

Design and Evaluation of a Customized Campus-Based Learning Management System for Cavite State University–Carmona Campus

ABRIL, Mark Anthony R.

(¹)  09-0003-7090-841X; Cavite State University Carmona Campus, Carmona, Cavite, Philippines.
markanthony.abril@cvsu.edu.ph

The content expressed in this article is the sole responsibility of its authors.

ABSTRACT

This study developed and evaluated a Campus-Based Learning Management System (CLMS) for Cavite State University – Carmona to facilitate access to academic services and online learning for students and educators. The system enables instructors to upload lessons, assignments, quizzes, and learning resources while providing students with centralized access to course materials, assignments, and quizzes with the system. It has features like deadlines that can be changed, modules that let you interact with them, notifications that come in real time, and a central place to store resources. The design of the CLMS was influenced by a study of how schools work. It also had a Hybrid Search and Recommendation Algorithm (HSRA) to make it easier to find content and make the system respond faster. A mixed-methods approach was employed to evaluate the system's functionality, usability, and performance, involving 122 participants—114 students and 8 faculty members—according to ISO/IEC 25010 software quality standards. The results showed that users were very happy, with weighted mean ratings of 4.50 to 4.54 across all modules. This showed that the system worked well, was easy to use, and was efficient. The CLMS was found to make academic workflows more efficient, help with ongoing learning assessment, and improve communication. Adding enrollment modules, plagiarism detection, and AI-assisted analytics are some ideas for how to make the system even better in the future.

RESUME

Este estudo criou e testou um Sistema de Gestão de Aprendizagem Baseado no Campus (CLMS) para a Universidade Estadual de Cavite – Campus Carmona, com o objetivo de facilitar o acesso de estudantes e professores aos serviços acadêmicos e ao aprendizado online. O sistema permite o fácil envio de aulas, tarefas e questionários, possuindo recursos como prazos configuráveis, módulos interativos, notificações em tempo real e um repositório central de recursos. Uma análise das operações acadêmicas ajudou a definir a arquitetura do CLMS, que também incorporou um Algoritmo Híbrido de Busca e Recomendação (HSRA) para aprimorar a recuperação de conteúdo e a responsividade do sistema. Foi utilizada uma abordagem de métodos mistos, envolvendo 122 participantes — 114 estudantes e 8 professores — que avaliaram a funcionalidade, a usabilidade e o desempenho do sistema com base nos padrões de qualidade de software ISO/IEC 25010. Os resultados mostraram que os usuários ficaram altamente satisfeitos, com médias ponderadas entre 4,50 e 4,54 em todos os módulos, confirmando que o sistema é altamente funcional, fácil de usar e eficiente. Constatou-se que o CLMS torna os fluxos de trabalho acadêmicos mais eficientes, melhora a comunicação e apoia a avaliação contínua da aprendizagem. As sugestões para desenvolvimentos futuros incluem a adição de módulos de matrícula, detecção de plágio e análises assistidas por IA, a fim de tornar o sistema ainda mais aprimorado.

ARTICLE INFORMATION

Article process:

Submitted: 10/28/2025

Approved: 07/20/2026

Published: 08/01/2026



Keywords:

Campus-Based Learning Management System (CLMS), digital learning, blended learning, educational technology, Cavite State University

Palavras chave:

Sistema de Gestão de Aprendizagem no Campus (CLMS), aprendizado digital, aprendizado híbrido, tecnologia educacional, Universidade Estadual de Cavite

Introduction

In today's knowledge-driven, technology-intensive society, schools must produce academically proficient, globally competitive, and technically skilled graduates. Implementing information and communication technology (ICT) in academia improves educational delivery, streamlines operations, and promotes outcome-based learning (Alsadoon, 2023). Educational innovation is needed to efficiently teach current knowledge as information grows exponentially. Educators should use dynamic, technology-supported methods that accommodate diverse learning styles and encourage meaningful engagement (Singh & Hassan, 2023). To prepare students for careers, institutions must align their curricula with industry standards as the academic landscape changes (Chan & Yu, 2024).

Structured institutional support systems that guide students from enrollment to career placement can bridge academic training and workforce readiness. Career orientation, job readiness, industry partnerships, and internships are typical frameworks. Higher education institutions improve students' academic preparedness and employability, boosting national workforce development and lifelong learning (Reyes et al., 2024).

Learning Management Systems (LMS) are crucial to digital transformation. Their platform integrates learning content, progress tracking, and teacher–student interaction. LMSs enable blended and remote learning, flexibility, accessibility, and industry-standard curriculum (Martinez, Santos, & Villanueva, 2023).

Moodle is a popular open-source LMS due to its flexibility and affordability. However, its complex setup, administrative requirements, and steep learning curve often challenge educators and institutions, especially those with limited technical expertise (Brown & Jackson, 2023; Domingo & Tan, 2022).

Due to these challenges, Cavite State University – Carmona Campus has actively integrated ICT into its academic operations to provide quality and inclusive education. A Learning Management System improved content delivery, faculty support, and student engagement on campus. Moodle was considered, but the university found implementation barriers and explored alternative platforms and customized configurations to improve adoption, usability, and learning effectiveness.

To address these limitations, this study designed, developed, implemented, and evaluated a Campus-Based Learning Management System (CLMS) as an alternative to the existing Moodle-based learning environment. The proposed CLMS was developed from the ground up to address the usability, accessibility, and academic workflow limitations identified at Cavite State University–Carmona Campus. Rather than relying on Moodle's architecture, the system was specifically designed to support the university's instructional processes, academic management, assessment, communication, and student monitoring requirements.

Statement of the Problem

Cavite State University – Carmona Campus struggles to deliver courses, track student progress, and evaluate technical and conceptual skills. Asynchronous and remote learners often cannot access course materials. The lack of a unified digital platform for real-time evaluation, feedback, and performance tracking hinders instructors' assessments and interventions. Printed handouts, PowerPoint presentations, and shared digital files are the main instructional materials. The manual process often delays updates, delivers inconsistent content, and limits interactivity. Consequently, faculty struggle to dynamically adapt materials or track student engagement throughout the semester, hindering learning outcomes improvement.

A preliminary survey of students and faculty revealed major academic delivery system flaws. Respondents reported difficulties in the teaching–learning process (51.1%), developing structured and guided learning paths (46%), limited access to assessment and feedback tools like self-grading quizzes (51.1%), poor availability of downloadable learning materials for online participation and evaluation (58.1%), and time and cost efficiency concerns (47.1%). These findings highlight the need for a centralized, accessible, and responsive Campus-based Learning Management System (CLMS) that supports outcome-based, student-centered, and industry-aligned education.

The campus also struggles with grade verification. Students often worry about the accuracy and accessibility of their academic records, especially when they don't get grade updates. The lack of a centralized digital system for real-time grade monitoring causes miscommunication, reconciliation delays, and a lack of transparency between students and faculty.

During class suspensions due to weather or other events, the lack of an online submission mechanism has disrupted instruction and assessment. Faculty struggle to manage evaluations and students delay coursework completion without an asynchronous submission platform. Moodle is an LMS, but its technical complexity and resource requirements discourage instructors and students from using it.

Finally, academic programs require a customizable, self-grading quiz module, which the current system lacks. Assessment and feedback are inefficient without flexible automated scoring, rubric integration, and question-type variety tools. Moodle has such capabilities, but its complex configuration and usability issues have prevented the university from fully utilizing digital learning technologies' pedagogical and administrative benefits.

The primary objective of this study was to design, develop, implement, and evaluate a Campus-Based Learning Management System (CLMS) as an alternative to the existing Moodle-based learning environment in order to support the academic and instructional requirements of Cavite State University–Carmona Campus: identify the functional and technical requirements of faculty members, students, administrators, and academic offices for

a campus-based learning management system; design and develop a Campus-Based Learning Management System that integrates institution-specific academic workflows, learning management functions, and digital instructional tools tailored to the needs of Cavite State University–Carmona Campus; implement the developed CLMS through pilot deployment at Cavite State University–Carmona Campus; and evaluate the developed CLMS using the ISO/IEC 25010 Software Quality Model in terms of functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability.

Significance of the Study

The design, development, and implementation of an accurate, accessible, and user-friendly Campus-based Learning Management System (CLMS) for Cavite State University – Carmona Campus is significant. The proposed system improves learning material distribution, faculty-student communication, and academic processes. The project makes digital learning more inclusive and effective by addressing Moodle's technical complexity and underutilization.

The CLMS handles academic operations and digital content for the institution centrally and cheaply. Administrators can efficiently manage class schedules, course offerings, faculty assignments, attendance, and academic pathways. The system also coordinates institutional activities like seminars, training, and announcements, improving organizational efficiency and interdepartmental collaboration.

The CLMS provides faculty with an integrated and organized repository for instructional resources, replacing outdated file systems. Instructors can easily share multimedia, lead interactive learning sessions, and communicate with students and colleagues in real time. Automated report generation, multi-section course assignments, and content management reduce administrative workload, letting teachers focus on teaching and student engagement.

The CLMS offers students an interactive, accessible learning environment with online discussions, digital submissions, and automated assessments. A comprehensive dashboard and calendar let students download materials, take quizzes, and track their academic progress. Personalized user profiles, notifications, and reminders promote self-directed learning. The system gives students more control over their education and ensures academic continuity during class suspensions or unexpected disruptions.

Scope and Limitations

This study focused on the design, development, implementation, and evaluation of a Campus-Based Learning Management System (CLMS) for Cavite State University–Carmona Campus. The system was developed as an alternative to the existing Moodle-based learning environment to address the campus's specific instructional and academic management requirements. The developed CLMS included Administrator, Faculty, and Student modules, incorporating features such as course management, lesson delivery, assignment submission,

quiz management, discussion forums, grade monitoring, announcements, notifications, and academic resource management.

The system was developed using the Agile Software Development methodology and evaluated using the ISO/IEC 25010 Software Quality Model. The needs assessment involved 272 respondents consisting of administrators, faculty members, and students to determine the functional requirements of the proposed system. Following system development and pilot implementation, the completed CLMS was evaluated by 122 respondents composed of 114 students and 8 faculty members.

The study was limited to Cavite State University–Carmona Campus and did not include enrollment management, financial transactions, library management, student information systems, or other institutional administrative modules. Likewise, the evaluation focused on software quality characteristics under ISO/IEC 25010 and did not measure long-term academic performance, learning outcomes, or institutional policy impacts beyond the implementation period.

Related Literature

The rapid growth of internet use for communication, education, and institutional operations has changed academia. Educational institutions increasingly use digital platforms for file sharing, course delivery, collaboration, and performance tracking. The COVID-19 pandemic has increased dependence on Learning Management Systems (LMS) to support hybrid and flexible learning modalities, driving universities worldwide to invest heavily in LMS (Cruz & Reyes, 2023).

LMS adoption in the Philippines has increased to 67% of public and 87% of private higher education institutions by 2022 (CHED, 2022). Despite increased usage, many faculty and students still struggle with Moodle. Santos & Dela Peña (2022) found that usability barriers, such as complicated navigation, poor interface design, and limited accessibility, reduce learning effectiveness and discourage user adoption. These limitations demonstrate the need for Philippine state university-specific LMS solutions.

LMS design should reflect how students learn best, according to pedagogical frameworks. According to Mayer's Cognitive Theory of Multimedia Learning and the Cognitive-Affective Theory of Learning with Multimedia, dual coding, motivation, and metacognitive processing improve information retention when auditory and visual channels are engaged (Mayer, 2021; Castro & Lim, 2023). Filipino student studies show that multimedia-rich environments—video lectures, interactive simulations, and annotated modules—improve engagement and comprehension (Tan & Manuel, 2024). These findings suggest that redesigned LMS platforms should support learner-centered pedagogy with multimedia, real-time feedback, and simplified workflows.

In the 1960s and 1970s, Computer-Based Instruction (CBI) systems like PLATO and TICCIT pioneered adaptive learning paths and modular content delivery. Their principles still

shape global e-learning platforms (Martin & Blake, 2022; Navarro & Castillo, 2023). Modern universities combine historical insights with new technologies to create flexible, inclusive, and interactive digital learning environments. Generalized systems like Moodle may not fit the localized academic workflows, cultural context, and technical capacity of Philippine state universities like Cavite State University – Carmona Campus.

Locale research emphasizes standardization and automation in course materials and assessments. Standardized learning modules ensure course section and instructor consistency (Cruz & Aquino, 2024).

The DOST–SEI Courseware Project showed that integrating open educational resources (OER) aligned with national curricula and cultural values works, but adapting them into complex LMS platforms like Moodle is difficult (DOST-SEI, 2023).

MIT OpenCourseWare and ALISON show that multimedia integration, automated feedback, and self-paced learning motivate and succeed students (MIT, 2023; Alison, 2024).

Enterprise LMS platforms like Blackboard and Desire2Learn offer robust assessment and analytics but are financially and administratively prohibitive for public institutions (Navarro & Linao, 2023).

The reviewed literature concludes that Cavite State University – Carmona Campus needs a customized, user-friendly, and resource-appropriate LMS with multimedia functionality, localized usability features, and efficient academic workflows. A system that bridges global technological advances and local implementation constraints would improve learning outcomes, accessibility, and sustainability.

This study is based on Mayer's Cognitive-Affective Theory of Learning with Multimedia (CATLM), which states that multimedia design integrates cognitive and emotional processes to promote meaningful learning. Dual coding, learner control, and motivation drive engagement and retention (Mayer, 2021). The proposed LMS for Cavite State University – Carmona Campus uses CATLM to promote deep learning with multimedia-based instructional elements, interactive feedback, and intuitive user interfaces. Based on the theory, a platform can align technological design with cognitive and affective learning processes to support outcome-based, learner-centered, and inclusive digital education.

Theoretical Framework

The design, development, implementation, and evaluation of the proposed Campus-Based Learning Management System (CLMS) were anchored on complementary educational and technology adoption theories that explain how digital learning environments support effective instruction, learner engagement, user acceptance, and software quality. Specifically, this study was guided by the Cognitive-Affective Theory of Learning with Multimedia (CATLM), the Technology Acceptance Model (TAM), Constructivist Learning Theory, and the ISO/IEC 25010 Software Quality Model. Together, these frameworks provide a comprehensive

foundation for developing a learning management system that is pedagogically effective, user-centered, and technically reliable.

Cognitive-Affective Theory of Learning with Multimedia (CATLM)

The Cognitive-Affective Theory of Learning with Multimedia (CATLM), proposed by Mayer (2021), explains that meaningful learning occurs when learners actively process information presented through multiple media while simultaneously engaging cognitive and emotional processes. The theory extends the Cognitive Theory of Multimedia Learning by recognizing that learner motivation, emotions, and engagement significantly influence knowledge acquisition and retention. CATLM emphasizes that well-designed multimedia environments reduce cognitive overload, encourage learner control, and promote deeper understanding through the integration of text, graphics, audio, video, and interactive activities.

The proposed Campus-Based Learning Management System was designed following these principles by integrating multimedia instructional materials, downloadable resources, interactive quizzes, discussion forums, and real-time feedback mechanisms. These features encourage active participation, improve learner engagement, and support self-paced learning. By providing an intuitive and multimedia-rich learning environment, the CLMS facilitates meaningful learning experiences consistent with the principles of CATLM.

Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM), developed by Davis (1989), explains how users decide whether to accept and use a new information system. According to TAM, two primary factors influence technology adoption: Perceived Usefulness (PU), which refers to the extent to which users believe that a system improves their performance, and Perceived Ease of Use (PEOU), which reflects the degree to which users believe that the system is simple to learn and operate.

These constructs are highly relevant to the present study because the proposed CLMS was developed to address usability challenges associated with existing learning management systems. The evaluation of usability, accessibility, interface design, and overall user satisfaction directly reflects the principles of TAM. A system that users perceive as useful and easy to use is more likely to be adopted by faculty members and students, thereby supporting successful implementation within the university.

Constructivist Learning Theory

Constructivist Learning Theory, primarily associated with Piaget and Vygotsky, proposes that learners actively construct knowledge through interaction, collaboration, reflection, and authentic learning experiences rather than passively receiving information. Learning occurs when students engage in meaningful activities, communicate with peers and instructors, solve problems, and connect new knowledge with prior experiences.

The proposed CLMS incorporates several constructivist principles by providing discussion forums, collaborative learning activities, assignment submissions, self-assessment

quizzes, announcements, and communication tools that encourage continuous interaction between instructors and students. These features promote active participation, collaborative learning, and learner autonomy while supporting outcome-based education practices adopted by higher education institutions.

ISO/IEC 25010 Software Quality Model

The ISO/IEC 25010 Software Quality Model provides an internationally recognized framework for evaluating software quality. The model defines quality characteristics including functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability, allowing software systems to be evaluated systematically according to internationally accepted standards.

In this study, ISO/IEC 25010 served as the primary framework for evaluating the developed Campus-Based Learning Management System. Following pilot implementation, faculty members and students assessed the system using software quality characteristics defined by the standard. The evaluation determined whether the CLMS effectively satisfied institutional requirements while providing reliable, secure, efficient, and user-friendly digital learning services.

Synthesis of the Theoretical Framework

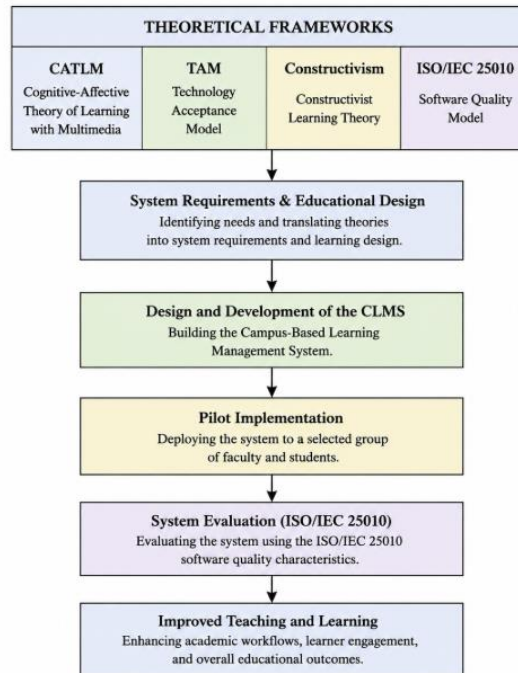
The four frameworks collectively establish the theoretical foundation of this study. The Cognitive-Affective Theory of Learning with Multimedia guided the instructional and multimedia design of the CLMS by emphasizing meaningful learning through interactive digital resources. Constructivist Learning Theory informed the development of collaborative and learner-centered learning activities that promote active knowledge construction. The Technology Acceptance Model explained the factors influencing user acceptance, particularly perceived usefulness and ease of use, which are essential for successful adoption of the developed system. Finally, the ISO/IEC 25010 Software Quality Model provided the framework for evaluating the technical quality and overall performance of the CLMS.

By integrating these complementary frameworks, the study addresses both the pedagogical and technological dimensions of learning management system development. This theoretical integration supports the design, development, implementation, and evaluation of a Campus-Based Learning Management System that is educationally meaningful, user-centered, and aligned with internationally recognized software quality standards.

Figure 1 illustrates the conceptual relationship among the educational theories, technology acceptance framework, software quality model, and the development and evaluation processes of the proposed Campus-Based Learning Management System.

Figure 1

Conceptual relationship among the educational theories, technology acceptance framework, software quality model, and the development and evaluation processes of the proposed Campus-Based Learning Management System

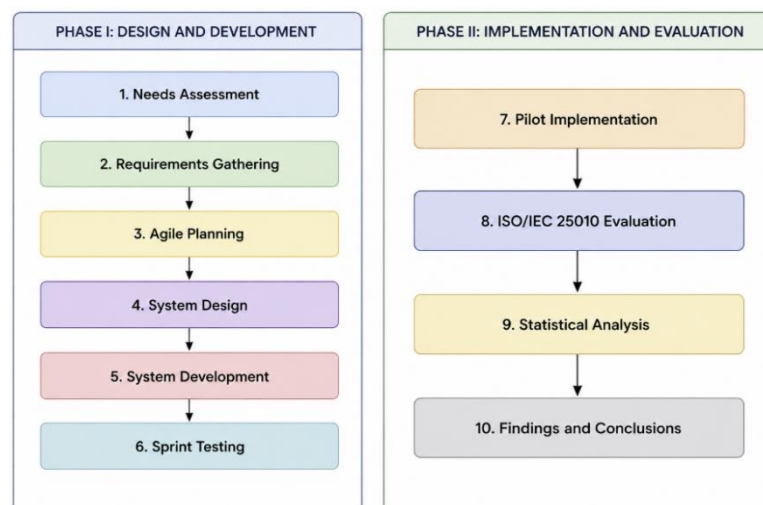


Methodology

This study employed a mixed-methods research design consisting of two major phases: (1) the design, development, and implementation of a Campus-Based Learning Management System (CLMS) developed as an alternative to the existing Moodle-based learning environment using the Agile Software Development methodology, and (2) the evaluation of the developed CLMS using the ISO/IEC 25010 Software Quality Model.

Figure 2.

Research Methodology Flowchart



The qualitative component was conducted during the needs assessment and system development phases through interviews and consultation meetings with department heads, faculty members, information technology personnel, and student representatives. These activities identified institutional requirements, existing workflow challenges, and desired system functionalities. Qualitative responses were analyzed using thematic analysis and served as the basis for defining the functional specifications of the proposed CLMS.

The quantitative component was conducted during the system evaluation phase. After pilot implementation, the developed CLMS was evaluated by faculty members and students using a structured questionnaire based on the ISO/IEC 25010 Software Quality Model. The collected responses were analyzed using descriptive statistics to determine the software's quality and user acceptance.

Agile was chosen over Waterfall because it encourages flexibility, incremental progress, and stakeholder engagement. Development was done in two- to three-week sprints. Course module management, user authentication, grade tracking, and report generation were developed, tested, and refined during each sprint based on real-time feedback from faculty, students, and administrative staff.

Its focus on collaboration, transparency, and continuous testing makes Agile appealing. User feedback was used throughout development to improve interface design, simplify navigation, and ensure the system's functionality matches academic workflows. This iterative, feedback-driven process produced a technically robust and pedagogically responsive CLMS that supports flexible, accessible, and efficient teaching–learning.

To define project goals, user needs, and technical specifications, department chairs, instructors, IT staff, and student representatives were consulted during planning. The next sprints included planning, coding, integration, and evaluation. CLMS modules were reviewed and refined after each sprint to meet user and academic goals. User Acceptance Testing (UAT) and pilot implementation at Cavite State University – Carmona Campus followed core component completion. The CLMS met usability, accessibility, and performance standards during this testing phase. Post-deployment feedback loops collected user experiences to inform module updates and improvements.

Agile development improved risk management, productivity, and CLMS flexibility to meet university needs. The study created a cost-effective, scalable, and localized digital learning platform for Cavite State University – Carmona City's academic and administrative environment through continuous iteration, stakeholder collaboration, and rigorous testing.

Population and locale of the study

The study employed a mixed-methods research design. The quantitative component involved collecting objective and generalizable data regarding the evaluation of the developed Campus-Based Learning Management System (CLMS), while the qualitative component

supported the needs assessment and requirements gathering during the system development phase. Slovin's formula (1960) with a 5% margin of error and 95% confidence level were used to select 272 respondents from 847 administrators, faculty, and students. Purposive sampling ensured participation of university learning environment and system workflow experts. CLMS functionality and user experience were measured using structured surveys. The study used standardized questionnaires, consistent coding, and peer-reviewed data verification to ensure validity and reliability. Aggregating and interpreting data aligned system development with institutional and user needs. Working with the Registrar, Academic Affairs, and Information Technology ensured that the CLMS framework met academic and administrative goals.

The study was conducted in two phases. Phase I involved 272 respondents for the needs assessment and requirements gathering. The data collected during this phase served as the basis for designing and developing the proposed CLMS. Phase II involved 122 evaluators composed of 114 students and 8 faculty members who assessed the completed system using the ISO/IEC 25010 Software Quality Model following pilot implementation.

Data Instrument

This study relied on a structured survey questionnaire. The questionnaire was adapted from validated tools in related research and contextualized for Cavite State University – Carmona City's Campus-Based Learning Management System (CLMS). It assessed student and faculty perceptions of accessibility, usability, user satisfaction, and system functionality. The instrument had seven core questions on a five-point Likert scale from 1 (Strongly Disagree) to 5 (Strongly Agree).

The questionnaire was developed based on the ISO/IEC 25010 Software Product Quality Model and contextualized to evaluate the developed Campus-Based Learning Management System.

Instrument Validation

The questionnaire was content validated by three educational technology, instructional systems design, and quantitative research experts before deployment. Clarity, relevance, and study objectives were checked for each item. The instrument's CVI was 0.92, indicating excellent content validity. A pilot test was conducted with 30 non-participating respondents like the target population to ensure internal consistency. A Cronbach's alpha coefficient of 0.88 indicates high reliability and internal consistency across all constructs, as confirmed by the reliability test results.

Administration and Data Collection

After validation, the final questionnaire was distributed to students, faculty, and administrators chosen for their CLMS platform familiarity. Participants were told their participation was voluntary and confidential. To reduce response bias and ensure accurate perception data, sufficient time and clarifications were provided.

Department heads and system administrators were interviewed after the quantitative survey to provide qualitative feedback on platform usability, system integration, and functional gaps. Triangulation improved quantitative results and informed CLMS framework refinement. A thorough literature synthesis using academic databases, digital libraries, and institutional repositories contextualized the findings. This secondary data analysis gave the system theoretical and empirical foundations to follow global educational technology and instructional management best practices (Alvino, Persico, & Tondello, 2022; Graham, Henrie, & Gibbons, 2021).

Research Ethics

Ethical approval for this study was obtained from the appropriate university authorities before data collection. Participation was voluntary, and all respondents provided informed consent. Participants were informed of the purpose of the study, their right to withdraw at any time, and the confidential handling of their responses. No personally identifiable information was disclosed during data analysis or publication. Student records, grades, and instructional materials used during system evaluation were accessed only through authorized channels and handled in accordance with the Data Privacy Act of 2012 (Republic Act No. 10173) and institutional research policies.

Data Analysis and Interpretation

The study used descriptive and inferential statistical analyses to interpret the data and validate respondents' perceptions of Cavite State University – Carmona City's proposed Campus-Based Learning Management System (CLMS).

Descriptive statistics summarized and identified dataset patterns and trends. The overall response distribution and respondent agreement across survey indicators were presented using central tendency and variability measures (Gravetter & Wallnau, 2022). Descriptive analysis helps present large datasets meaningfully, revealing opinions and attitudes toward the proposed system without drawing conclusions. In contrast, inferential statistics were used to assess sample representativeness and reliability, especially when generalizing to the university population. Probability theory guided inferential analysis to reduce sampling error and reflect administrators, faculty, and students' views (Field, 2022; Salkind, 2021).

For system functionality, usability, and educational impact, survey items were measured on a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree).

Descriptive Findings

Table 1 presents descriptive analysis. Most respondents supported CLMS across all indicators. Most respondents (96.7%) strongly agreed (58.1%) or moderately agreed (38.6%) that the CLMS would provide downloadable learning materials and activities to assess student progress. Over 99% thought the CLMS would improve course delivery, teaching–learning, and structured learning. Faculty, administrators, and students agreed on all indicators, with few disagreeing or strongly disagreeing. Each item scored 4.69–4.95, indicating high acceptance and usefulness. These findings show that the university community needs and benefits from a localized, user-friendly CLMS. Respondents said the system could improve instruction, assessment, and academic resources. Cavite State University – Carmona City is ready and committed to digital learning.

Results and Discussion

The study developed and evaluated Cavite State University – Carmona City's Campus-Based Learning Management System (CLMS), a scalable, locally hosted platform to improve course delivery, assessment, and academic communication. A Hybrid Search and Recommendation Algorithm (HSRA) improves search speed, content retrieval, and personalized learning, making the system adaptive and responsive to user needs.

TABLE I
DESCRIPTIVE ANALYSIS

Indicator	SAF (%)	MAF (%)	A (%)	SD (%)	D (%)
1. The creation of a Learning Management System for Cavite State University – Carmona Campus would aid in the teaching-learning process.	139 (51.1%)	132 (48.5%)	1 (0.4%)	0 (0.0%)	0 (0.0%)
2. The creation of a Learning Management System for Cavite State University – Carmona Campus would result in time and cost benefits	128 (47.1%)	108 (39.7%)	36 (13.24%)	0 (0.0%)	0 (0.0%)
3. The creation of a Learning Management System for Cavite State University – Carmona Campus would aid in course delivery and associated activities.	125 (46.0%)	128 (47.1%)	19 (6.99%)	0 (0.0%)	0 (0.0%)
4. The creation of a Learning Management System for Cavite State University – Carmona Campus would support the formation of learning paths for students.	125 (46.0%)	121 (44.5%)	26 (9.56%)	0 (0.0%)	0 (0.0%)
5. The creation of a Learning Management System for Cavite State University – Carmona Campus would aid in student assessment and feedback using self-grading quizzes.	139 (51.1%)	85 (31.3%)	43 (15.81%)	5 (1.8%)	0 (0.0%)
6. The creation of a Learning Management System for Cavite State University – Carmona Campus would allow individual, group, or anonymous graded assignments.	132 (48.5%)	117 (43.0%)	23 (8.46%)	0 (0.0%)	0 (0.0%)
7. The creation of a Learning Management System for Cavite State University – Carmona Campus would provide a pool of academic resources accessible to students.	127 (46.7%)	132 (48.5%)	13 (4.78%)	0 (0.0%)	0 (0.0%)
8. The creation of a Learning Management System for Cavite State University – Carmona Campus would provide downloadable documents or activities that can assess students' learning progress through participation/online interaction.	158 (58.1%)	105 (38.6%)	9 (3.31%)	0 (0.0%)	0 (0.0%)

The CLMS performed well in eight dimensions—functional suitability, efficiency, compatibility, usability, reliability, security, maintainability, and portability—according to ISO/IEC 25010 software quality model validation. Participants strongly agreed that the CLMS improves accessibility, usability, and learning engagement, with over 96% user satisfaction. The findings show that the CLMS is functionally reliable, pedagogically effective, and technically optimized, supporting outcome-based education (OBE) and the university's digital transformation and sustainable educational innovation.

System Design and Implementation

The Campus-Based Learning Management System (CLMS) for Cavite State University – Carmona City was designed to be accessible, scalable, and user-centered to support academic workflows. Agile development ensured iterative prototyping, stakeholder feedback integration, and timely functional module delivery.

A thorough analysis of academic operations like content uploading, student assessment, and grade management informed system architecture and interface design to meet institutional needs. The CLMS uses a Hybrid Search and Recommendation Algorithm (HSRA) to improve content retrieval, search accuracy, and system responsiveness to provide efficient access to educational resources regardless of data complexity.

Faculty, students, and academic coordinators reviewed interfaces iteratively to prioritize user-centered design. We improved usability, accessibility, and functionality based on their feedback. The final CLMS prototype showed high system performance, functional reliability, and user acceptability, marking its potential as a sustainable, campus-based digital learning solution that meets Cavite State University – Carmona's pedagogical and technological goals.

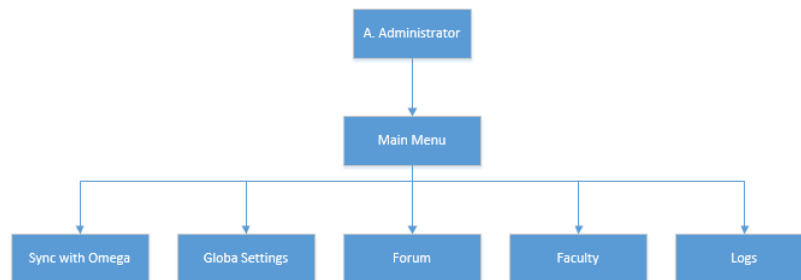
System Module

For data integrity, system scalability, and a smooth user experience, Cavite State University – Carmona City's Campus-Based Learning Management System (CLMS) uses a modular, role-based architecture. Users are directed to Administrator, Faculty, or Student modules after authentication, each with academic and administrative functions.

The Hybrid Search and Recommendation Algorithm (HSRA) improves content retrieval and personalized learning materials. This intelligent search engine prioritizes resources by user roles, access frequency, and course relevance for efficient navigation and real-time data synchronization across all modules.

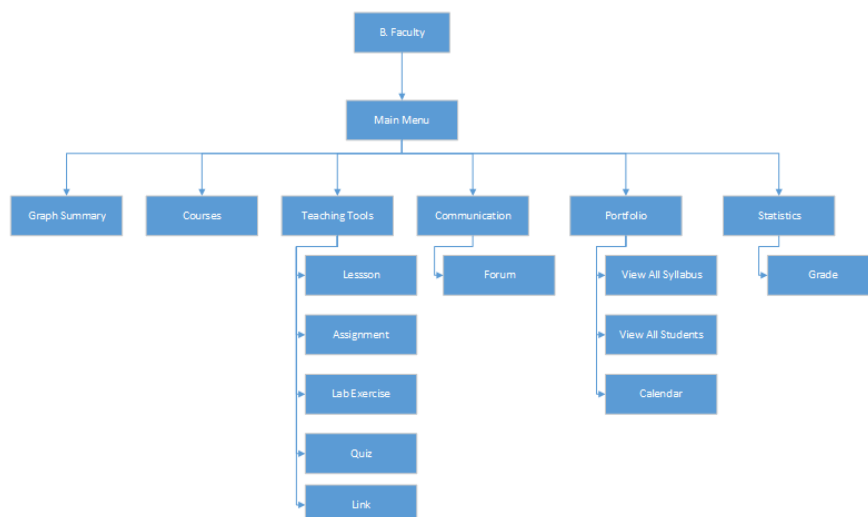
The Administrator Module handles system setup, user management, academic term configuration, and institutional database content synchronization. Communication tools, forum management, and user log monitoring ensure learning operations transparency, accountability, and centralization. Figure 3 depicts administrator flow.

Figure 3.
Administrator Module



Faculty Module simplifies course management and teaching. An integrated Teaching Tools suite lets instructors create and organize course content, assignments, lab activities, quizzes, and resource links. Portfolios and communication tools aid syllabus management, class announcements, and faculty–student collaboration. Data-driven instructional decisions are made using statistical dashboards of student performance and content engagement. Figure 4 depicts faculty flow.

Figure 4.
Faculty Module

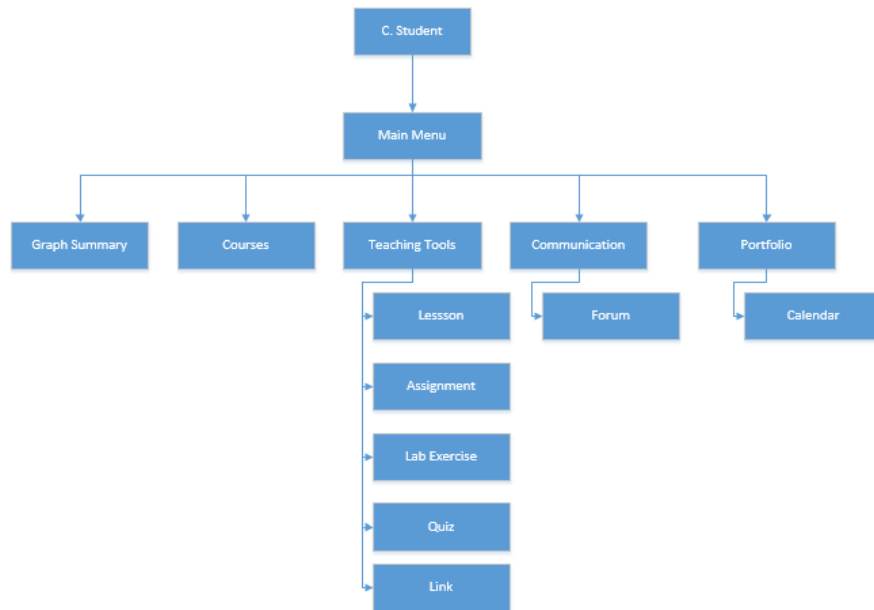


Our Student Module gives students structured access to course materials, assessments, and schedules. Personalized dashboards show activities, deadlines, and progress. It promotes

accountability and self-paced learning by transparently monitoring submitted tasks, quiz results, and course participation alongside the Faculty Module. Figure 5 shows student flow.

Figure 5.

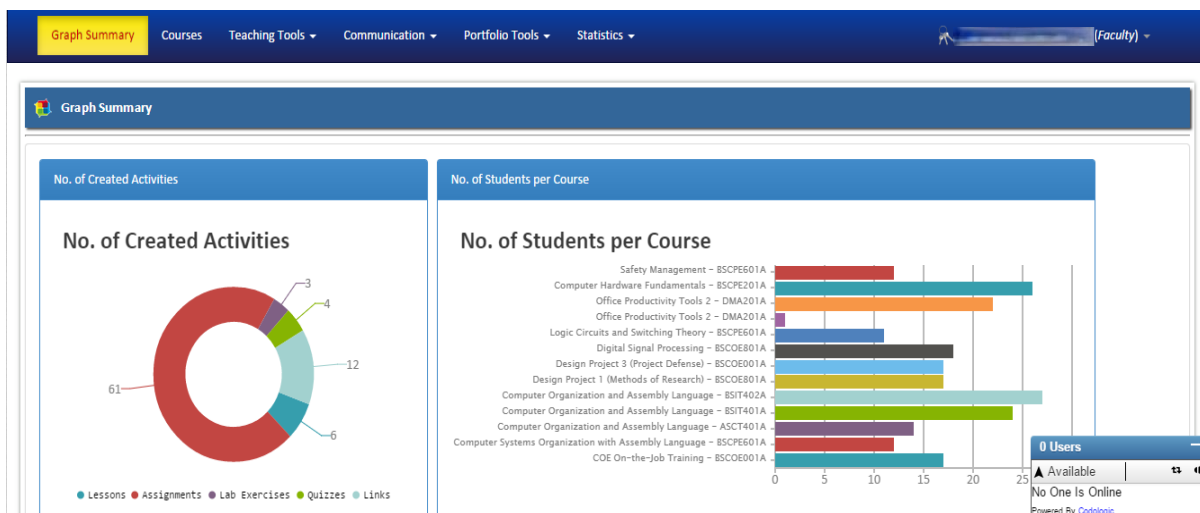
Student Module



Cavite State University – Carmona City's CLMS Faculty Module Graph Summary is shown in Figure 5. The dashboard displays real-time course engagement and instruction. Two main panels display the number of lessons, assignments, lab exercises, quizzes, uploaded links, and students per course by subject and section. This module lets instructors track student participation, workload distribution, and teaching productivity across courses. Visualizing academic data in the Graph Summary promotes data-driven decision-making and course transparency. ISO/IEC 25010-compliant CLMS performance monitoring for usability, functionality, and efficiency is supported.

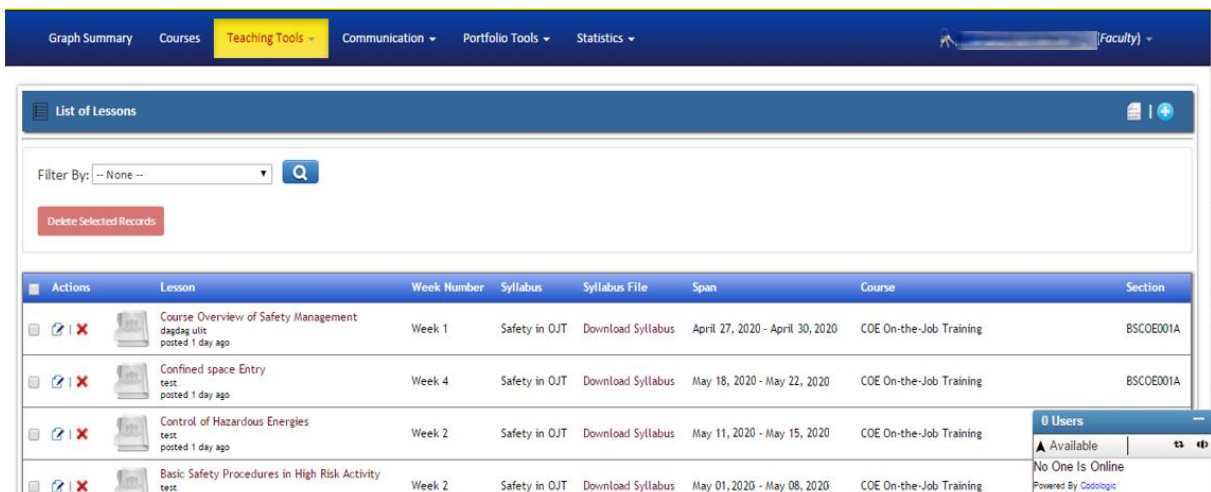
Figure 6

. Graph Summary



The Faculty Module's Teaching Tools – List of Lessons interface for Cavite State University – Carmona City, Cavite, Philippines' Campus-Based Learning Management System is shown in Figure 7. This feature lets instructors organize, upload, and manage weekly lectures, course outlines, and downloadable syllabi. Each entry includes lesson titles, week numbers, course codes, and class sections for academic schedule consistency. For efficiency and flexibility, this module allows real-time content updates and structured lesson sequencing. The system meets ISO/IEC 25010 functional suitability, usability, and maintainability standards, making lessons accessible, consistent, and secure. Standardizing lesson delivery with Teaching Tools improves instructional quality, supports outcome-based education (OBE), and promotes academic resource access across programs.

Figure 7.
Teaching Tools (List of Lessons)



Actions	Lesson	Week Number	Syllabus	Syllabus File	Span	Course	Section
	Course Overview of Safety Management dagdag ulit posted 1 day ago	Week 1	Safety in OJT	Download Syllabus	April 27, 2020 - April 30, 2020	COE On-the-Job Training	BSCOE001A
	Confined space Entry test posted 1 day ago	Week 4	Safety in OJT	Download Syllabus	May 18, 2020 - May 22, 2020	COE On-the-Job Training	BSCOE001A
	Control of Hazardous Energies test posted 1 day ago	Week 2	Safety in OJT	Download Syllabus	May 11, 2020 - May 15, 2020	COE On-the-Job Training	
	Basic Safety Procedures in High Risk Activity test	Week 2	Safety in OJT	Download Syllabus	May 01, 2020 - May 08, 2020	COE On-the-Job Training	

0 Users
 ▲ Available
 No One Is Online
 Powered By Codigolgo

The Faculty Module's Teaching Tools – List of Quizzes interface for Cavite State University – Carmona City, Cavite, Philippines' Campus-Based Learning Management System is shown in Figure 8. This feature lets teachers create, manage, and give ID, multiple-choice, and true-or-false quizzes. For organized and transparent evaluation, quiz entries have scheduling parameters, course and section identifiers, submission tracking tools, and a list of students who submitted each quiz. The module meets ISO/IEC 25010 software quality standards for functionality, usability, and performance. By automating quiz creation, randomization, and grading, instructors can give timely, objective feedback. Auto-grading reduces paperwork and improves accuracy. Centralizing assessment management in Teaching Tools – List of Quizzes improves digital pedagogy, academic integrity, and CLMS continuous learning assessment.

Figure 8.
Teaching Tools (List of Quizzes)

Actions	Quiz	Course	Section	Submitters	Schedule
☐	test me i test posted 1 month ago	COE On-the-Job Training	BSCOE001A	1/17	March 20, 2022 - 03:05PM to March 20, 2022 - 03:30PM
☐	test test posted 1 month ago	COE On-the-Job Training	BSCOE001A	0/17	March 15, 2022 - 12:05PM to March 15, 2022 - 01:00PM
☐	2nd quiz SAFEMGT Check the CAPITAL word/s if it is TRUE or FALSE posted 4 months ago	Safety Management	BSCPE601A	11/12	December 15, 2022 - 01:00PM to December 15, 2022 - 02:30PM
☐	1st quiz SAFEMGT Answer the following question. posted 4 months ago	Safety Management	BSCPE601A	11/12	December 15, 2022 - 01:00PM to December 15, 2022 - 02:30PM

Figure 9 shows the Faculty Module of the Campus-Based Learning Management System (CLMS) for Cavite State University – Carmona City, Cavite, Philippines' Portfolio Module with Calendar interface. This feature lets instructors see all upcoming lessons, quizzes, and assignments in one place. To ensure timely completion and student engagement, each calendar entry is linked to its course and section with configurable scheduling, deadlines, and automated notifications. The Portfolio Module improves digital pedagogy, student accountability, and CLMS continuous learning assessment by integrating lessons, assessments, and notifications into a dashboard.

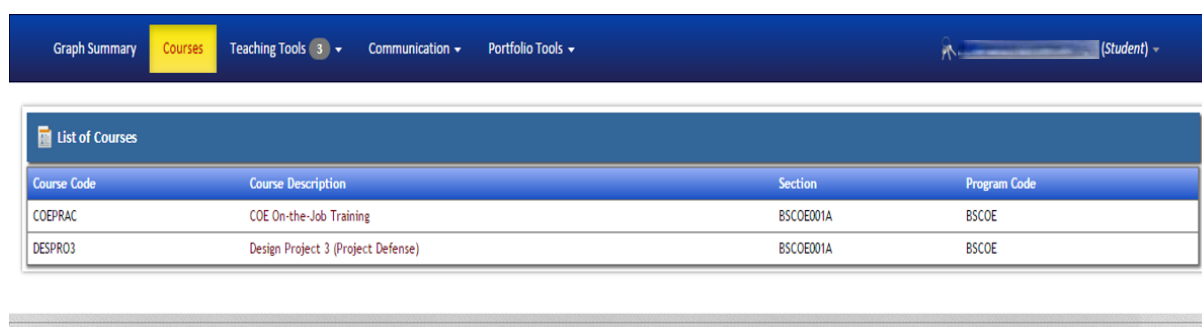
Figure 9.
Portfolio Tools (Calendar)

Previous							Next
S	M	T	W	T	F	S	THINGS TO DO
29	30	31	1	2	3	4	Lessons [3]
5	6	7	8	9	10	11	Quizzes [0]
12	13	14	15	16	17	18	Assignments [0]
19	20	21	22	23	24	25	

The Student Module had the highest usability and accessibility, proving its effectiveness in improving student engagement and satisfaction. A dashboard gives students easy access to lessons, assignments, quizzes, and communication tools. Dynamic academic calendars and real-time progress tracking enable personalized learning and active participation. The Student Module promotes self-paced learning and digital inclusivity in diverse learning environments through responsive design and optimized navigation.

Figure 10 shows the Courses interface in the Student Module of Cavite State University – Carmona City's Campus-Based Learning Management System (CLMS). This module lists all enrolled courses, including course codes, descriptions, section identifiers, and program codes. Course details, enrollment, and learning activities are easily accessible to students. The interface improves usability, organizes academic information, and helps students plan and track coursework within CLMS.

Figure 10.
Courses (List of Courses)



Course Code	Course Description	Section	Program Code
COEPRAC	COE On-the-Job Training	BSCOE001A	BSCOE
DESPRO3	Design Project 3 (Project Defense)	BSCOE001A	BSCOE

In the Faculty Module of the Campus-Based Learning Management System (CLMS) developed for Cavite State University – Carmona City, Cavite, Philippines, Figure 11 shows the Teaching Tools – Lessons interface. Faculty-uploaded lessons are listed by name, week, syllabus title, downloadable syllabus file, duration, course title, and section. Teachers and students receive integrated notifications of new or updated lessons, ensuring timely engagement. This module improves instructional efficiency, course delivery, and CLMS continuous learning assessment by centralizing lesson management and making content visible.

Figure 11.
Teaching Tools (List of Lessons)

Lesson	Week Number	Syllabus	Syllabus File	Span	Course	Section
Course Overview of Safety Management dagdag ulit posted 1 day ago	Week 1	Safety in OJT	Download Syllabus	April 27, 2022 - April 30, 2022	COE On-the-Job Training	BSCOE001A
Confined space Entry test posted 1 day ago	Week 4	Safety in OJT	Download Syllabus	May 18, 2022 - May 22, 2022	COE On-the-Job Training	BSCOE001A
Control of Hazardous Energies test posted 1 day ago	Week 2	Safety in OJT	Download Syllabus	May 11, 2022 - May 15, 2022	COE On-the-Job Training	BSCOE001A
Basic Safety Procedures in High Risk Activity test posted 1 day ago	Week 2	Safety in OJT	Download Syllabus	May 01, 2022 - May 08, 2022	COE On-the-Job Training	BSCOE001A
Course Overview of Safety Management test	Week 1	Safety in OJT	Download Syllabus	April 27, 2022 - April 30, 2022	COE On-the-Job Training	BSCOE001A

In the Faculty Module of the Campus-Based Learning Management System (CLMS) developed for Cavite State University – Carmona City, Cavite, Philippines, Figure 12 shows the Teaching Tools – Quizzes interface with notifications. This feature lists quizzes by name, section, course, upload schedule, and duration. The interface shows each quiz's status—ongoing, completed, or due—and notifies instructors and students of updates. This module improves instructional efficiency, assessment management, and CLMS engagement by centralizing quiz information and providing real-time alerts.

Figure 12.
Teaching Tools (List of Quizzes)

Quiz	Section	Course	Schedule	Status
BSCOE test posted 1 month ago	BSCOE001A	COE On-the-Job Training	March 20, 2022 - 03:05PM to March 20, 2022 - 03:30PM	Done
BSCOE test posted 1 month ago	BSCOE001A	COE On-the-Job Training	March 15, 2022 - 12:05PM to March 15, 2022 - 01:00PM	Due

Figure 13 shows the Communication Module – List of Forums interface in the Student and Faculty Modules of Cavite State University – Carmona City, Cavite, Philippines' Campus-Based Learning Management System (CLMS). It shows forum threads' title, last post, number of replies, course, and section. It allows students and instructors to discuss, ask questions, and give feedback on subject matter. The module improves collaborative learning, active participation, and CLMS engagement by centralizing forum interactions.

Figure 13.
Communication (List of Forums)

Actions	Thread	Last Post	Replies	Course	Section
	What is mnemonic code? Answer the following question. by <i>MATHEWS</i> → 1 month ago	Replied 1 month ago by <i>MATHEWS</i>	1	COE On-the-Job Training	BSCOE001A
	Test Forum For testing. by <i>esjay</i> → 1 month ago	--	0	--	--

Page 1 of 1: Showing Record 1 to 2 of 2

0 Users
▲ Available
No One Is Online
Powered By Codologic

Testing Result

The Cavite State University – Carmona Campus-Based Learning Management System (CLMS) was evaluated by 122 respondents—114 students and 8 faculty members, including the Academic Head—based on ISO/IEC 25010 software quality standards for functional suitability, usability, and performance efficiency. Speed, accuracy, convenience, ease of navigation, and user-friendliness were consistently rated high, with a mean of 4.54, indicating a smooth user experience.

Module ratings were consistently high. The Subjects and Students Modules had mean scores of 4.38–4.61, indicating good course and student record management. Content delivery and communication and collaboration were efficient in the Lesson and Forum Modules (4.48–4.69). Assignment and Quiz Modules averaged 4.56–4.70, proving task management and assessment reliability. The Link, Grade, and Calendar Modules scored 4.48–4.78, demonstrating resource integration, intuitive academic performance presentation, and effective scheduling with notifications.

Most users completed module tasks in under two minutes, demonstrating the LMS's productivity and ease of use. High module and ISO/IEC 25010 parameter ratings show that the LMS is reliable, efficient, and user-friendly, supporting digital pedagogy, continuous learning assessment, and organized academic administration.

Summary

The ISO/IEC 25010 software quality standards were used to evaluate Cavite State University – Carmona's Campus-Based Learning Management System (CLMS), focusing on functional suitability, usability, performance efficiency, reliability, and maintainability. To meet institutional needs, the system's architecture and interface were based on a thorough analysis of academic operations like content uploading, student assessment, and grade

management. Faculty and students gave requirement compliance, submission database, lessons, quizzes, and forums high ratings (weighted means 4.50–4.54), indicating functional suitability and usability. Real-time MySQL integration and a Hybrid Search and Recommendation Algorithm (HSRA) improved content retrieval, search accuracy, and system responsiveness, ensuring efficient educational resource access. System reliability and maintainability were supported by consistent system performance and a modular design for updates and error-free operation. The CLMS improves teaching, learning, and academic administration with its reliability, efficiency, and usability.

Conclusion

Cavite State University – Carmona's Campus-Based Learning Management System (CLMS) solves academic content management, student assessment, and faculty-student communication problems. The CLMS had excellent functional suitability, usability, performance efficiency, reliability, and maintainability according to ISO/IEC 25010 standards. A Hybrid Search and Recommendation Algorithm (HSRA) and real-time MySQL backend provide fast, accurate, and efficient access to lessons, assignments, quizzes, and resources. High user ratings across all modules confirm that the system is intuitive, reliable, and time-efficient, streamlining academic workflows, promoting continuous learning, and improving digital pedagogy. Overall, the CLMS provides a robust solution for improving teaching and learning on campus while meeting institutional and user needs.

Recommendations

After developing and evaluating the Campus-Based Learning Management System (CLMS) for Cavite State University – Carmona, it is recommended that it be expanded to other campuses to provide broader access to a centralized learning platform and ensure continuity in teaching and learning. Enrollment and registration modules, online financial transactions, plagiarism detection, interactive polling, automated supervisor workflows, and AI-assisted analytics may be added in the future to improve academic integrity, assessment efficiency, and adaptive learning. To maximize system effectiveness, faculty should update course materials, quizzes, and instructional resources each term. To optimize adoption, usability, and CLMS alignment with institutional academic goals, faculty and students should receive regular training and support, as well as periodic user feedback and system analytics. These recommendations will make the CLMS more comprehensive, adaptive, and user-friendly, improving digital pedagogy, academic management, and teaching and learning.

Acknowledgment

The author thanks Cavite State University – Carmona Campus for its ongoing support and resources for this study. A tribute to Ms. Resty F. Aldana, whose mentorship, dedication, and love of teaching inspired this work. Her legacy affects the author's research. The author also thanks Ms. Mari Cris M. Tan for her work reviewing the manuscript's format and structure

to ensure academic standards were met. I also appreciate all colleagues, respondents, and individuals who donated time, insights, and encouragement to complete this project.

REFERENCES

- Alsadoon, A. (2023). The impact of ICT tools on student learning and teaching efficiency: A review. *Education and Information Technologies*, 28, 1475–1490.
<https://doi.org/10.1007/s10639-023-11490-3>
- Singh, P., & Hassan, M. A. (2023). Leveraging digital pedagogy for effective learning in the post-pandemic era. *International Journal of Educational Technology in Higher Education*, 20(1), 1–18. <https://doi.org/10.1186/s41239-023-00423-0>
- Chan, C. L., & Yu, K. L. (2024). Bridging the skills gap: Aligning curriculum with industry needs in the digital age. *Journal of Education and Work*, 37(1), 49–64.
<https://doi.org/10.1080/13639080.2024.1978452>
- Reyes, T., Esguerra, M. J., & Dela Cruz, L. R. (2024). Institutional support mechanisms for graduate employability: A Philippine HEI case study. *Asia Pacific Journal of Education*, 45(2), 134–150. <https://doi.org/10.1080/02188791.2024.1990774>
- Martinez, J. D., Santos, A. B., & Villanueva, R. (2023). Evaluating LMS effectiveness in hybrid learning environments: A Philippine university perspective. *International Journal of Learning Technologies*, 19(3), 215–232.
<https://doi.org/10.1504/IJLT.2023.100589>
- Brown, M. W., & Jackson, S. A. (2023). Barriers to Moodle adoption in higher education: A faculty perspective. *British Journal of Educational Technology*, 54(5), 1218–1232.
<https://doi.org/10.1111/bjet.13230>
- Domingo, E. R., & Tan, J. L. (2022). Usability issues and adoption challenges in implementing Moodle in Philippine state universities. *Philippine Journal of ICT and Education*, 12(2), 56–70.
- Cruz, M., & Reyes, J. T. (2023). The evolution of LMS in Philippine education: Post-pandemic developments and insights. *Philippine Journal of Educational Technology*, 14(1), 23–35.
- Commission on Higher Education. (2022). *Philippine higher education ICT use report*.
- Santos, A. A., & Dela Peña, M. P. (2022). Barriers to LMS effectiveness in Philippine HEIs: A usability-centered analysis. *Asian Journal of Distance Education*, 18(2), 58–72.
- Mayer, R. E. (2021). *Multimedia learning* (3rd ed.). Cambridge University Press.
- Castro, C. R., & Lim, F. N. (2023). Integrating the cognitive-affective theory of learning with multimedia in LMS design. *International Journal of Instructional Technology and Distance Learning*, 21(1), 11–28.

- Tan, G., & Manuel, L. B. (2024). Engagement and retention in multimedia-enhanced online courses: A Philippine case study. *eLearning and Digital Media*, 22(3), 129–144. <https://doi.org/10.1177/2042753024123456>
- Martin, K. R., & Blake, S. D. (2022). Legacy of CBI systems: PLATO, TICCIT, and their influence on modern LMS design. *Educational Technology Research and Development*, 70(4), 865–880.
- Navarro, L., & Castillo, H. Y. (2023). Tracing instructional systems from PLATO to Philippine LMS platforms. *Philippine Journal of Open Learning*, 10(2), 99–110.
- Cruz, R. V., & Aquino, F. S. (2024). Standardized e-learning modules in multi-instructor environments: A case study in Southern Luzon. *Asian Journal of eLearning and Education*, 6(1), 41–55.
- Department of Science and Technology–Science Education Institute. (2023). *National courseware development project report*.
- Massachusetts Institute of Technology. (2023). *MIT OpenCourseWare: Enhancing learning through multimedia and analytics*. <https://ocw.mit.edu>
- Alison. (2024). *Free online learning with certification and analytics*. <https://alison.com>
- Navarro, G. T., & Linao, S. R. (2023). A comparative review of enterprise LMS platforms in Southeast Asia: Access, cost, and local feasibility. *Southeast Asian Journal of Educational Management*, 5(3), 91–106.