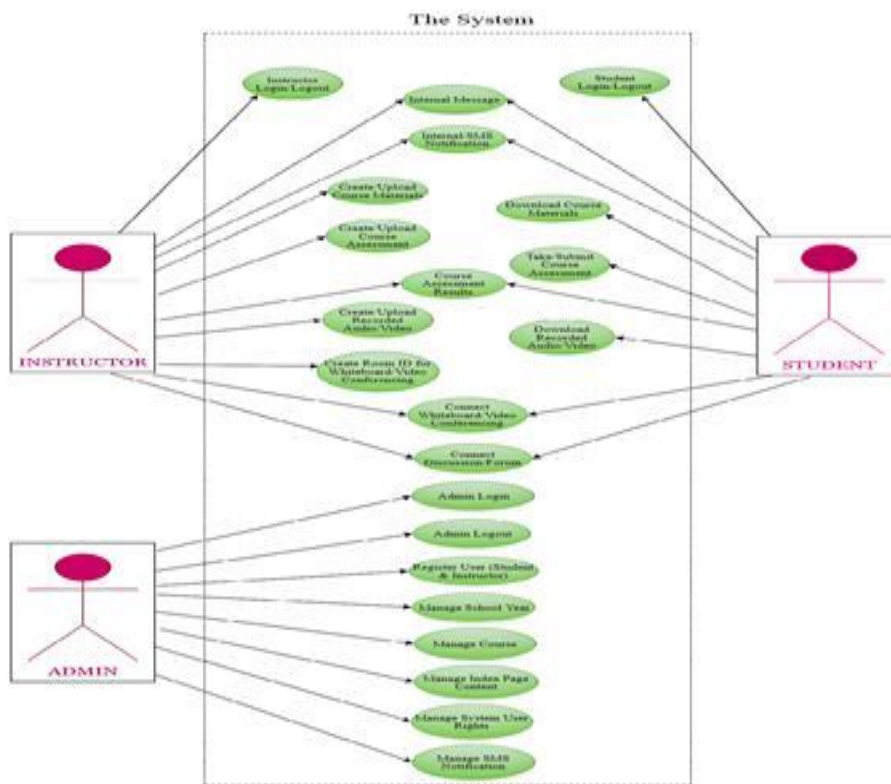


Fig 7 Use Case Diagram

Fig 7 shows several external actors and their relation to the use cases provided by the system. The system administrator, instructor, and student are the main actors in this figure.

➤ *Entity-Relationship Diagram*

Entity-relationship diagrams allow designers and users to interpret what the planned database is destined to do and how it could work and communicate about the database through a common language. This illustrates how data will be handled and structured within the various elements of the final database. Therefore, the entity-relationship diagram is used logically to give the instructor, student, and administrator a clear LMS picture.

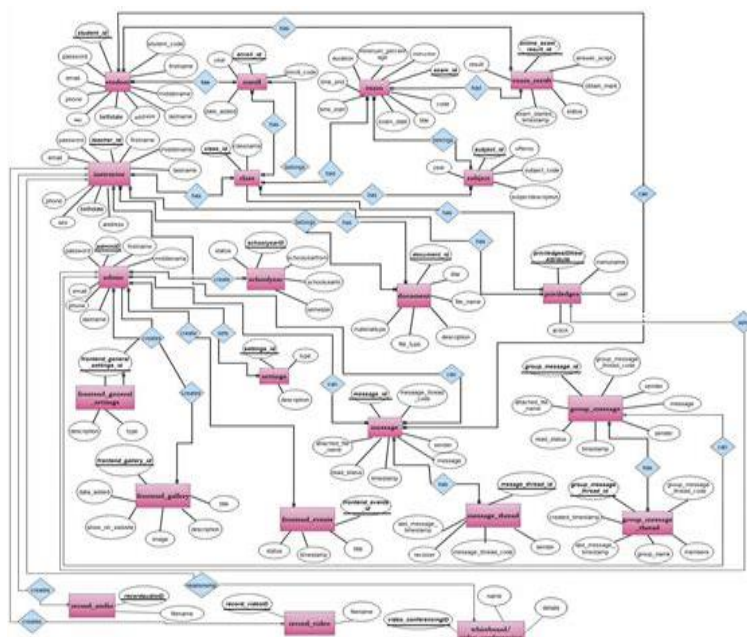


Fig 8 Entity Relationship Diagram

Fig 8 illustrates an entity-relationship diagram. The ERD has different entities in the Learning Management System for the instructor, student, and administrator. That entity is composed of attributes that define that entity's records.

E. Participants and Sampling Procedure

A survey was conducted randomly based on the Technology Acceptance Model (TAM) and the ISO 9126 Software Quality Model to gather information on the developed Learning Management System. In this case, the following were considered as the participants of the study:

- The current 100 students enrolled in St. Peter's College Bachelor of Science in Information Technology;
- 100 Faculty members of St. Peter's College;
- and 7 identified Experts

F. Research Instruments

The Technology Acceptance Model served as the basis for the survey preparation. The survey prepared was a standard and pilot evaluation of students' and instructors' questions from the study by [2], [17] was done. A five (5) - point Likert scale was used to determine the level of agreement or disagreement with particular questions and statements for the respondents' survey. Table 4 on the agreement level and their concise description are shown on the following page.

Table 4 Agreement Levels and their Concise Description

Scale	Range of Means	Verbal Description
5	4.50 – 5.00	Strongly Agree
4	3.50 – 4.49	Agree
3	2.50 – 3.49	Neutral
2	1.50 – 2.49	Disagree
1	1.00 – 1.49	Strongly Disagree

An expert using the Standard ISO 9126 Quality Model was given another set of survey questionnaires. A five-point Likert scale was used to determine the level of agreement or disagreement with the participants' responses to particular questions and statements. Table 5 shows the agreement level, and their concise description is below.

Table 5 Agreement Levels and their Concise Description

Scale	Range of Means	Verbal Description
5	4.50 – 5.00	Highly Acceptable
4	3.50 – 4.49	Acceptable
3	2.50 – 3.49	Neutral
2	1.50 – 2.49	Unacceptable
1	1.00 – 1.49	Highly Unacceptable

Nonetheless, the anonymity of the responses was underlined with the guarantee that the study would not state the respondents' identities. Finally, all the questions were restricted; only one respondent's answer was needed.

G. Validity and Reliability of the Instruments

The researchers carried out the test instrument validity and reliability. The questionnaire was pretested to 30 instructors, 30 St. Peter's College students, and 5 identified experts.

Also, the validity of the measurement in terms of the design's reliability and validity was determined. The reliability analysis was performed to ensure the internal validity and accuracy of the items used for each variable. Cronbach's alpha was used to assess that the survey questions are a reliable measurement instrument.

Table 6 shows the reliability of the three (3) survey questionnaires. Based on the results shown in Table VI, both constructs exhibited Cronbach alpha values higher than 0.70, which means it was a reliable tool.

Table 6 Reliability Statistics of the Three Questionnaires

Items	Cronbach's Alpha	N of Items	Number of Respondents
Instructor	0.960	16	30
Student	0.917	11	30
Expert	0.900	23	5

H. Data Gathering Procedure

The data were collected in the following phases: The researchers sent a letter to the School of Graduate Studies and the Vice President for Research and Extension's office to approve the study. After the study was approved, the researchers sent a letter to the president of St. Peter's College (SPC) requesting that the institution, students, and faculty participate in this study's pilot test. Also, the researchers consulted with some experts to evaluate the system. A written letter of consent to the participants informing

them about the scope of the study and requesting them to participate was also expedited.

The program deployed on the cloud server, and there were actual system uses. A questionnaire was given to the students and instructor to assess the system after the system's first use.

An expert evaluated the system to determine the quality characteristics of the system.

I. Statistical Techniques

The data collected were entered into the Statistical Analysis System (SAS), and the researchers sought assistance from a statistician to ensure the right understanding and analysis of the findings.

For Objective 2, Mean and Standard Deviation were used to determine the Learning Management System's level of acceptance using the Technology Acceptance Model. Also, for Objective 2, Pearson Product-Moment Correlation and Multiple Regression were used to assess their efficacy.

For Objective 3, Mean and Standard Deviation were used to assess the Learning Management System Software Quality level as perceived by the experts.

IV. PRESENTATION, ANALYSIS, AND INTERPRETATION OF DATA

This section conferred the results of the system layout and assessment. This includes the appearance, investigation, and explanation of data gathered from the questionnaires distributed to the respondents. This also consists of the tabular presentation of data along with their respective interpretations.

A. Final Project

This is the homepage of the final product, as shown in Fig 9—the system's homepage for instructor, student, and administrator web applications.



Fig 9 System's Homepage

After clicking the Login Portal button on the homepage, Fig 10 will be shown.



Fig 10 Login Page

➤ *Adding and Updating System Users Account in the System*

A user account was created in two (2) ways. First, the student or the instructor would create their account on the Login Page see Fig 10 on the previous page, after which the user chooses whether they are a student or an instructor. The form found in the administrator account would be redirected to register a student or an instructor. The second way is the administrator, who is the one who will create a user account. It could be an instructor, a student account, or the administrator account itself.

• *System Module*

Learning Management System was accessible through the three (3) user levels, the system administrator, instructors, and student.

The system was grouped based on each user's role. Each user has to enter their username and password on the Login Page, as shown in Fig 10 above.

➤ *The Administrator Area*

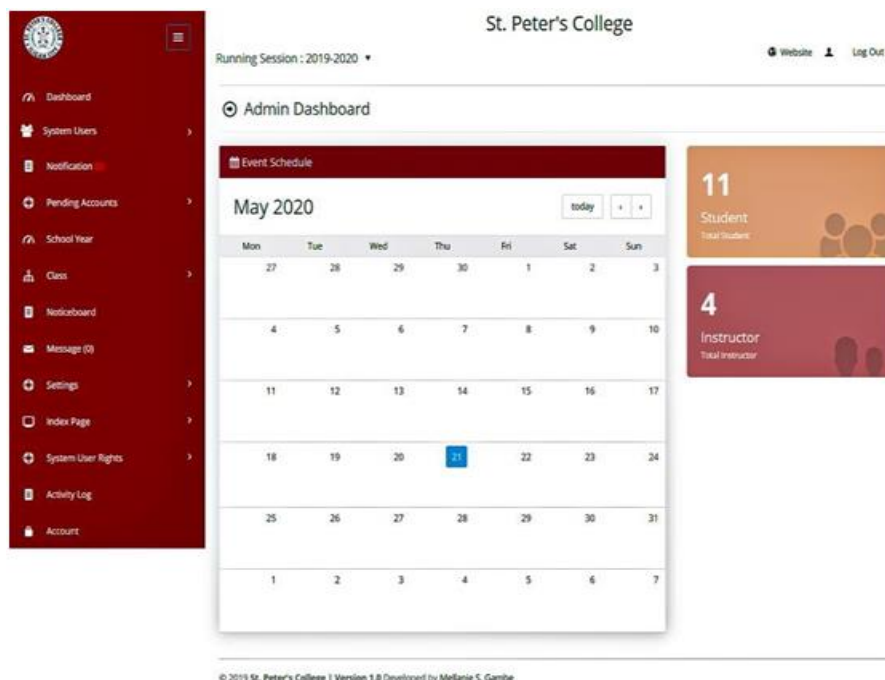


Fig 11 Administrators Dashboard

The administrator area is where the administrator can add New System Users, Notification, Pending Accounts, School Year, Class, Noticeboard, Messages, Website Settings, Index Page, and System Users' Rights and Website Activity Log, see Fig 11.

Once the administrator has signed in, a list of administrative items will be displayed on the screen's left side.



Fig 12 System Users Drop-Down Menu

Fig 12 shows the system users drop-down menu for creating system users.

After the system administrator selected any of the users to be created, the following figures below, Fig 13, 14, and 15, showed the different user forms, such as the administrator, student, and instructor forms, would appear.

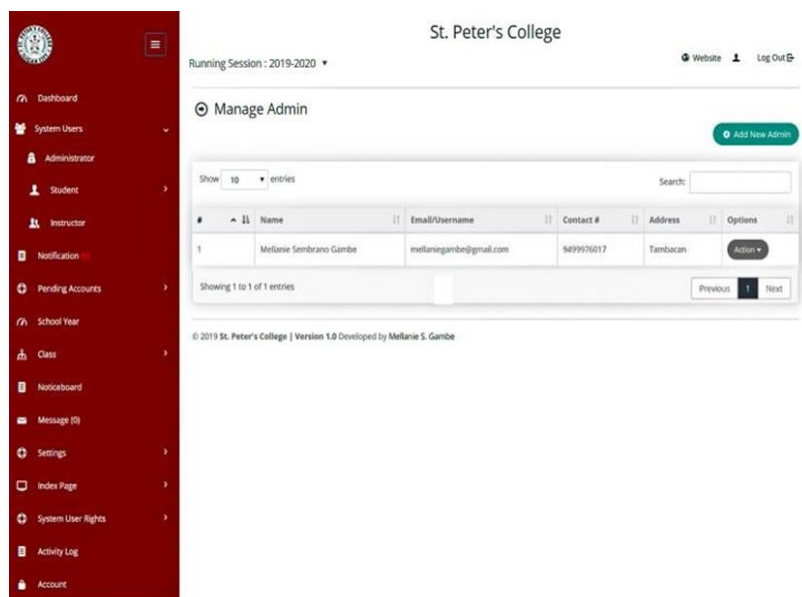


Fig 13 Administrator Form

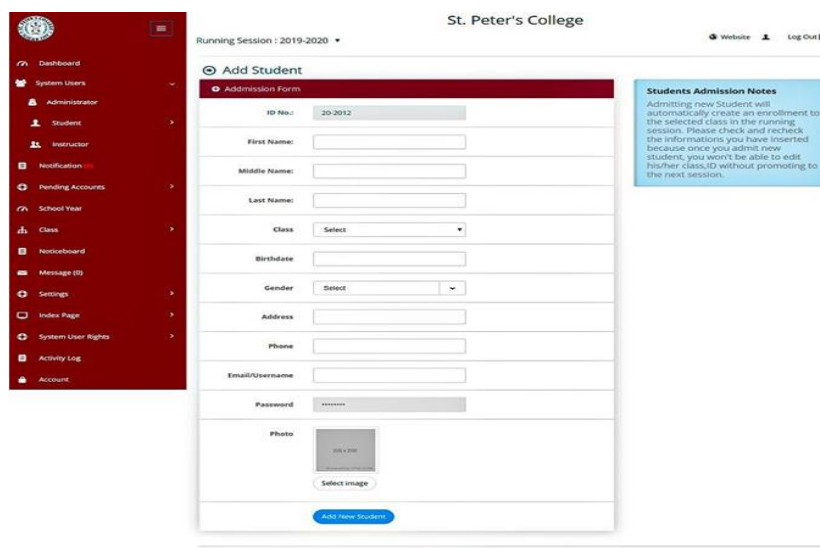


Fig 14 Student Form

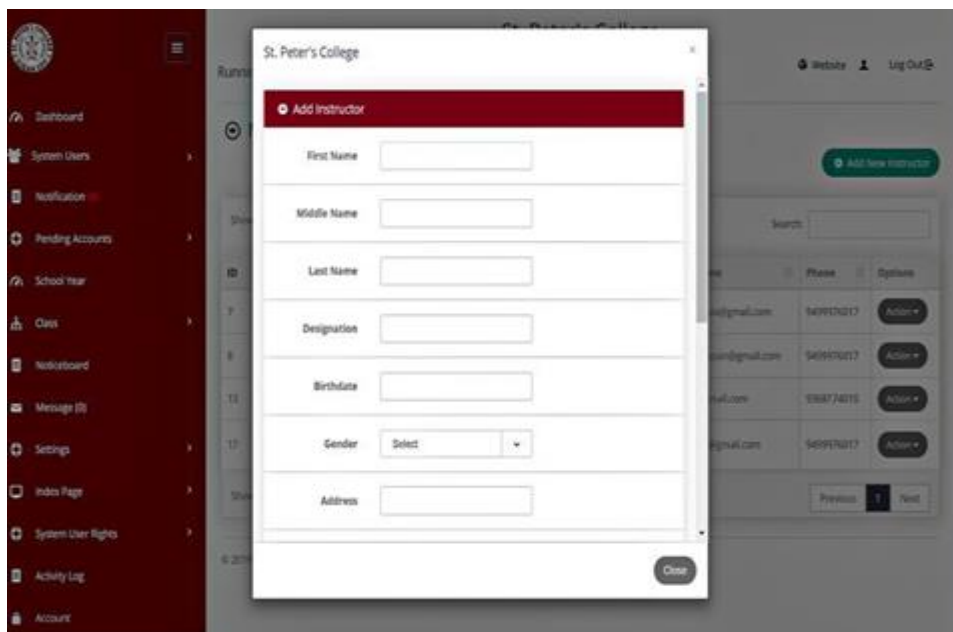


Fig 15 Instructor Form

➤ *Email and SMS Notification of the Account Details Created*

Upon registration, the system will send SMS and Email Notification to the users who have already created their account details.



Fig 16 SMS Notification for User's Account Registration



Fig 17 Email Notification for User's Account Registration

Fig 16 and 17 show the screenshots for SMS and Email notification received by the user.

➤ *Forgot Password*

When the user forgets their password, the system has a function to reset the password.

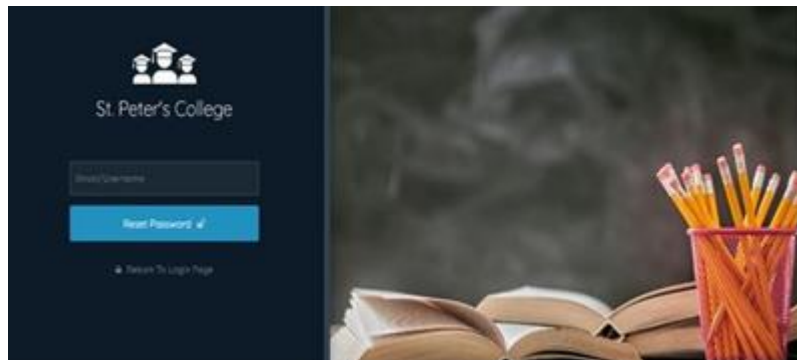


Fig 18 Resetting User's Password

Fig 18 indicates the password reset page. The only prerequisite for resetting the user's password is email or username.



Fig 19 Email Notification for Resetting User's Password

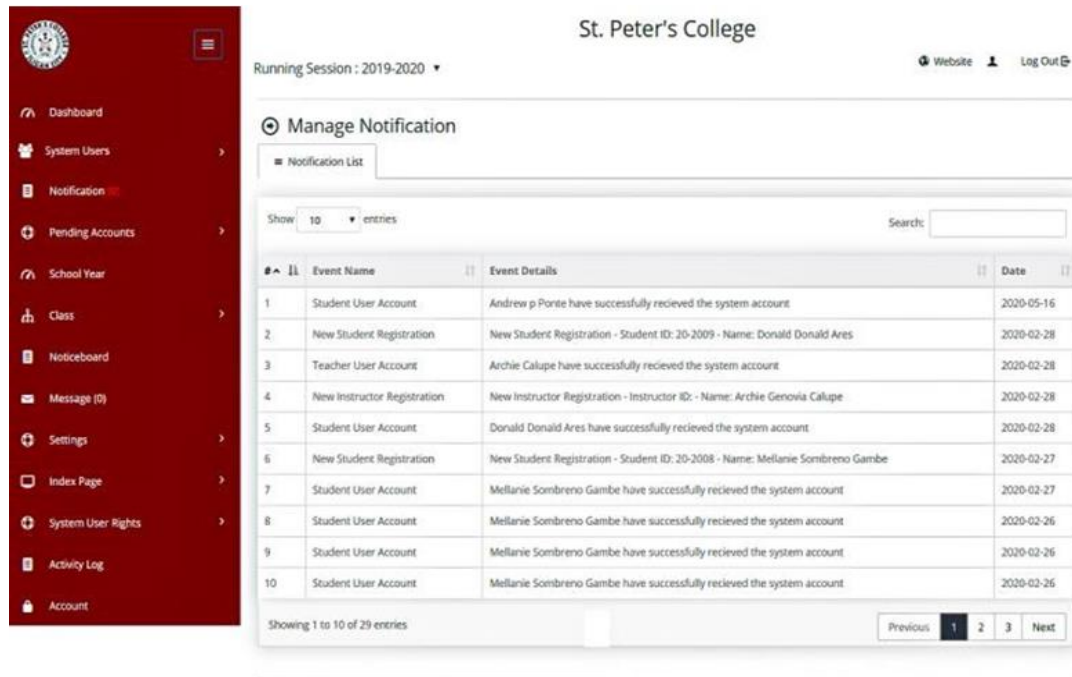


Fig 20 SMS Notification for Resetting User's Password

Upon successfully resetting the password, the user will receive an Email and SMS notification. See Fig 19 and 20 above.

➤ *Notification*

This page contains two (2) kinds of notification. First, a notification by the administrator of the created user accounts whether the student or instructor successfully received the account login details. Second, whether the instructor or the student has created a new registration.



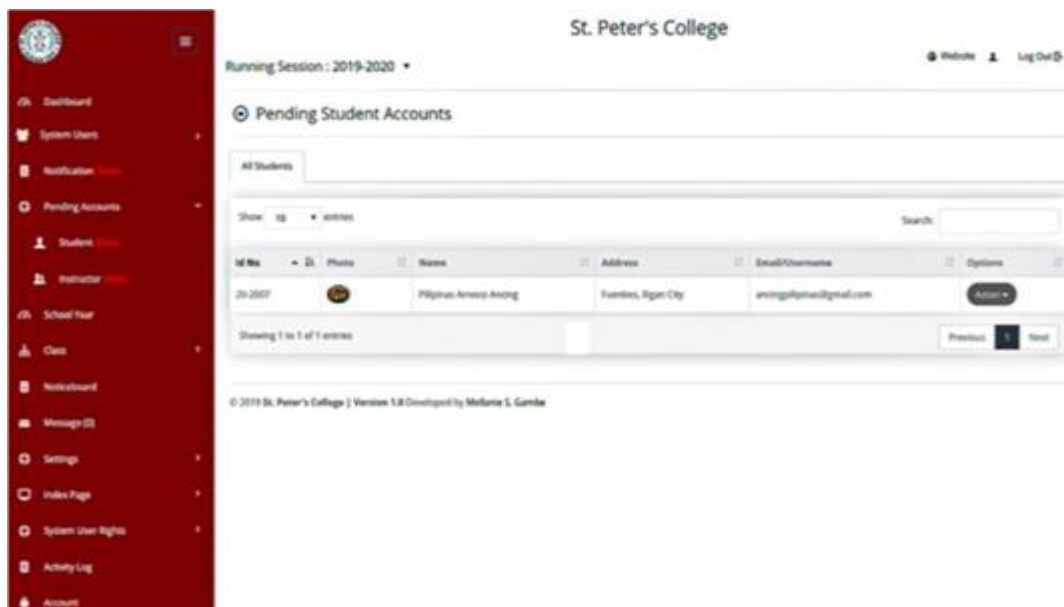
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Fig 21 Notification Dashboard

For verification and activation purposes, the administrator will be notified of the new application for registration; see Fig 21 above.

➤ *Pending Accounts*

This menu contains the requests for the student’s or instructor’s pending account registration.



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Fig 22 Pending Accounts

The administrator must validate and activate the pending account registration, see Fig 22.

➤ *School Year Form*

Once the system is used or published, the administrator must first set the school year and semester before adding any data into the system.

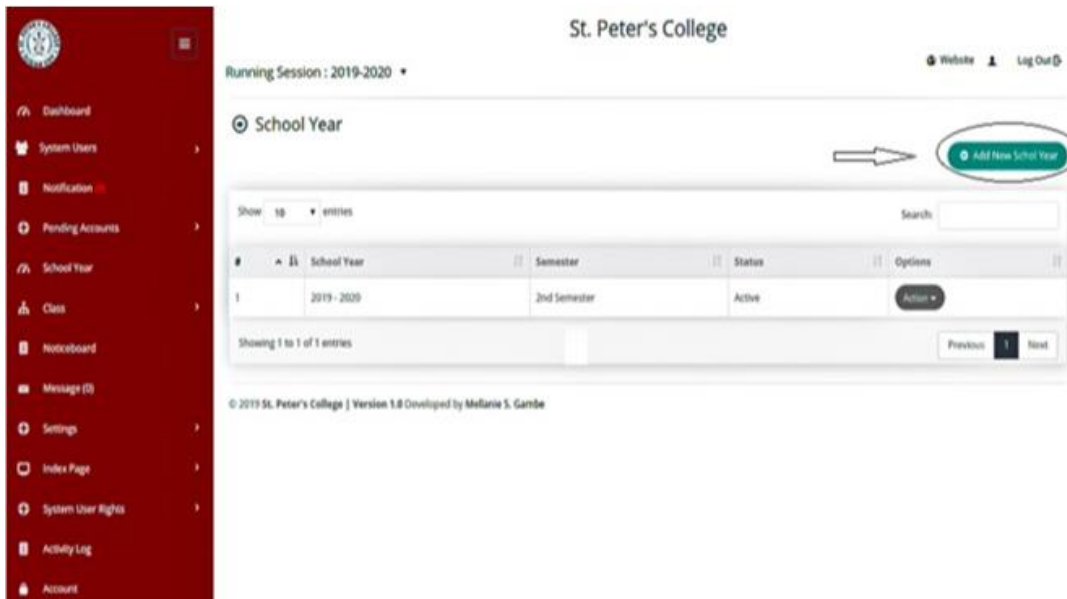


Fig 23 School Year form

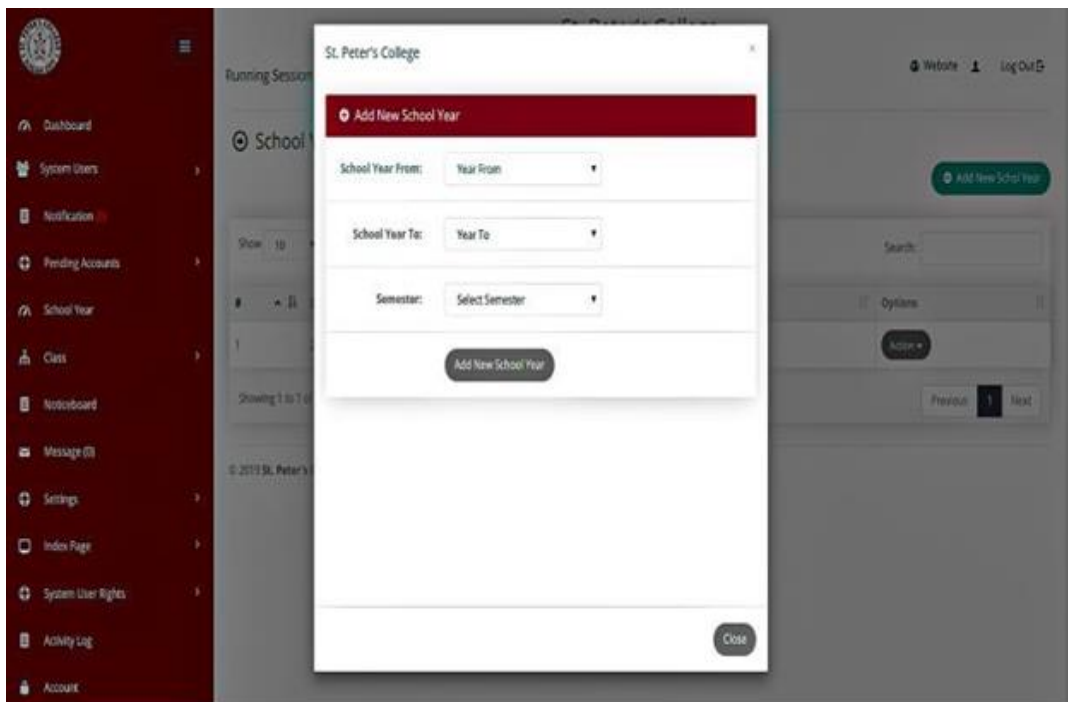


Fig 24 Add New School Year form

The school year form is shown in Fig 23 and contains the school year and semester list. Click the Add New School year button at the top of the form on the right side to add new data. After clicking the Add New School year button, the Add New School Year form will be displayed, as shown in Fig 24. The administrator must input three parameters when setting the New School Year: school year from school year to semester.

➤ *Class Form*

After setting the school year, the administrator will need to set the classes offered in the current school year and semester.

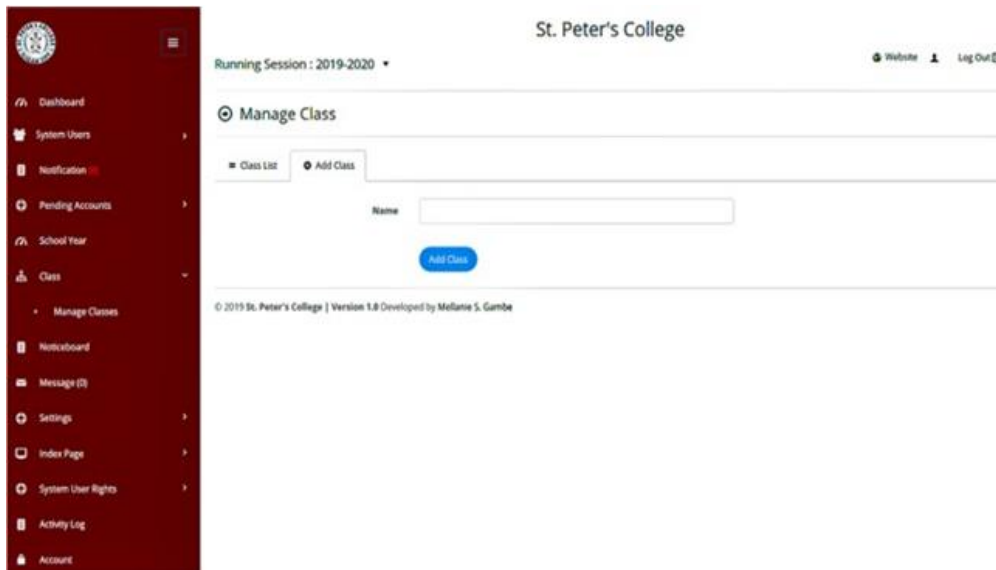


Fig 25 Add Class Form

Fig 25 shows the Class Form. The administrator will add a particular class by clicking the drop-down Menu Class and Manage Class. In this form, the administrator will provide only one parameter: the class name.

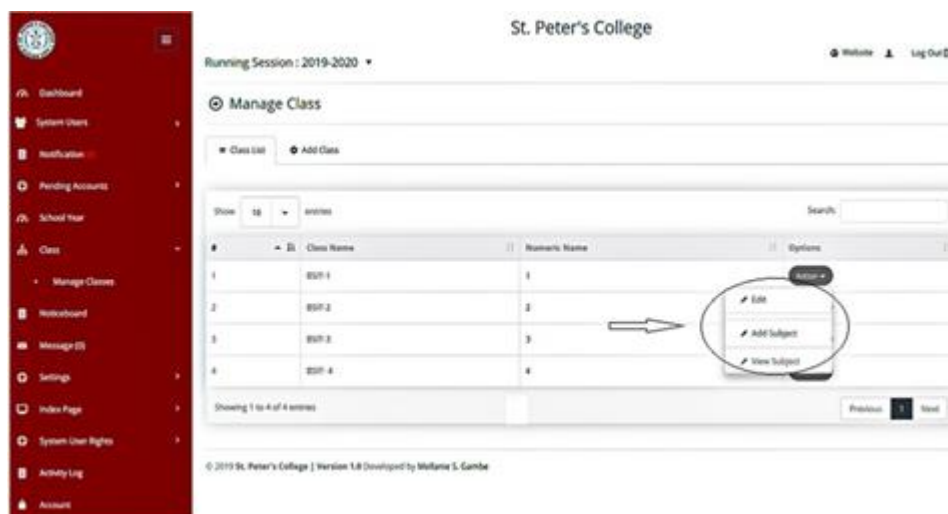


Fig 26 Class Form Drop-down Menu

The administrator will then need to set the subject in the current class by clicking the action button and display a list of menus: Edit, Add subject and View subject, as shown in Fig 26.

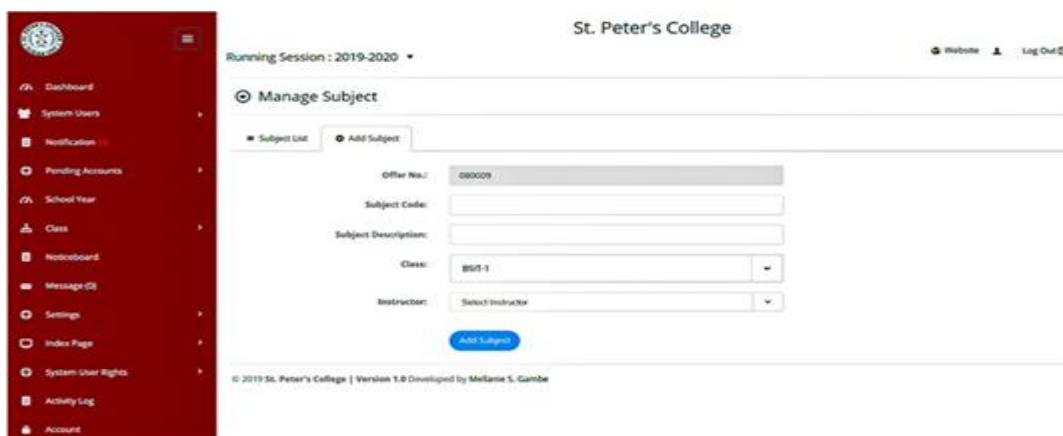


Fig 27 Add Subject Form

Fig 27 shows the Subject form. The administrator will need information such as the subject code, subject description, and instructor.

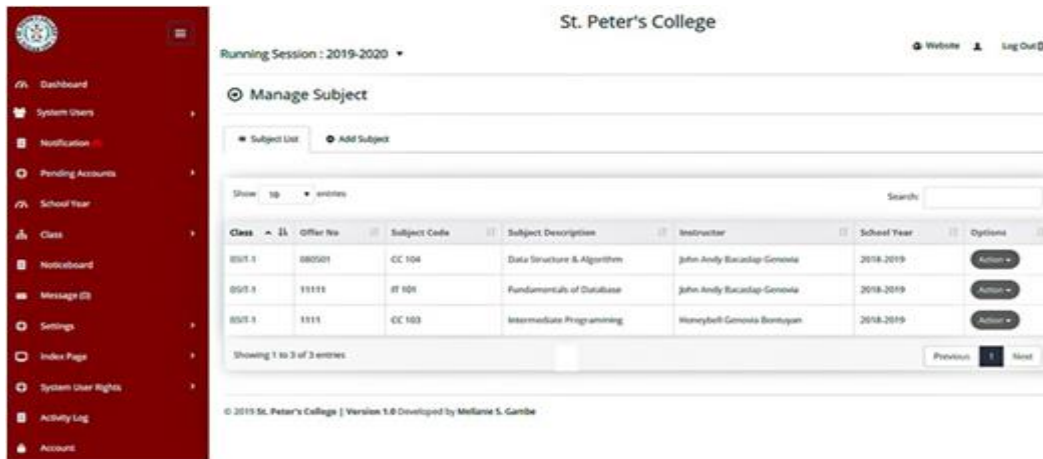


Fig 28 Subject List Form

After clicking on the Add Subject button, it will automatically appear on the subject list in that class. See sample Fig 28.

➤ *System Announcement/Noticeboard*

The system announcement or noticeboard is shown in Fig 29 and 30.

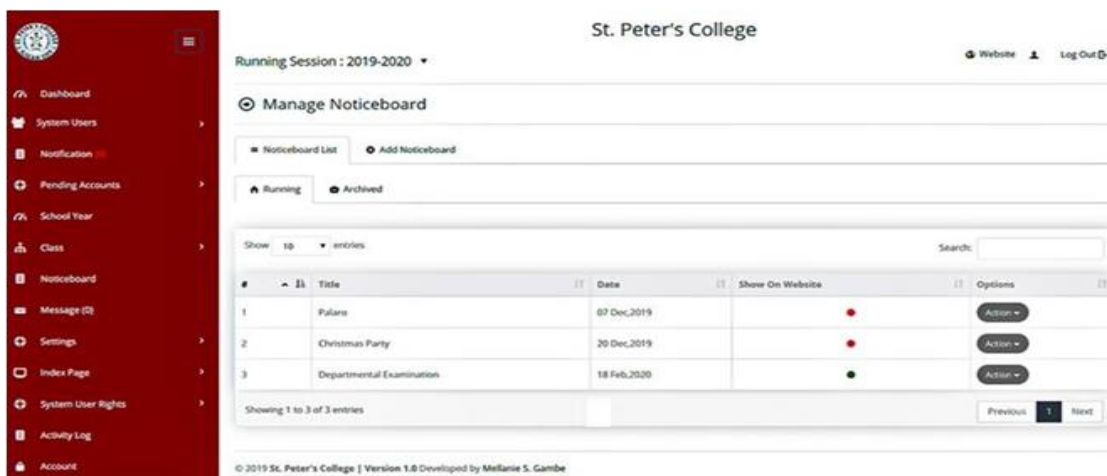


Fig 29 Notice Board or System Announcement Form

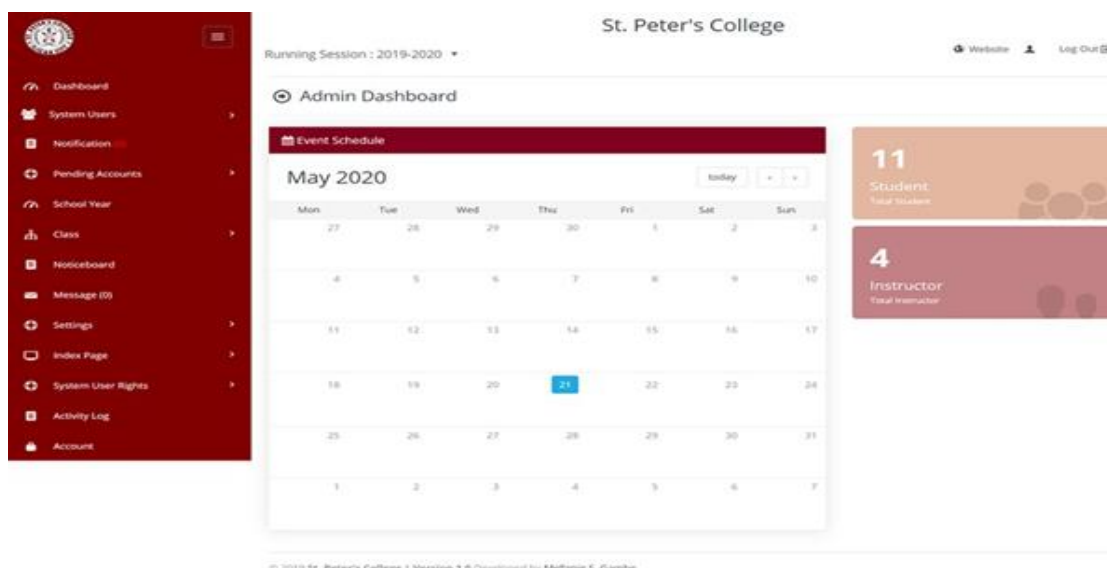


Fig 30 Board or System Announcement Output

The figures above are part of the administrator account where the administrator will create an announcement throughout the system and be shown to every user on the system homepage and system calendar page.

➤ *System Message*

The system can send messages from the administrator via the instructor or the student or vice versa from different users.



Fig 31 Message Dashboard

Fig 31 shows the message page interface in the system wherein the administrator can create a message by group or by an individual for the instructor or the student.

➤ *System Settings*

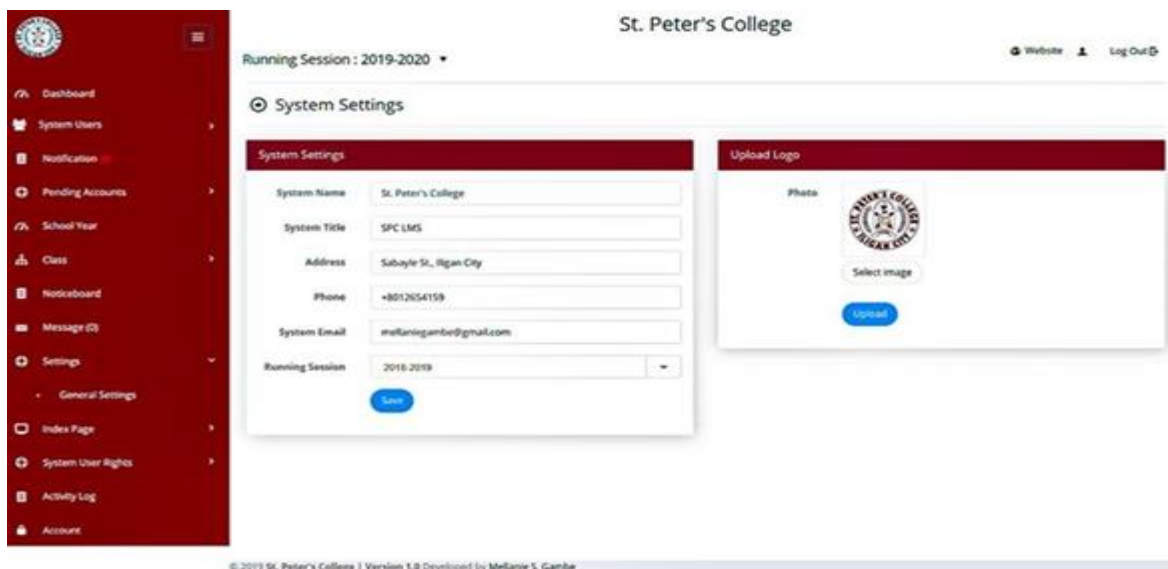


Fig 32 System Setting's Form

The general system settings contain six (6) parameters: System Name, System Title, Address, Phone, System Email, and the Running Session, see Fig 32. Also, the administrator can modify the system logo on the right side of the page.

➤ *Index Page*

The menu index page includes the section where the user must revise the system's front-page display.

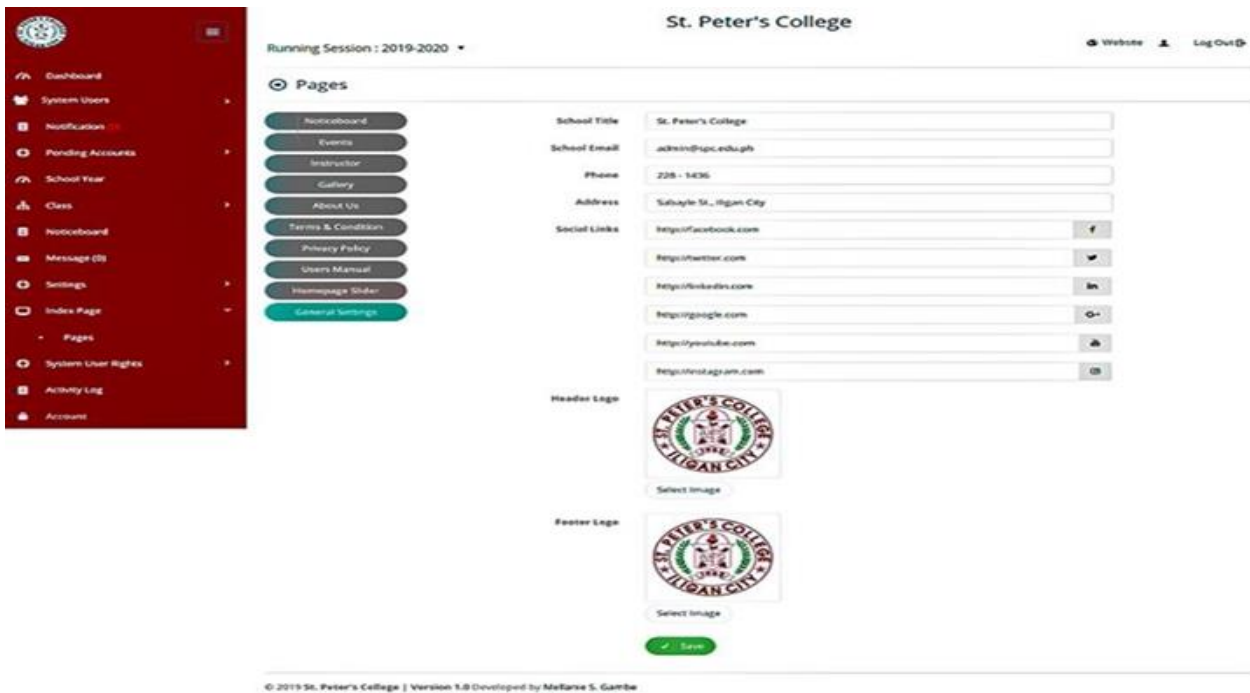


Fig 33 Index Page Form

➤ The following is shown in Fig 33.

- Noticeboard is the system announcement part where the administrator will create an announcement and show it on each page’s homepage (inside the system).
- The menu events page is also an announcement page and will appear on the website's front-end page.
- A Gallery menu page allows the administrator to dynamically add or remove images from the system and view them in the gallery menu at the front-end of the website.
- About Us contains the information or the details of the system or website.
- Home Page Slider page is where the administrator can change or update the photo slider on the website index page.
- The General Setting contains some details of the website and the application logo.

➤ *System User Rights*

An administrator privileged is where the manager can apply the level of entry in the system of the student and instructor according to the menu.

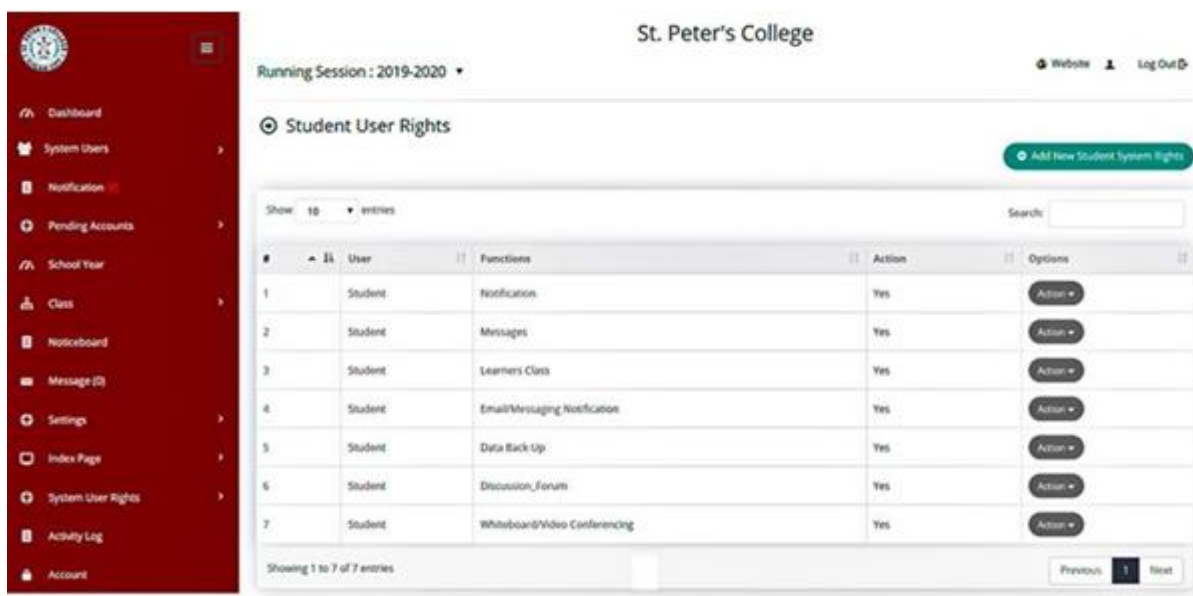


Fig 34 Student User Rights

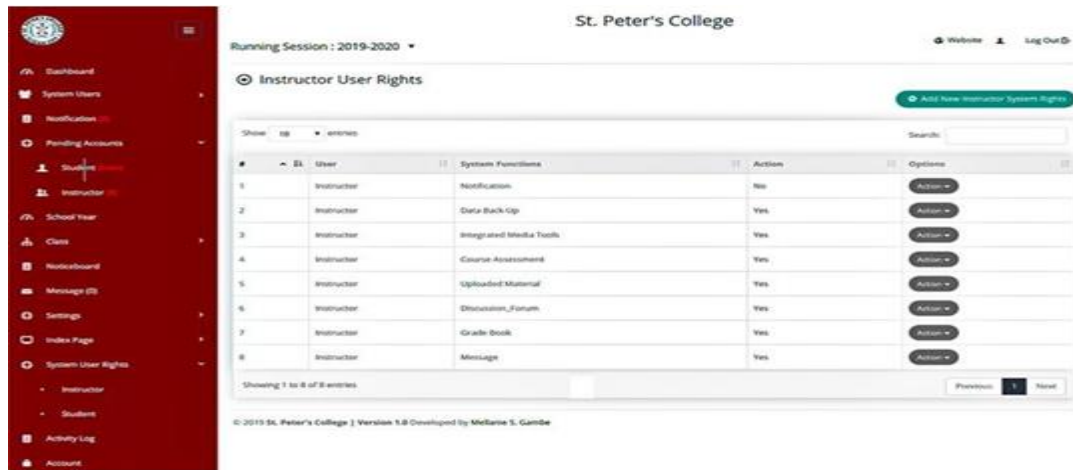


Fig 35 Instructor User Rights

Fig 34 shows the system user rights of the student, while the instructor’s system user rights are set out in Fig 35.

➤ Activity Log

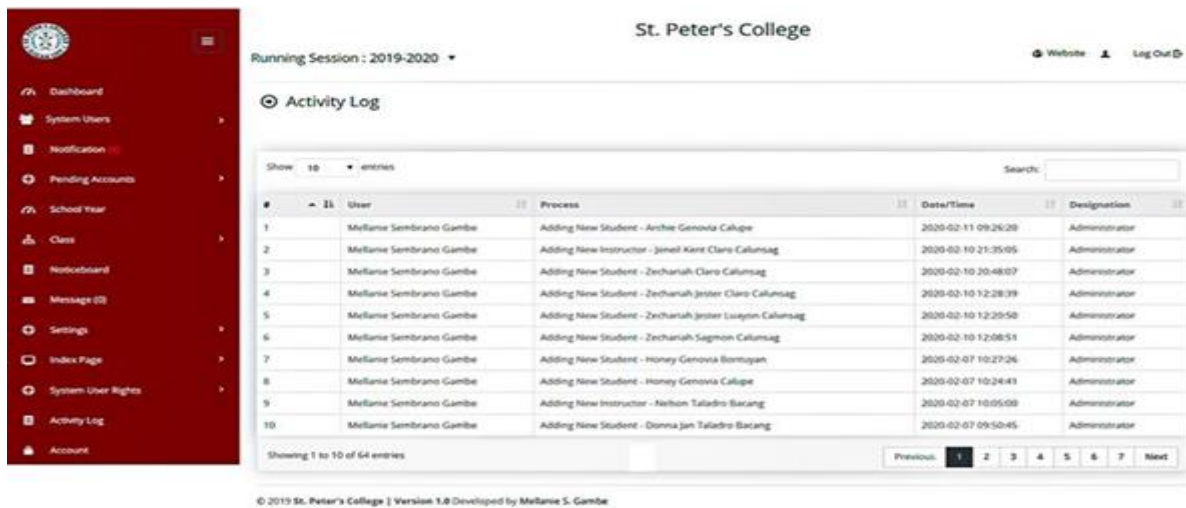


Fig 36 System’s Activity Log

Fig 36 contains all the system logs, such as the list of activities created by the administrator, instructor, and student.

➤ Account

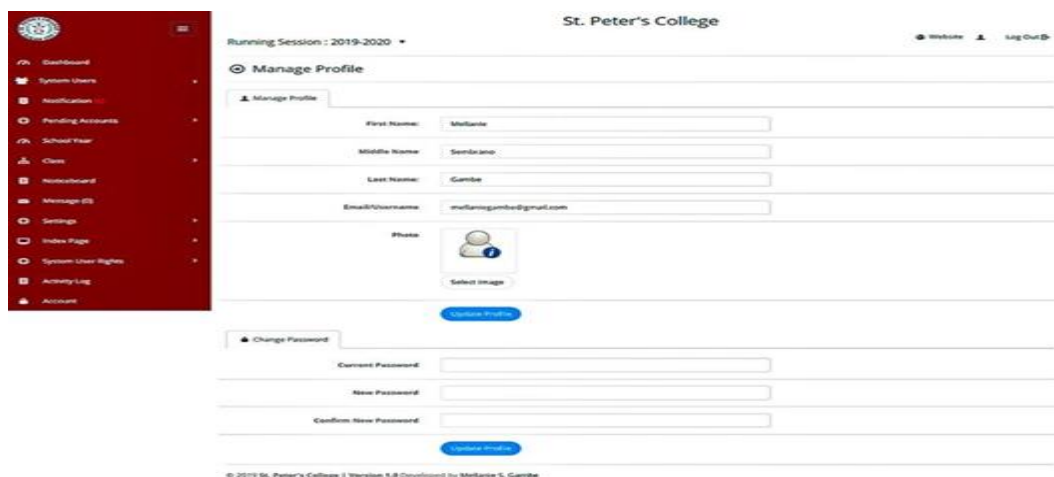


Fig 37 Account Form

In Fig 37, the manager can revise their data and change the username and password.

➤ *Instructor's Account*



Fig 38 Instructor's Dashboard

Fig 38 shows the dashboard of the instructor's account containing the list of menus such as Class, Course Material, Course Assessment, Integrated Media Tools, Notification, Discussion or Forum, Message, and Account Menu.

➤ *Instructor's Class*

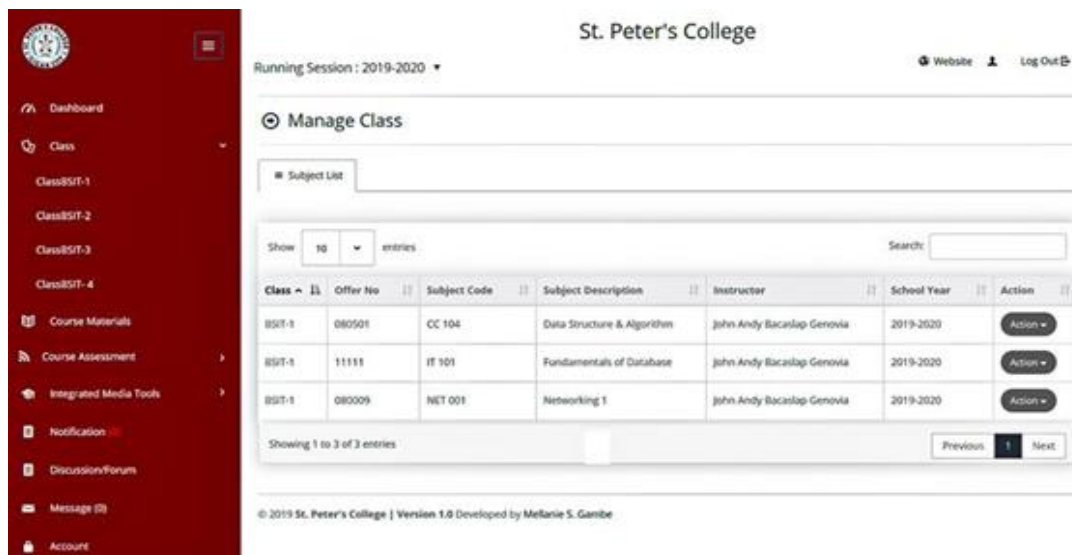


Fig 39 Instructor' Class Form

Fig 39 contains the list of classes, subjects, and a student assigned to the instructor.

➤ *Course Material*

This page is where the instructor will add or create different course materials that will be used for the whole or a particular class. Also, the instructor can download all of the course or specific materials created.

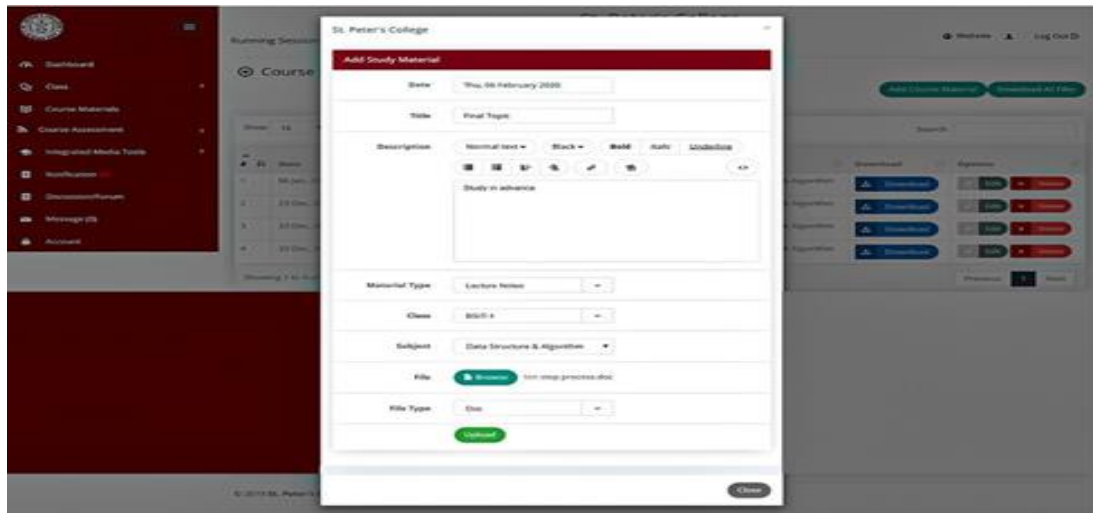


Fig 40 Adding Course Material

Fig 40 shows the form in which the instructor can add or create course material.

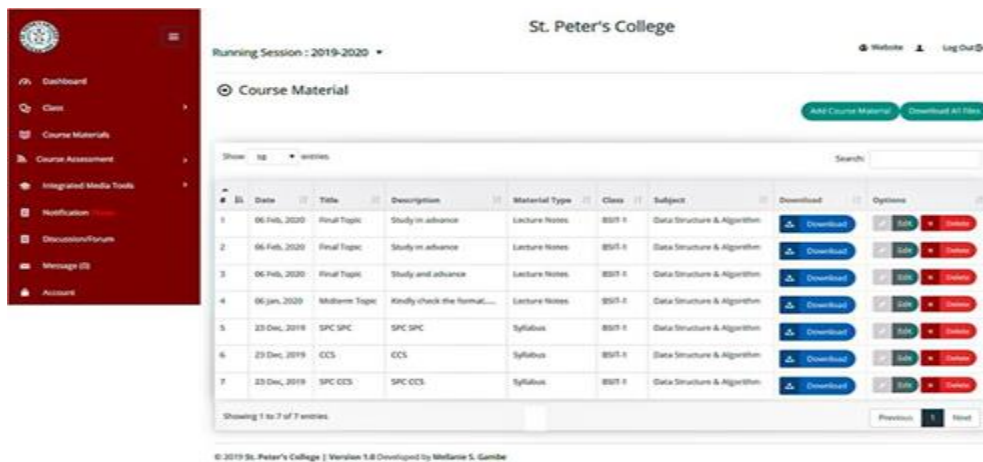


Fig 41 List of Course Materials Created

Fig 41 shows the list of course materials created.

➤ **Course Assessment**

There are two (2) submenus in this menu: Create Course Assessment and Manage Course Assessment. Furthermore, in this menu, the instructor can edit and delete details of the course assessment. This page also contains the action button where the instructor can cancel the course assessment publication after it has been published. It is important to note that the instructor must publish the course assessment before the student can take it.

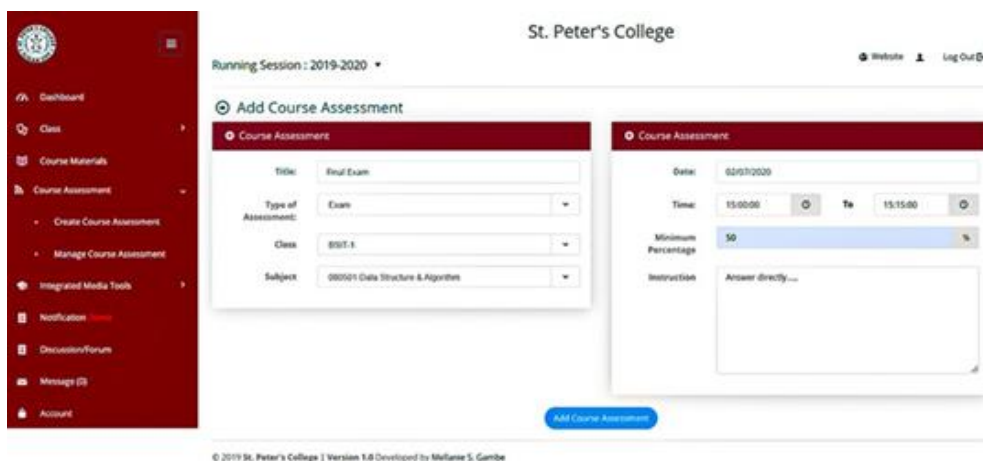


Fig 42 Adding Course Assessment Menu

Fig 42 shows the create course assessment menu where the instructor will create a different course assessment (assignment, exam, and quiz) for the student. The instructor may also assign which date and time to publish.

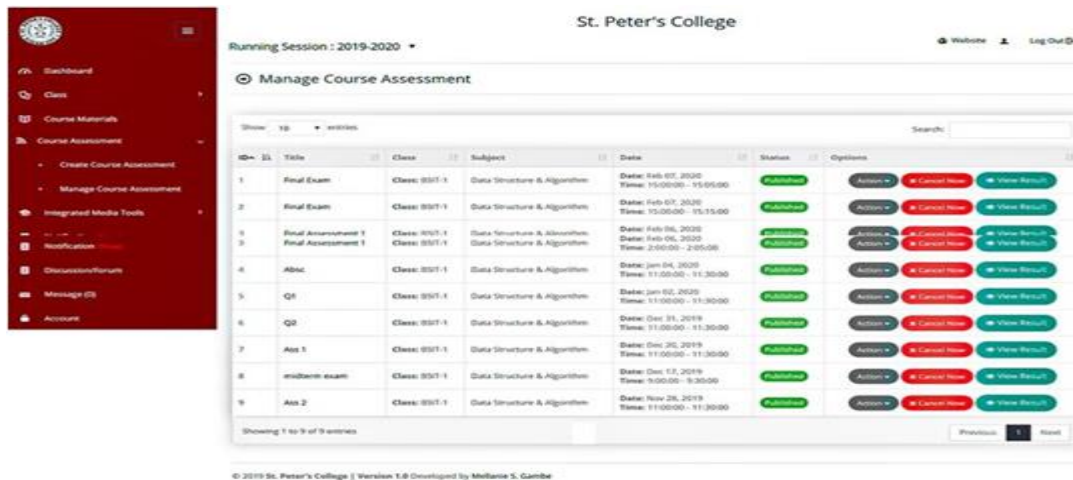


Fig 43 Manage Course Assessment Menu

Fig 43 shows the managed course assessment in which the instructor can see the list of course assessments created on this page.

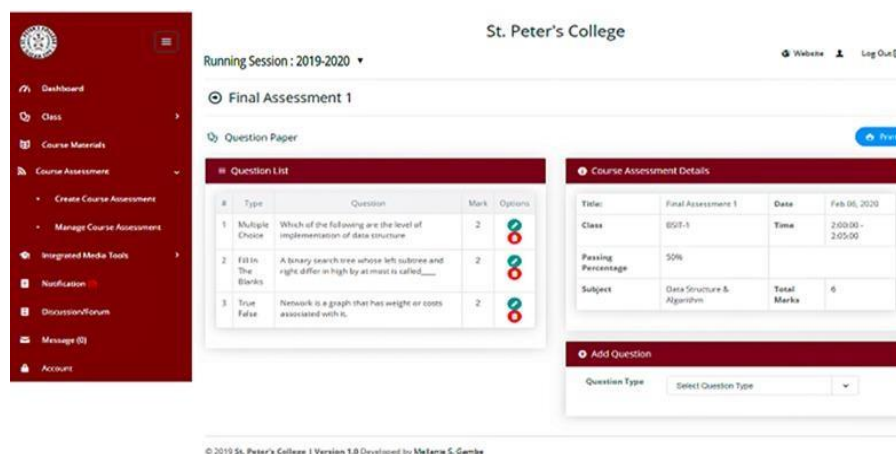


Fig 44 Adding Questions in the Course Assessment

Moreover, the instructor can add questions in that particular course assessment created by clicking the action menu button and clicking manage question, see Fig 44.

➤ *Integrated Media Tools (Record Audio, Record Video and Whiteboard or Video conferencing)*

This menu has three (3) separate submenus: the recorded audio, the recorded video, and the whiteboard or video conferencing.

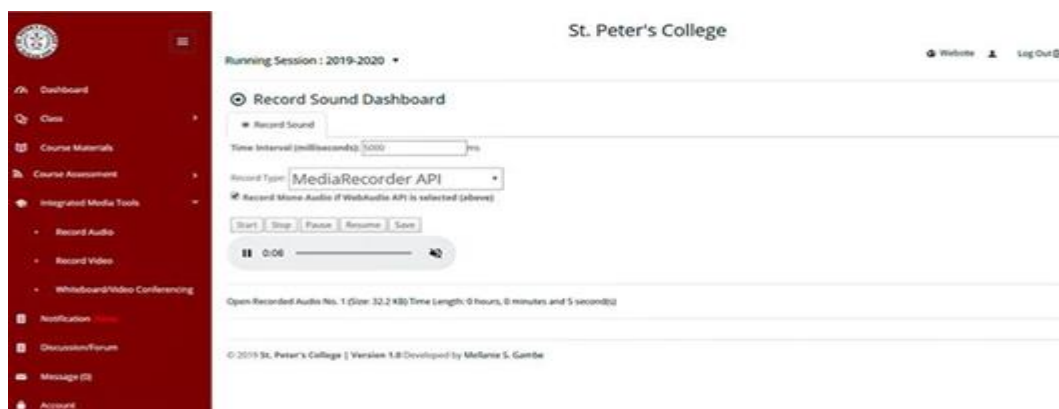


Fig 45 Record Audio Dashboard



Fig 46 Record Video Dashboard

Fig 45 and 46 show the screenshots to record audio and video. Once the instructor has finished recording the audio or video for the student’s assessment, it’ll be found in downloads on your computer.

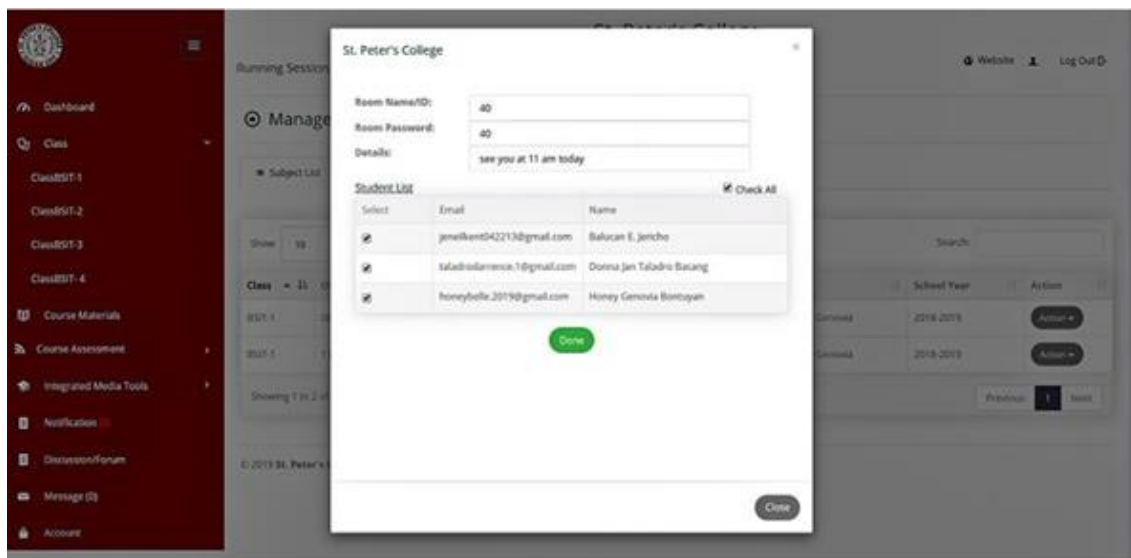


Fig 47 Form for Selecting Students for Whiteboard or Videoconferencing

In whiteboard or video conferencing, as shown in Fig47, the instructor must first choose which class the instructor will assign for a whiteboard or video conference. The instructor will then need to select what subject and the list of students to be included in the process. The instructor may choose a specific student or the whole class in that particular subject.

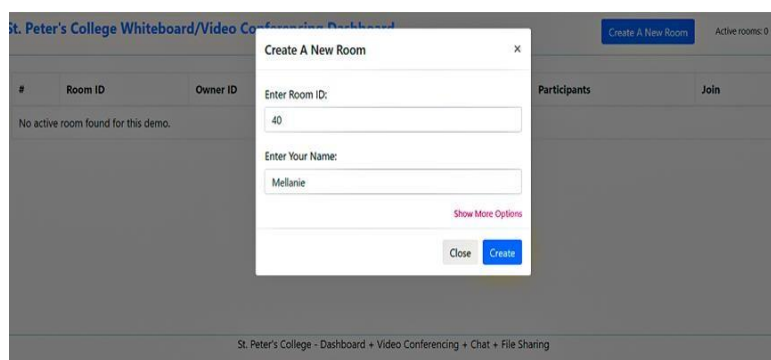


Fig 48 Creating a Room Name for Whiteboard or Videoconferencing

Fig 48 shows the form for whiteboard or video conference room name creation. The student will then receive the details of this process via SMS, Email, and internal notifications.

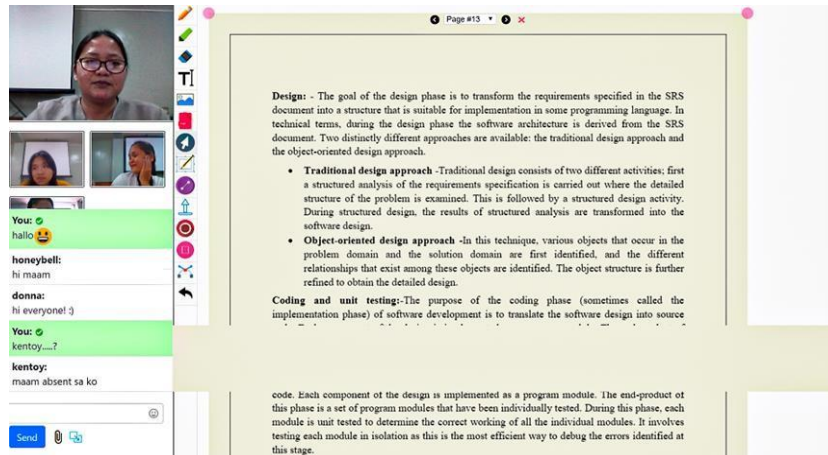


Fig 49 Actual Image for Whiteboard or Videoconferencing

Fig 49 shows the actual whiteboard or video conferencing screenshots.

➤ Notification

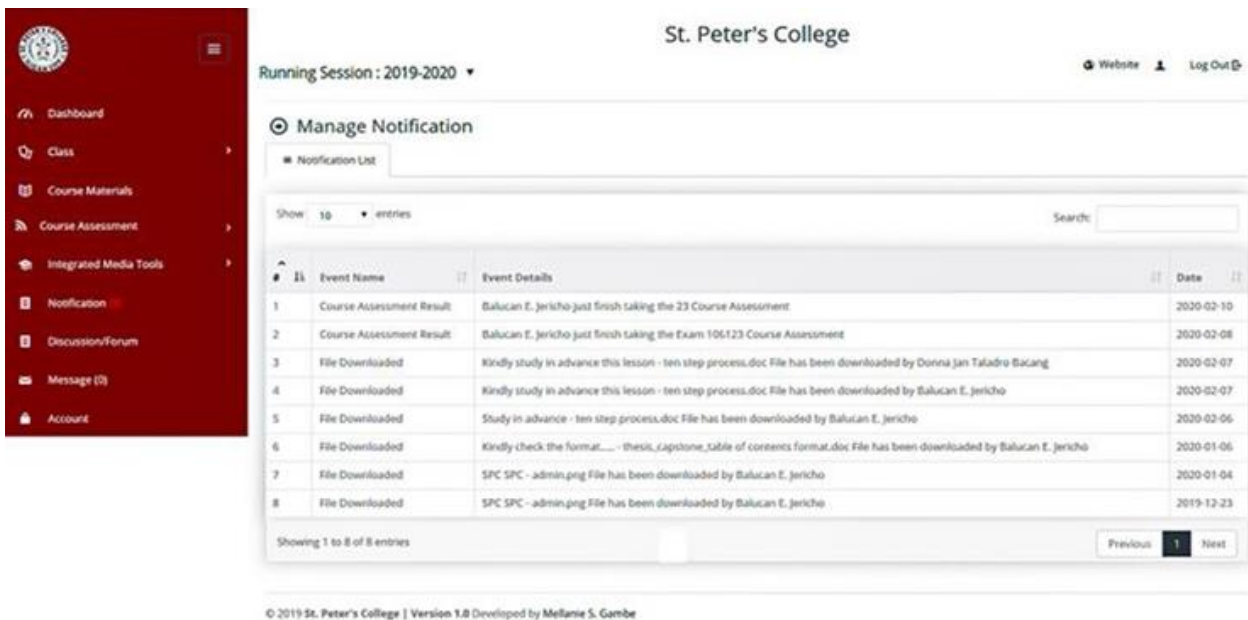


Fig 50 Notification Algorithm Dashboard

Fig 50 contains the instructor's notification once the student has downloaded the instructor's uploaded course materials and the student has already taken the course assessment.

➤ Discussion or Forum

This is a message board or internet forum. It is also an online discussion site where students and instructors can hold conversations by posting messages. It is distinct from chat rooms in that messages are often longer than one line of text and are stored at least temporarily. There are two (2) ways to access it: first, it can access via the homepage where Discussion or Forum is located; second, it can access inside the users' account; there is a separate menu for that.

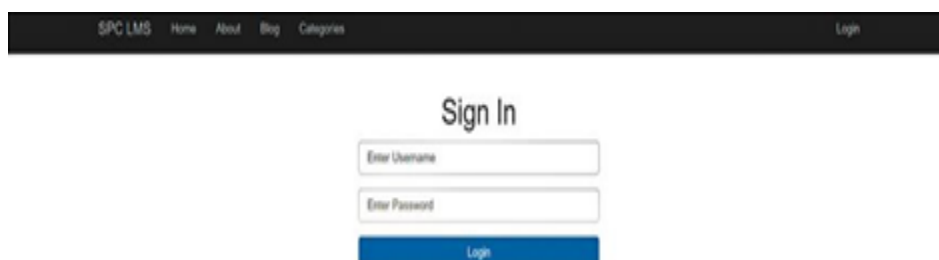


Fig 51 Discussion or Forum Login Page

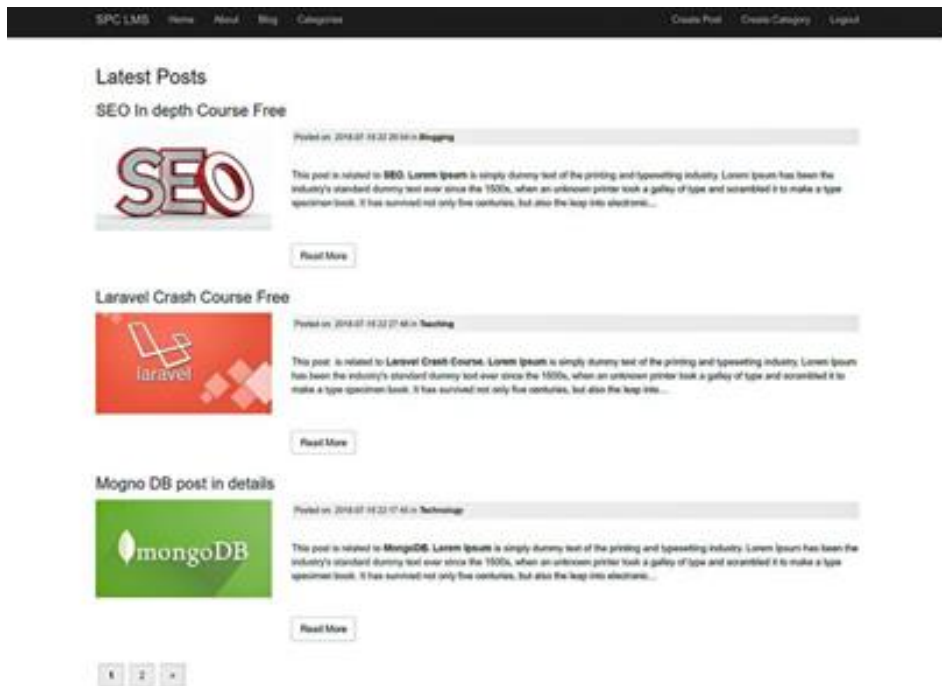


Fig 52 Discussion or Forum Actual Page

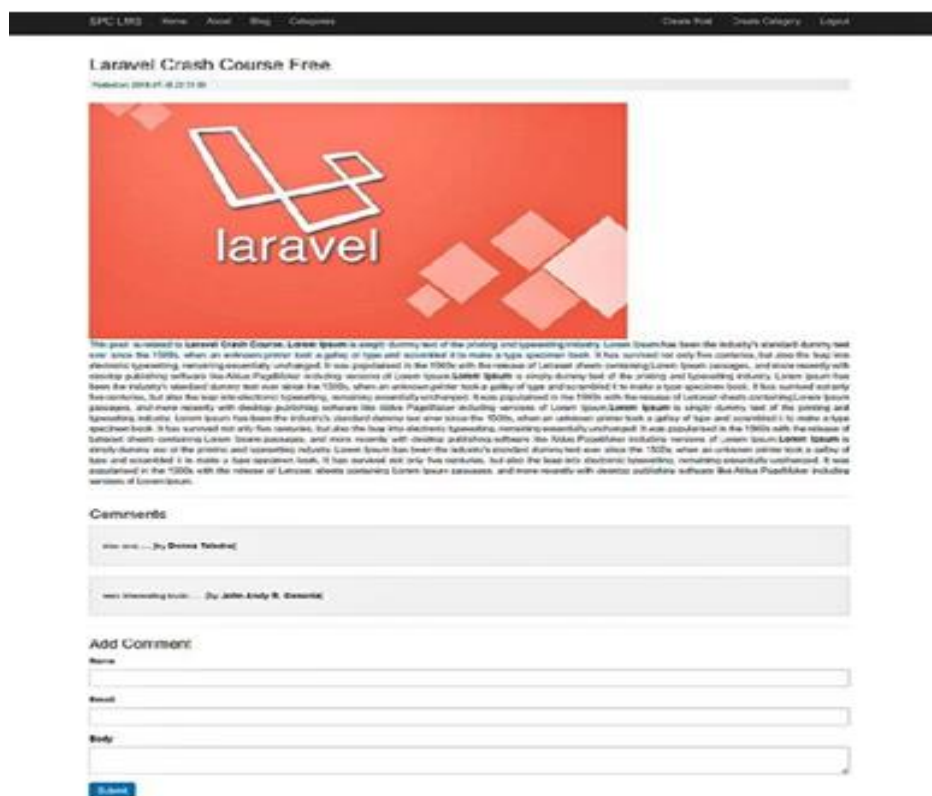


Fig 53 Dashboard for Adding & Submitting a Comment

Fig 51 shows the login page for this feature, while Fig 52 is the actual page, and Fig 53 is a sample screenshot where the instructor wants to comment on something posted on a particular topic or blog.

➤ *Message and Account Menu*

On the previous page of this paper, this menu is the same as the menu found in the administrator account: the same function and process.

➤ *Student's Account*

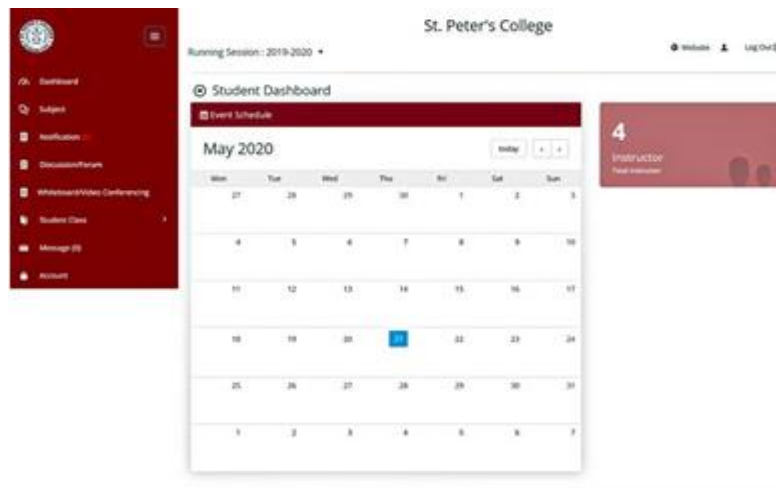


Fig 54 Student's Account Dashboard

Fig 54 shows the Student Account Dashboard with menus such as Subject, Notification, Discussion or Forum, Whiteboard or Video Conferencing, Student Class, Message, and Account.

➤ *Student's Subject*

This menu contains the list of subjects of the student as well as the designated instructor.

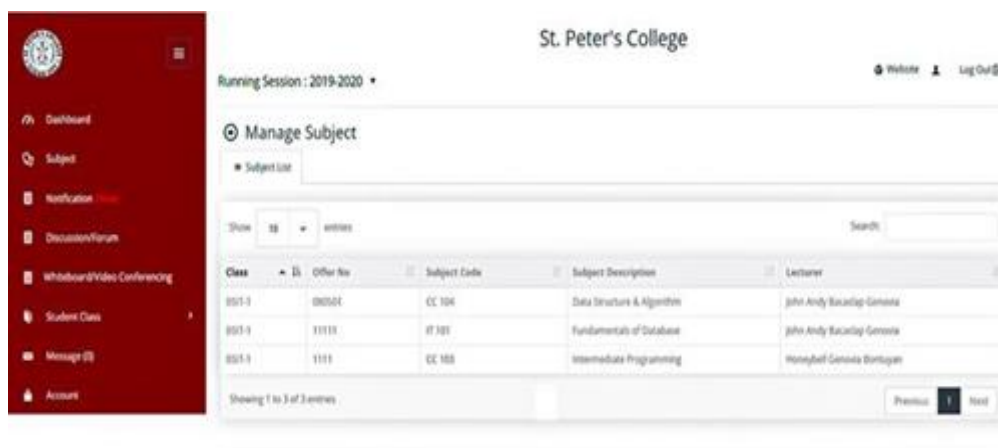


Fig 55 List of Student Subjects

The sample screenshot of the students' subject list is shown in Fig 55.

➤ *Student Notification*

This menu is where the student will be notified if their instructor has uploaded course material or an assessment. There are three (3) ways to notify the student: Email, SMS, and Internal Notification.

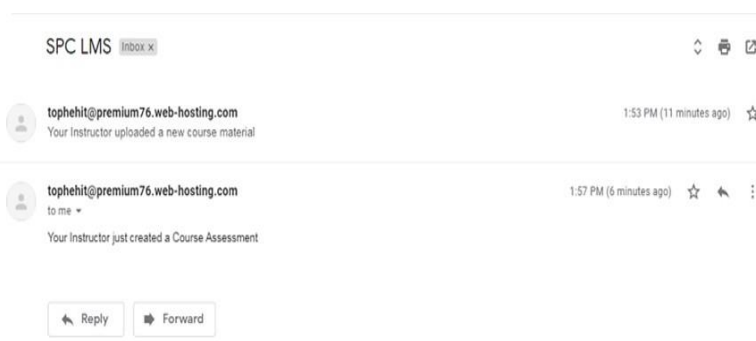


Fig 56 Student's Email Notification



Fig 57 Student’s SMS Notification

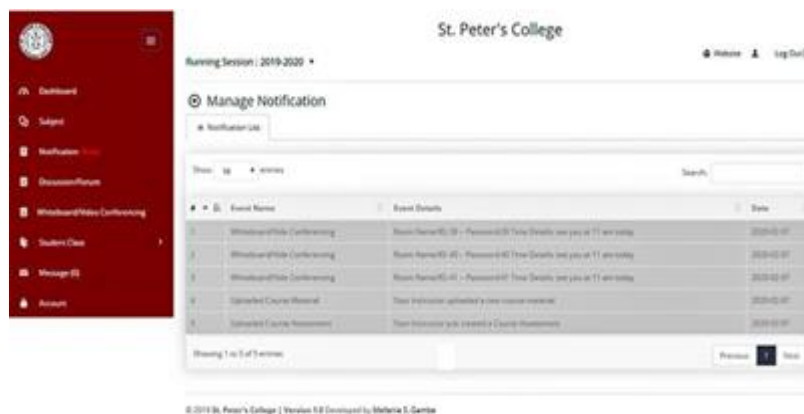


Fig 58 Student’s Internal Notification

Fig 56 shows a student has received an email notification. Likewise, an SMS notification is shown in Fig 57. Fig 58 also shows an internal notification

➤ *Discussion or Forum*

This menu is also available on the student's menu, where the student and the instructor can hold online discussions or conversations. This menu's function is the same as in the instructor account on the previous page.

➤ *Whiteboard or Video Conferencing*

This menu’s function and process are similar to the function found in the instructor's account. Before the student can access this feature, the student will receive a notification from the instructor when the whiteboard or video conferencing occurs. A room ID is also stated in that notification for them to join a particular room; see Fig 58 for this notification on the previous page.



Fig 59 Student’s Notification Link for Joining a Room

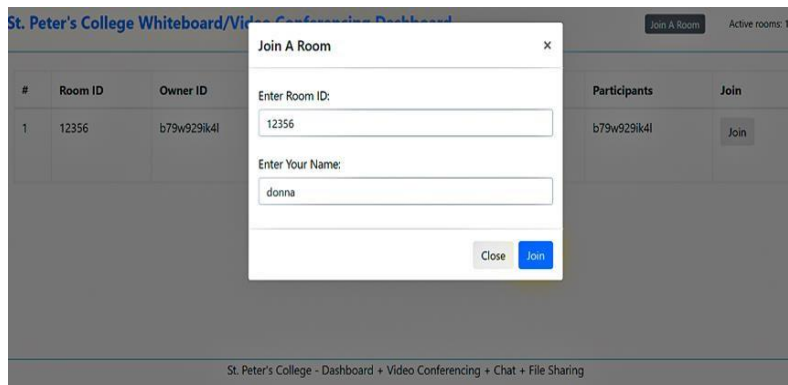


Fig 60 Dashboard for Joining a Room with a particular Room ID

Fig 59 and 60 show the menu for joining a particular room provided with a room name.

➤ *Student Class*

This menu consists of two (2) submenus, mainly CourseMaterial and Course Assessment.

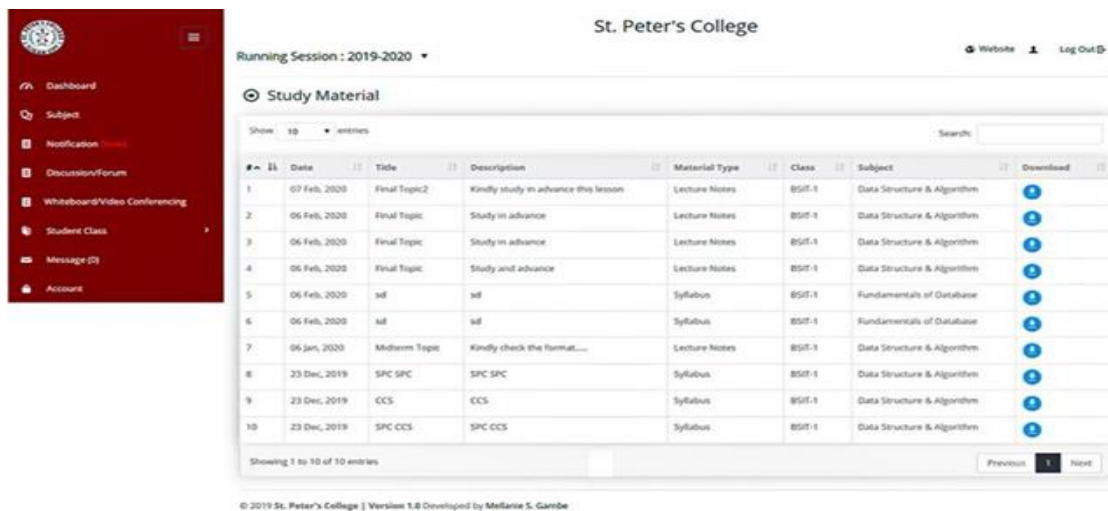


Fig 61 Course Material Menu

Fig 61 shows the course material page where the student can download all the files that the instructor has uploaded.

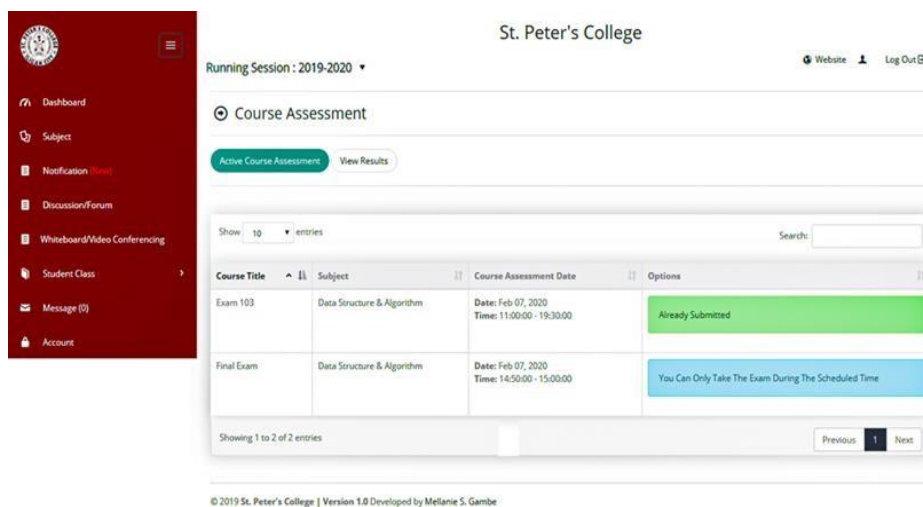


Fig 62 Course Assessment Menu

Fig 62 contains the page where the student can see the list and take the course assessment created or uploaded by their subject instructor. These are categorized into three (3) course assessments: the student's exam, quiz, and assignment per subject. Additionally, the student may take the course assessment during the scheduled time the instructor set.

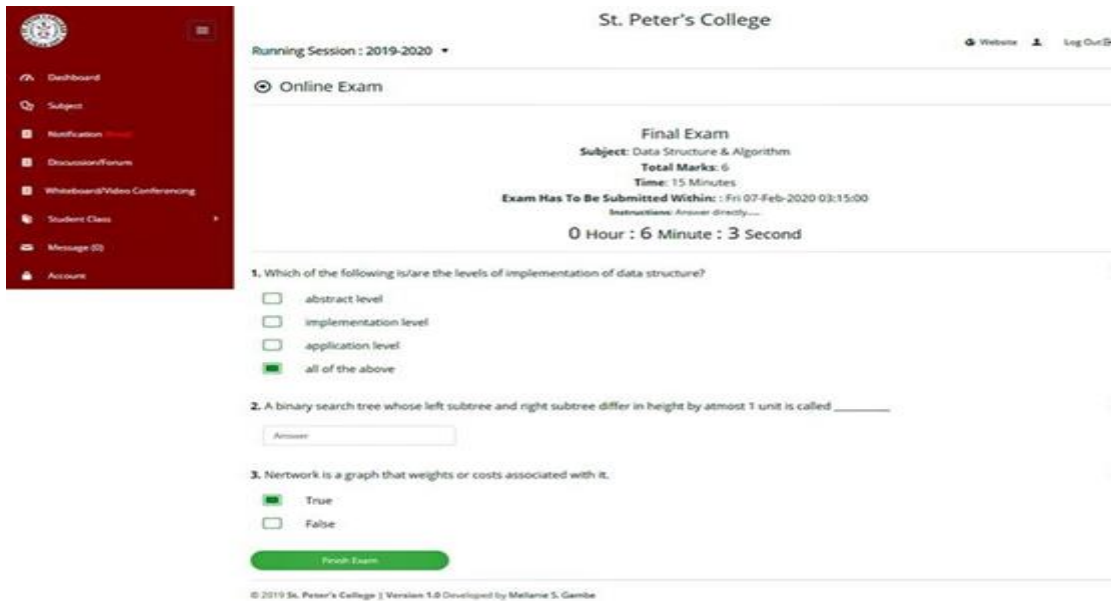


Fig 63 Dashboard for Actual Answering Sheet

Fig 63 shows the actual answer page for the course assessment. This includes the subject, instruction from the instructor's, allotted time, and total marks.

➤ *Message and Account Menu*

This page contains the same function as the account of the instructors shown on the previous page.

B. *Evaluation of the acceptance level and its efficacy of the Learning Management System using the Technology Acceptance Model by the instructors and students.*

Table 7 Profile of the Instructors

	Frequency	Percentage (%)
Age		
21 – 25 years old	8	8.0
26 – 30 years old	26	26.0
31 – 35 years old	21	21.0
36 – 40 years old	19	19.0
41 – 45 years old	16	16.0
Above 45 years old	10	10.0
Sex		
Male	42	42.0
Female	58	58.0
Years of Service		
0 – 2 years	17	17.0
3 – 5 years	38	38.0
6 – 8 years	21	21.0
9 – 11 years	14	14.0
Above 11 years	10	10.0

Table 7 presents the instructors' profile that evaluated the learning management system's acceptance level and efficacy using the Technology Acceptance Model. Results have shown that 26% of the respondents were 26 – 30 years old, 58% were female, and 38% were in service for 3 – 5 years. This indicates that most of the instructors in St. Peter's College were young adults and were mostly females working in the institution for 3 – 5 years.

Table 8 Year Level of the Students

Year Level	Frequency	Percentage (%)
1st year	41	41.0
2nd year	19	19.0
3rd year	23	23.0
4th year	17	17.0

Table 8 presents the students' profiles that evaluated the learning management system's acceptance level and efficacy using the Technology Acceptance Model. Results have shown that 41% of the respondents were 1st year, 23% were 3rd year, 19% were 2nd year, and 17% were 4th year. This suggests that the majority of the respondents were from the first (1st) year level.

Table 9 Acceptance Level of the Instructors using the Technology Acceptance Model

	Mean	Standard Deviation	Verbal Description
Perceived Ease of Use			
1. I feel that using the SPC Learning Management System would be easy for me.	4.71	0.46	Strongly Agree
2. I feel that my interaction with SPC Learning Management System would be clear and understandable.	4.65	0.48	Strongly Agree
3. I find the SPC Learning Management System to be flexible to interact with.	4.78	0.42	Strongly Agree
4. Interacting with SPC Learning Management System does not require a lot of mental effort.	4.28	0.83	Agree
5. It would be easy for me to get SPC Learning Management System to do what I want to do.	4.39	0.80	Agree
6. In general, SPC Learning Management System is easy to use.	4.58	0.64	Strongly Agree
Perceived Usefulness			
1. Using SPC LMS in my job would enable me to accomplish tasks more quickly.	4.95	0.22	Strongly Agree
2. Using SPC LMS would improve my job performance.	4.15	0.36	Agree
3. Using SPC LMS in my job would increase my productivity.	4.90	0.30	Strongly Agree
4. Using SPC LMS would enhance my effectiveness in my job.	4.73	0.45	Strongly Agree
5. Using SPC LMS would make it easier to do my job.	4.78	0.42	Strongly Agree
6. SPC Learning Management System provides related information that I need	4.72	0.45	Strongly Agree
7. In general, I find the SPC Learning Management System to be helpful in my job.	4.54	0.50	Strongly Agree
Attitude Toward Usage			
1. I believe it is a good idea to use the SPC Learning Management System.	4.60	0.49	Strongly Agree
2. I like the idea of using the SPC LMS.	4.60	0.49	Strongly Agree
3. Using the SPC Learning Management System is a positive idea.	4.51	0.50	Strongly Agree
Overall Mean	4.62	0.49	Strongly Agree

Table 9 presents the acceptance level of the Instructors of Learning Management using the Technology Acceptance Model. Mean and Standard Deviation were used to determine the level of acceptance of the LMS. Results have shown an overall mean of 4.62, with a standard deviation of 0.49. This implies that the instructors highly take the Learning Management System. So, the respondents discover the system's use to be beneficial, especially in terms of efficiency and producing better results. Also, users can save time and effort and are open to the idea of using the system.

Table 10 Acceptance Level of the Students using the Technology Acceptance Model

	Mean	Standard Deviation	Verbal Description
Perceived Ease of Use			
1. I find the SPC Learning Management System easy to use.	4.72	0.45	Strongly Agree
2. Learning how to use the SPC Learning Management System is easy for me.	4.69	0.51	Strongly Agree
3. It is easy to be skillful at using the SPC Learning Management System.	4.61	0.57	Strongly Agree
4. In general, SPC Learning Management System is easy to use.	4.79	0.41	Strongly Agree
Perceived Usefulness			
1. The SPC Learning Management System			

would improve my learning performance.	4.52	0.67	Strongly Agree
2. The SPC Learning Management System would increase my academic productivity.	4.46	0.69	Agree
3. The SPC Learning Management System could make it easier to study the course content.	4.61	0.63	Strongly Agree
4. In general, I find the SPC Learning Management System to be helpful in my academic performance.	4.59	0.68	Strongly Agree
Attitude Toward Usage			
1. Studying through SPC Learning Management System is a good idea.	4.74	0.44	Strongly Agree
2. Studying through SPC Learning Management System is a wise idea.	4.67	0.47	Strongly Agree
3. I am confident in SPC Learning Management System.	4.70	0.48	Strongly Agree
Overall Mean	4.65	0.55	Strongly Agree

Table 10 presents the acceptance level of the Students of the Learning Management System using the Technology Acceptance Model. Mean and Standard Deviation were used to determine the level of acceptance of the LMS. Results have shown an overall mean of 4.65, with a standard deviation of 0.55. This implies that the students highly take the Learning Management System. Thus, the respondents discover the system’s use to be beneficial, especially in terms of efficiency and producing better results. Also, users do not need much time and energy commitment, and they are open to using the system.

Table 11 Relationship between perceived usefulness, perceived ease of use, and attitudes towards using the Learning Management System according to the Instructors

	Attitude towards Usage		
	Correlation Coefficient	p-value	Interpretation
Perceived Usefulness	0.247	0.002	Significant
Perceived Ease of Use	0.149	0.016	Significant

p<0.05, significant p>0.05, not significant

Table 11 shows the connection among perceived usefulness, perceived ease of use, and attitudes towards using the Learning Management System according to the Instructors. Pearson Correlation was used to determine the relationship. Results show that there is a substantial connection among the perceived usefulness, ease of use, and attitudes towards using the Learning Management System, according to the instructors, since the p-values are less than the 0.05 level of significance. This suggests that the instructor's attitude towards using Learning Management System is affected by their perception of its simplicity and helpfulness.

Table 12 Impact of perceived usefulness and perceived ease of Use on Users' attitudes towards using the Learning Management System According to the Instructors

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	5.516	0.946		5.832	0.000
Perceived usefulness	0.297	0.119	0.282	2.491	0.014
Perceived ease of use	0.098	0.114	0.098	0.863	0.391

➤ *Model Summary*

- R = 0.344
- R² = 0.118
- F = 6.513
- p = 0.002

Table 12 describes the effect of perceived usefulness and perceived ease of use on the instructor's attitudes toward using Learning Management. Multiple linear regression was calculated to predict the impact of perceived usefulness and perceived ease of use on the instructor's attitudes toward using the Learning Management System. A significant regression equation was found ($F(2,97) = 6.513, p \ll 0.002$), with an R^2 of 0.118. The predicted attitude towards using the LMS is equal to $5.516 + 0.098$ (perceived ease of use) + 0.297 (perceived usefulness). The instructor’s attitude towards using the LMS increased by 0.098 and 0.297 for each perceived ease of use and perceived usefulness, respectively. Consequently, both perceived ease of use and perceived usefulness have a positive effect on the attitude of the instructor when using the Learning Management System. Thus, the regression model in $\hat{y} = 5.516 + 0.098 x_1 + 0.297 x_2$

Where \hat{y} = user’s attitude towards using LMS x_1 = user’s perceived ease of use x_2 = user’s perceived usefulness

Table 13 Relationship between perceived usefulness, perceived ease of use, and attitudes towards using the Learning Management System according to the Students

	Attitude towards Usage		
	Correlation Coefficient	p-value	Interpretation
Perceived Usefulness	0.694	0.000	Significant
Perceived Ease of Use	0.623	0.000	Significant

$p < 0.05$, significant $p > 0.05$, not significant

Table 13 illustrates the connection among perceived usefulness, perceived ease of use, and attitude towards using the Learning Management System according to the Students.

Pearson Correlation was used to determine the relationship. Results revealed that there is a strong connection between the perceived usefulness, perceived ease of use, and the student's attitude toward using the Learning Management System since the p-values are less than the 0.05 level of significance. It indicates that the attitude of the student toward using the Learning Management System is influenced by their understanding of its ease of usage and usefulness.

Table 14 Impact of perceived usefulness and perceived ease of Use on Users' attitudes towards using the Learning Management System According to the Students

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	1.517	0.295		5.138	0.000
Perceived usefulness	0.323	0.046	0.516	7.086	0.000
Perceived ease of use	0.365	0.069	0.383	5.268	0.000

➤ Model Summary

- $R = 0.772$
- $R^2 = 0.596$
- $F = 71.689$
- $p = 0.000$

Table XIV discusses the effect of perceived usefulness and perceived ease of use on the attitudes of the student about their use of the Learning Management System. Multiple linear regression was calculated to predict the impact of perceived usefulness and perceived ease of use on the student's attitudes toward using the Learning Management System. A significant regression equation was found ($F(2,97) = 71.689, p \leq 0.000$), with an R^2 of 0.596. The predicted attitude towards using the LMS is equal to $1.517 + 0.365$ (perceived ease of use) $+ 0.323$ (perceived usefulness). The student's attitudes toward using the LMS increased by 0.365 and 0.323 for each perceived ease of use and perceived usefulness, respectively. Consequently, both perceived ease of use and perceived usefulness have a positive effect on the attitude of the student when using the Learning Management System. Thus, the regression model in $\hat{y} = 1.517 + 0.365 x_1 + 0.323 x_2$

Where \hat{y} = user’s attitude towards using LMS x_1 = user’s perceived ease of use x_2 = user’s perceived usefulness

C. Evaluation of the Software Quality Standard of the Learning Management System as perceived by the experts.

Table 15 Profile of the Experts

	Frequency	Percentage (%)
Age		
21 – 25 years old	0	0.0
26 – 30 years old	1	14.3
31 – 35 years old	2	28.6
36 – 40 years old	2	28.6
41 – 45 years old	0	0.0
Above 45 years old	2	28.6
Sex		
Male	6	85.7
Female	1	14.3
Field of Expertise		
Database Administrator	1	14.3

Full Stack Web Developer	2	28.6
Web Application Developer	1	14.3
Front End Web Developer	1	14.3
Programmer	2	28.6
System Administrator	1	14.3
System/Software Engineer	1	14.3
Senior Developer	1	14.3
System Analyst	1	14.3
Years of Service		
3 – 5 years	0	0.0
6 – 8 years	0	0.0
9 – 11 years	3	42.9
12 – 14 years	2	28.6
15 – 17 years	1	14.3
Above 17 years	1	14.3

Table 15 presents the experts' profiles that evaluated the Learning Management System Software Quality Standard. Results have shown that 28.6% of the respondents were 31 – 40 years old and above 45 years old, 85.7% were male, 28.6% were experts in full-stack web development and programming, and 42.9% had been in service for 9 – 11 years. This indicates that the experts that evaluated Learning Management in the field for a long time and their evaluation of the system will be highly reliable.

Table 16 Software Quality Standard of the LMS as Perceived by Experts

	Mean	Standard Deviation	Verbal Description
Functionality			
1. The system can perform the tasks required.	4.57	0.53	Highly Acceptable
2. The system can produce expected results.	4.43	0.53	Acceptable
3. The system can interact with another system.	4.57	0.53	Highly Acceptable
4. The system can prevent unauthorized access.	4.29	0.49	Acceptable
Reliability			
1. Most of the faults can be eliminated over time.	4.43	0.53	Acceptable
2. The system is capable of handling errors.	4.43	0.53	Acceptable
3. The system can resume working and restore lost data after failure.	4.14	0.38	Acceptable
Usability			
1. The system can be understood easily.	4.43	0.53	Acceptable
2. The user can learn to use the system easily.	4.29	0.49	Acceptable
3. The system can be operated with minimal effort.	4.43	0.53	Acceptable
4. The interface of the system is attractive.	4.29	0.49	Acceptable
5. The system can meet existing usability standards.	4.57	0.53	Highly Acceptable
Efficiency			
1. The system can behave in a timely manner.	4.29	0.49	Acceptable
2. The system can meet existing efficiency standards.	4.29	0.49	Acceptable
3. The system can be adapted easily.	4.71	0.49	Highly Acceptable
Maintainability			
1. System faults can be easily diagnosed.	4.86	0.38	Highly Acceptable

2. The system can be easily modified.	4.57	0.53	Highly Acceptable
3. The system can continue functioning if changes are made.	4.57	0.53	Highly Acceptable
4. The system can be tested easily.	4.57	0.53	Highly Acceptable
Portability			
1. The system can be installed easily.	4.43	0.53	Acceptable
2. The system can work with existing system/software.	4.57	0.53	Highly Acceptable
3. The system can be replaced with a similar product.	4.57	0.53	Highly Acceptable
4. The system can meet existing portability standards.	4.57	0.53	Highly Acceptable
Overall Mean	4.47	0.51	Acceptable

Table 16 presents expert assessments of the Learning Management System Software Quality Standard. The mean and standard deviation were used to assess the quality of the LMS. Results have shown an overall mean of 4.47, with a standard deviation of 0.51. This means that experts widely acknowledge the learning management system. Thus, this suggests that the institution's students and instructors can use the designed and developed Learning Management System.

V. SUMMARY, CONCLUSIONS, AND RECOMMENDATION

This chapter presents the outline of data and the corresponding conclusion derived in the conduct of the study. It also provides recommendations that could be pursued by future researchers.

A. Summary of Findings

The results of this study had a favorable implication in the Learning Management System implementation. Results have shown that:

- 26% of the respondents were 26 – 30 years old, 58% were female, and 38% were in service for 3 – 5 years.
- 41% were 1st year, 23% were 3rd year, 19% were 2nd year, and 17% were 4th year.
- The Learning Management System instructors' approval level using the Technology Acceptance Model has an average of 4.62, with a standard deviation of 0.49.
- The Learning Management System students' approval level using the Technology Acceptance Model has a mean of 4.65 with a standard deviation of 0.55.
- There is a strong relationship between the instructor's perceived usefulness and perceived ease of use towards their attitude toward using the Learning Management System since the p-values, 0.002 and 0.016, are less than the 0.05 level of significance.
- A significant regression equation was found ($F(2,97) = 6.513$, $p = 0.002$), with an R^2 of 0.118. Predicted the instructor's attitude toward using the LMS is equal to $5.516 + 0.098$ (perceived ease of use) + 0.297 (perceived usefulness).

- There is a strong relationship between perceived usefulness and perceived ease of use towards the attitude of the students when using the Learning Management System, as the p-values, 0.000 and 0.000, are less than the significance level of 0.05.
- A significant regression equation was found ($F(2,97) = 71.689$, $p = 0.000$), with an R^2 of 0.596. Predicted students' attitude toward using the LMS is equal to $1.517 + 0.365$ (perceived ease of use) + 0.323 (perceived usefulness).
- 28.6% of the respondents were 31 – 40 years old and above 45 years old, 85.7% were male, 28.6% were experts in full-stack web development and programming, and 42.9% had been in service for 9 – 11 years.
- The Learning Management System software quality standard, assessed by the experts, has an average of 4.47, with a standard deviation of 0.51.

B. Conclusions

➤ *Based on the findings of the study, the following conclusions are drawn.*

The majority of the instructors and students strongly accept the Learning Management System after their evaluation. It demonstrates that the attitudes of instructors and students toward using the Learning Management System are influenced by their understanding of its ease of usage and usefulness. Also, instructors and students' attitudes towards the use of the LMS increased for each perceived ease of use and perceived usefulness. Thus, both perceived ease of use and perceived usefulness have a positive impact on the attitudes of the instructors and students about using the learning management system.

Also, most of the experts who have been in the field for more than nine years accept the Learning Management System software quality standard. Therefore, it can be concluded that for the benefit of all its constituents, the Learning Management System is strongly recommended for implementation at St. Peter's College.

C. Recommendations

➤ Based on the findings, the recommendations for the School's Administrators are summarized as follows:

- Speedy internet access is strongly suggested upon the implementation of the system.
- The system is more beneficial if it is responsive to all platforms, from mobile phones to tablets and other devices.
- URL encryption strengthens the system's security mechanism. The system's URL upgrade from HTTP to HTTPS and captcha security will help it be supported.
- *The following needs to be addressed in the Front-End side of the system:*
 - ✓ Font family of 1 or 2 fonts and uniform font size for the paragraph and headings.
 - ✓ Use at least 2 or 3 colors that are reflected in the logo.
 - ✓ Maintain uniformity of paddings and margins and no strokes, shadows, gradient colors, and borders.
 - ✓ For the Events, add an image thumbnail and incorporate all in the default settings.
 - ✓ Top navigation, banner, main navigator, and a slider that would fit in the normal screen and the first to show up without scrolling will look more reader- friendly.
 - ✓ The view Gallery button is not necessary. All the photos will be directly shown.
 - ✓ Make four columns in the footer widgets. Each column will have Events, Gallery, About, and Calendar. Also, change images to icons and incorporate them all in the default settings.
 - ✓ On the Login page, on the image on the right, take a picture of the whole front gate.
- *The following also needs to be considered in the Back-Endside of the system:*
 - During registration, the student ID number is no longer needed because if there are two or more students who would register at the same time, the system will generate the same student ID number for all the students.
 - A database linkage of the existing system of the school's data on student registration, class management, instructor, and course management is highly beneficial.
 - Enhanced discussion and forum with features like forums, subforums, and threads. If necessary, incorporate this page into one dashboard.
 - Provide a convenient way for students to join or access the conference. For example, by connecting directly from their dashboard and removing unnecessary data from the conference table as it is confusing for non-IT or related purposes. Further, to avoid confusion, the expired video conferencing session is better to be disabled. To address both of these issues, the school needs to subscribe to this feature to a server exclusively for the institution.
 - Add parent account for monitoring purposes to his/her son/daughter.

- Refactor the code to psr-2 and encourage comments and documentation blocks for future development cycles.
- *Most importantly, the researchers would propose to the Board of Trustees to implement and utilize this system, which could supplement the learning process by providing a different avenue for the students.*

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