Learning Management System with Performance and Attendance Monitoring for ISPSC

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This paper addresses the need for efficient learning management in higher education by describing the design, development, and implementation of an open-source Learning Platform designed for Ilocos Sur Polytechnic State College. This novel Learning Platform integrates performance and attendance tracking to enhance the educational experience and assure teaching quality. Built on Moodle and a robust server infrastructure, the platform prioritizes user-friendliness for both instructors and students. Instructors can effectively manage courses, deliver materials, assess performance, and track attendance. Students benefit from a centralized platform for accessing content, submitting assignments, collaborating, and monitoring their progress. A key feature is the integrated performance and attendance monitoring, which provides valuable data for internal evaluation and curriculum improvement, ultimately leading to a higher quality of education at ISPSC. The implemented role-based access control to ensure data security and system integrity. This research contributes to the advancement of open-source LMS solutions and their potential to revolutionize teaching and learning practices. It empowers institutions like ISPSC to achieve a more holistic approach to education and foster high-quality learning experiences. Usability evaluations indicated strong user satisfaction with the platform across various aspects, with average scores exceeding 6.0, suggesting a well-received and valuable tool for ISPSC.

Keywords: Moodle LMS, Hostinger, Learning Platform, Performance and Attendance Monitoring, Role-Based Access Control.

INTRODUCTION

Learning Management Systems (LMS) have emerged as integral tools in modern organizational settings, serving multifaceted roles in promoting continuous learning, facilitating collaboration, and enhancing communication among employees. By fostering a culture of lifelong learning and skill development, LMS contributes to the cultivation of innovative practices within workplaces. Moreover, these systems enable remote work

arrangements, thereby streamlining operations, reducing costs, and augmenting organizational flexibility. LMS holds significant promise in empowering developing nations by providing access to educational resources, consequently fostering economic development and alleviating poverty. The idea explores the diverse applications of LMS across various sectors, ranging from safety training in manufacturing companies to collaborative endeavors in software development, elucidating their pivotal role in advancing sustainable industries, promoting technological advancements, and fostering innovation in infrastructure development. Through tailored training programs and enhanced collaboration, LMS serve as catalysts for organizational competitiveness and the formulation of efficient, sustainable solutions.

Learning Platforms serve as integrated media tools facilitating instructional processes through unified communication coordination during instructional events. Computer-managed learning (CML) systems, exemplified by LMS, have emerged as interactive platforms supporting sustainable educational practices. Forward-thinking technological networks employ Learning Platforms, encompassing platforms like Edmodo, social media, forums, Coursera, and specialized educational platforms focused on sustainability. Students are expected to utilize various resources, including LMS and scholarly works, to effectively complete academic assignments [1],[2].

The absence of well-defined social media policies, cyberbullying risks, and the need for faculty training in utilizing social media for educational purposes was highlighted as challenges faced by Higher Education Institutions [4]. In the educational landscape, the COVID-19 pandemic prompted a swift transition toward online learning platforms in Higher Educational Institutions (HEIs) [3]. This transition to virtual classrooms necessitates a focus on student engagement, a concept demonstrably linked to academic achievement [5]. It is imperative to recognize that the interplay among these elements may be influenced by diverse factors, encompassing the methodologies employed for gauging engagement and the cultural norms that mold students' educational encounters.

The successful application of LMS in higher education depends on a multifaceted approach that considers content quality, instructor support, student motivation, and the creation of a collaborative learning environment [6]. Previous research suggests a cross-cultural variation in LMS acceptance among sustainability students in higher education. Studies indicate a lower adoption rate of e-learning for sustainability in Arab universities of the Middle East [7]. Conversely, Western countries appear to demonstrate a higher level of acceptance for e-learning sustainability programs. It is important to analyze the factors leading to the literature available indicates that the level of acceptance of Learning Platforms among higher education sustainability students differs across countries. This is because engaging in e-learning programs focused on sustainability necessitates substantial investments in terms of capital and infrastructure [8].

In the context of technological progress, it is noteworthy that the learning platform employed by the various campuses of Ilocos Sur Polytechnic State College (ISPSC) lacks integration and implementation of a comprehensive software solution for managing and facilitating online classes. ISPSC's reliance solely on Google Classroom and Testmoz is insufficient for the effective delivery of high-quality instruction. The aforementioned mechanism poses a

hindrance to the efficiency of delivering high-quality instruction and has resulted in the accumulation of pending tasks that may disrupt the functioning of online classes at ISPSC. This research aims to address the current challenges faced by Ilocos Sur Polytechnic State College by proposing a solution in relation to the delivery of online classes in the institution.

Related Works

A review of the literature revealed the existence of numerous studies exploring the application of LMS across diverse industry and institutional contexts.

Previous research indicates that peer assessment holds greater value in fostering self-regulated learning and formative assessments compared to solely knowledge-based tasks. Furthermore, training students in providing constructive feedback and establishing clear evaluation criteria strengthens the effectiveness of peer assessment. However, the impact seems to vary by student level, with a more pronounced effect observed in primary and secondary education compared to tertiary education [9].

Educational data mining (EDM) methodologies are utilized to effectively monitor student learning within learning platforms, integrating early detection and personalized intervention strategies to address dropout rates and enhance student satisfaction. A custom application was developed as part of the study, enabling real-time monitoring of student progress and providing timely interventions for those at risk of academic [10].

Learning Platforms offer a multifaceted approach to education, presenting both opportunities and challenges. While LMS fosters online learning environments, communication channels, and dissemination of digital materials [11], its limitations include technological barriers, inadequate training, and dependence on internet connectivity [11].

Filipino students' embrace of Learning Platforms for remote learning during the pandemic correlated positively with their academic achievement. This association was further strengthened by students' self-efficacy in using the LMS, as those with higher confidence in their LMS skills exhibited stronger academic performance [12].

Despite the benefits of incorporating online learning platforms, such as expanded reach and flexible learning opportunities [13], technical difficulties, unreliable internet, and limitations in student assessment were identified as primary challenges.

Learning Platforms on engineering education in private higher education institutions within Pampanga, Philippines demonstrates a positive impact [14]. The learning platform reportedly enhanced student learning by facilitating access to course materials, assignment completion, and assessments, while also promoting communication with instructors and peers.

A customized learning platform for Isabela State University-Ilagan has the potential to improve the educational experience for both students and faculty [15]. This is achieved through the creation of a platform for online learning, enhanced communication channels, and the ability to share and develop digital course content.

Design Thinking Process

Design thinking framework helps in creating great

customer satisfaction. Design thinking framework has several benefits associated with it

including customers, better decision making, and innovation. It is a way to gain empathy with the customer to find their needs [16].

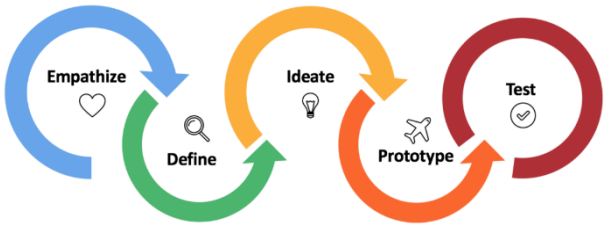

Fig. 1 – Design Thinking Framework

As seen in the image above Figure 1, There are several stages in design thinking which includes – Empathize, Define, Ideate, Prototype and Test [16].

This research will follow a design thinking approach to address a specific problem within the institution. Here's a breakdown of the key stages:

Empathize - Conduct interviews with administrative staff to understand their experiences with the current process for online delivery of classes. Encourage participants to share personal anecdotes about challenges encountered with the existing procedures. This will provide insights into current practices and user pain points.

Define - Develop a concise problem statement that captures the core issue and guides the design process. Identify user needs, frustrations, and goals to prioritize crucial design elements.

Ideate - Conduct a focused evaluation of existing learning platforms relevant to the identified problem.

Prototype - Iteratively build and test prototypes until a solution is achieved that meets user needs and addresses the defined problem. User feedback will be incorporated to refine the prototype and identify any remaining design issues before real-world implementation.

Test - Gather user feedback on the prototype to identify areas for improvement and inform further iterations.

This approach ensures a user-centered solution that effectively addresses the identified problem.

Research Methodology

This section covers Agile and Design thinking principles. Agile software development is iterative. Agile framework has fewer software failures than planned software development because it accommodates changing customer needs [17].

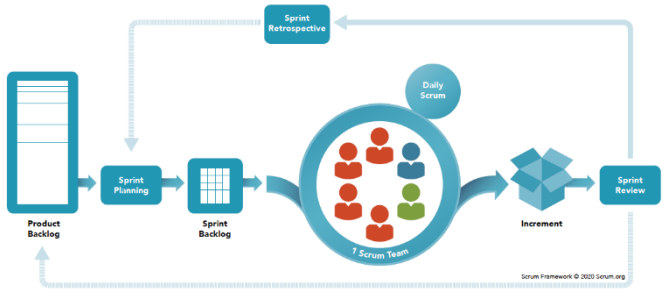

Fig. 2 – Scrum Agile Software Development Methodology

Scrum is an agile framework that helps people, teams and organizations deliver value incrementally with fast feedback loops [18].

The Scrum framework's emphasis on adaptability, transparency, continuous delivery, and risk mitigation makes it a popular choice for Learning Platform development. This is particularly advantageous given the potential for evolving learner and business needs within the LMS domain. Scrum's iterative approach allows adjustments to accommodate these changing demands, ensuring the LMS remains relevant and effective.

The following outlines the 6 phases of the Scrum framework as presented in Figure 2, an iterative and user-centric approach for developing the Learning Platform.

Product Backlog - A prioritized list of features and requirements managed by the product owner. The researcher contribute by identifying and prioritizing user needs within the backlog.

Sprints - Fixed-length development cycles where a subset of backlog items are selected and completed.

Sprint Planning - A collaborative session to define the sprint goals, estimate workload, and create a detailed sprint plan with tasks, timelines, and assigned responsibilities.

Daily Scrum - A brief daily meeting for the researcher to discuss progress, identify roadblocks, and ensure alignment with sprint goals.

Sprint Review - A meeting at the end of each sprint to showcase the completed work to stakeholders and gather feedback for future iterations. The researcher presents the LMS prototype and receive user input.

Sprint Retrospective - A collaborative reflection session after the sprint review to assess the team's performance, identify areas for improvement, and plan for the upcoming sprint. The researchers will share his insights and contribute to the ongoing development process.

Results and Discussion

A) Framework and Technologies Used

1)Framework of Conducting Performance and Attendance Monitoring:

Ilocos Sur Polytechnic State College's (ISPSC) proposed learning platform integrates performance and attendance monitoring to enhance education quality. It offers a virtual space for online learning, improves communication, and simplifies the sharing of learning materials. This platform aligns with UN SDG 9 by promoting quality education, innovation, and wider access to learning. To ensure user needs were met, the researcher gathered feedback on features before building and launching the LMS platform on Moodle and Hostinger.

Drawing on interviews with ISPSC's Computing Studies Unit, Figure 3 outlines a framework for defining a study's nature and scope.

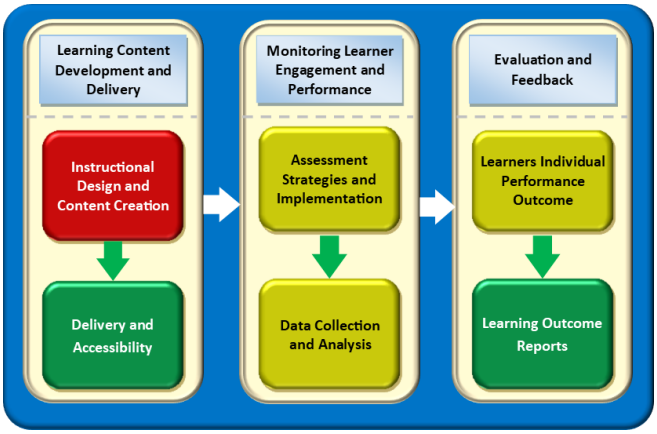

Fig. 3 – Framework Design of Conducting Performance and Attendance Monitoring in ISPSC

2)Technologies Used:

The learning platform uses Moodle LMS (built with PHP, JS, and MySQL) for managing courses and user data. The user interface is built with HTML, CSS, and JS for a user-friendly experience. It runs on a Linux server with LiteSpeed web server software for efficiency and is hosted by Hostinger with MySQL for data storage. Moodle and Hostinger work together to deliver course content and manage user interaction securely. Moodle's open-source nature allows for customization, and Hostinger offers Moodle-optimized configurations for better performance.

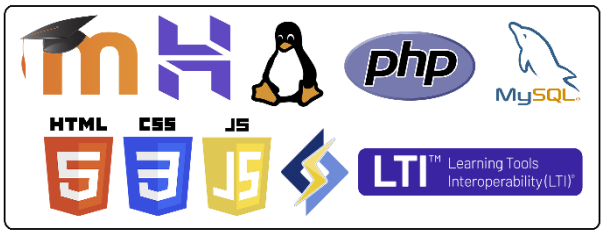

Figure 4 - Technologies used in development phase of the Learning Platform

The researcher utilized Moodle LMS, a free and open-source LMS, for its flexibility, affordability, and user-friendly features for both students and instructors. Moodle's open-source nature allows for customization to fit specific needs, while its interface makes it easy for students to access materials and for instructors to manage courses.

B)System Design and Functionality

This section dives into the details of ISPSC's proposed learning platform, explaining its server infrastructure and using Unified Modeling Language (UML) diagrams (like user interaction and system architecture) to visually represent its functionality.

This study proposes a learning platform for Ilocos Sur Polytechnic State College (ISPSC) to address limitations in online class management and enhance educational quality. The platform incorporates features for monitoring student performance and attendance, allowing for data-driven internal evaluation and subsequent curriculum improvement.

1)Web Hosting Service

Initially deployed on a local server for testing purposes, the platform was migrated to a more robust hosting solution due to the limitations of free hosting options. Hostinger provided several advantages, including improved performance, dedicated Moodle support, robust security measures, and scalability to accommodate future growth. Additionally, the platform benefits from Hostinger's user-friendly interface and affordable pricing plans. To ensure platform security, Hostinger employs a multi-layered approach encompassing up-to-date systems with security patches, Web Application Firewalls (WAFs) for malicious traffic filtering, malware scanning for proactive threat detection, and user authentication measures like strong password policies and two-factor authentication (2FA). This comprehensive security strategy fosters a safe and secure environment for the learning platform.

TABLE I. WEB HOSTING SERVICE DETAILS

Hosting Details	
Disk Space	100 GB
RAM	1024 MB
CPU Cores	1
Inodes	400000
Addons/Websites	100
Active Processes	40
Entry Processes	20
Bandwidth	Unlimited
Nameservers	
Current nameserver 1	ns1.dns-parking.com
Current nameserver 2	ns2.dns-parking.com
Hostinger nameservers:	ns1.dns-parking.com (162.159.24.201) ns2.dns-parking.com (162.159.25.42)
Server Details	
Server Name	server1235
Server Location	Asia (Singapore)
FTP Details	
FTP IP	ftp://45.130.228.251
FTP Hostname	ftp://ispsc-bscs-lms.com
FTP Username	u791665007
File Upload Path	public_html

Table I outlines the technical specifications required to deploy the proposed learning platform for Ilocos Sur Polytechnic State College (ISPCS). A critical advantage of this LMS is its device agnosticism. In contrast to some systems that necessitate specific hardware or software configurations, this platform can be accessed from any device with a stable internet connection. This fosters greater accessibility and promotes wider user reach.

2)Unified Modeling Language

The platform's functionalities are illustrated through UML diagrams. Figure 5, a Use Case Diagram, details user interactions. To ensure data security, Role-Based Access Control (RBAC) is implemented, assigning specific permissions to distinct user roles (e.g., Site Administrator, Instructor, Student, Guest).

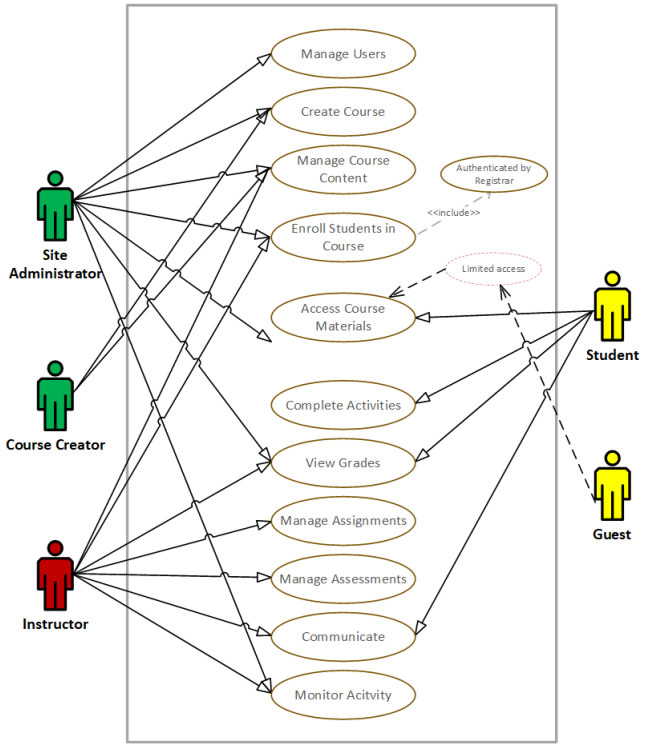

Fig. 5 – Use Case Diagram of ISPSC Learning Platform

3)Architecture Design

Employing a multi-tier architecture to facilitate efficient interaction between system components. This tiered approach ensures smooth operation when users access the Moodle LMS hosted on the Hostinger server. Figure 6 depicts the learning platform's architectural design.

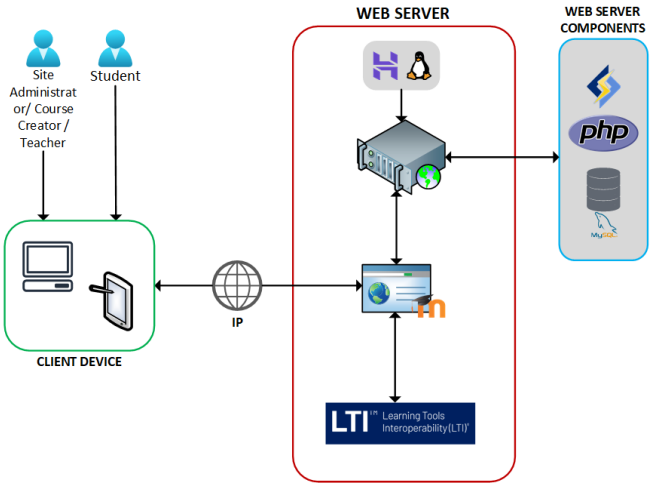

Fig. 6 – Architecture Design of the Proposed Learning Platform

3)Role-Based Access Control

The proposed learning platform has a role-based access control as mentioned in Figure 5: Site Administrator, Course Creator, Instructor, Student, and Guest. The learning platform implements a role-based access control (RBAC) system, with the Site Administrator holding the highest level of authority. This role is responsible for critical tasks like system configuration, user account management (creation, deletion, and role assignment), server settings, security measures, overall platform maintenance, and upgrading or migrating hosting plans. Essentially, the Site Administrator acts as the system architect, ensuring Moodle's optimal functionality to support the institution's educational needs. Site Administrators can also switch between user roles based on RBAC to test updated settings from different user perspectives.

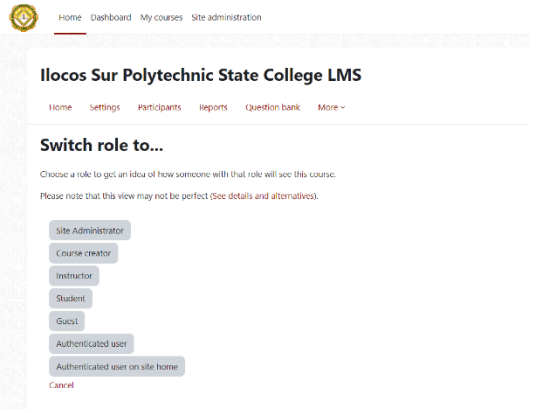

Fig. 7 – Role Based Access Control

Performance Monitoring. This study leveraged a dedicated learning analytics and usage statistics plugin for Moodle LMS to monitor student performance. By integrating this plugin, the proposed platform generates analytical and statistical reports that assess student progress in terms of completion rates, performance metrics, and activity engagement. Furthermore, the plugin empowers Site Administrators and Instructors to examine student interaction patterns, providing insights into collaboration, communication, and knowledge sharing within the learning environment as presented in Figure 7.

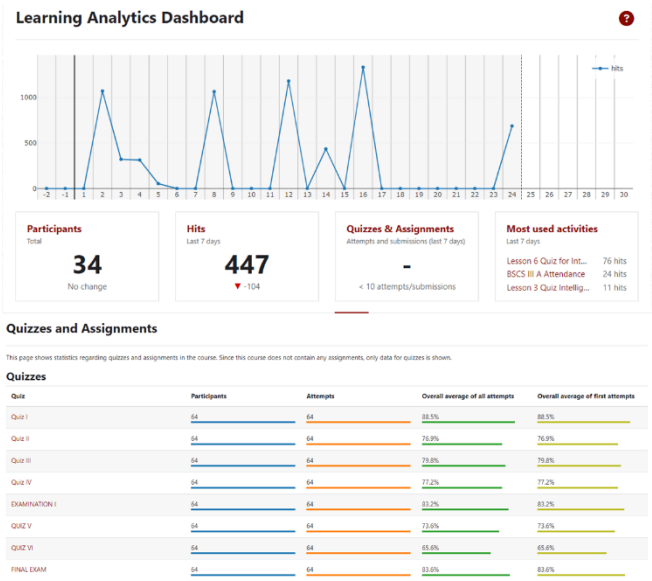

Fig. 7 – Learning Analytics and Usage Statistics

4)Attendance Monitoring

The proposed learning platform incorporates a customizable attendance monitoring feature. This feature, configurable by both Site Administrators and Instructors, allows institutions to tailor attendance requirements to their specific needs. The platform can be configured to generate automated warning messages for students falling below a predefined attendance threshold for a course. Upon receiving these notifications, Instructors can then choose to send targeted messages to individual students or groups of students exhibiting concerning attendance percentage. This functionality facilitates proactive intervention to address potential issues and support student success.

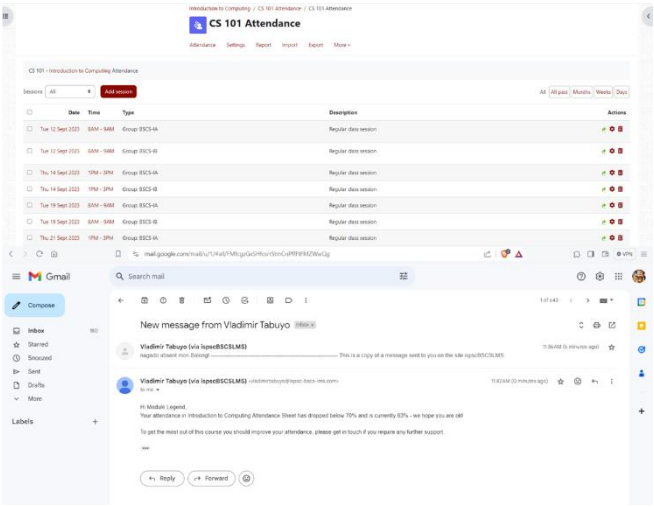

Fig. 8 – Attendance Monitoring and Intervention with Automated Warning Email

C)Extent of Usability of the Proposed Learning Platform

To determine the usability of the proposed Learning Platform, the researcher conducted survey on the target area of the institution including the Program Head, Faculty and Students by the College of Arts and Sciences, Computing Studies Unit of ISPSC Main Campus. The results indicate that the proposed learning platform performs well across various aspects as presented in Table II.

TABLE II. USABILITY EVALUATION RESULT

Indicators	Mean	Descriptive Equivalent	Descriptive Interpretation
Usefulness	6.06	Agree	Usable
Satisfaction	6.01	Agree	Usable
Ease of Use	6.00	Agree	Usable
Average	6.02	Agree	Usable

A user evaluation was conducted to assess the overall usability of the proposed learning platform. Participants responded to Likert scale questions, with a score of 7 representing "strongly agree" and 1 representing "strongly disagree." The results indicated positive user perceptions, with a mean score of 6.06 for the "usefulness" subscale. This score translates to "strong agreement" and suggests users found the platform to be valuable in their learning experience. Similarly, high mean scores for "satisfaction with course content and functionalities" (6.01) and "ease of use due to technical performance" (6.00) further support these findings. The overall mean score of 6.02 across all usability metrics reinforces the conclusion that the proposed learning platform is well-received by users and demonstrates positive usability in terms of usefulness, satisfaction, and ease of use.

Conclusion and Recommendation

Conclusion

This study addressed limitations in Ilocos Sur Polytechnic State College's (ISPSC) online learning environment by proposing a secure and well-designed learning platform built on

Moodle LMS, an open-source system. The platform's functionalities, including performance and attendance monitoring, directly target identified needs to enhance educational quality. Moreover, its open-source nature fosters knowledge sharing and aligns with Sustainable Development Goal (SDG) 9's emphasis on innovation. By providing wider access to education through a virtual platform, the solution contributes to SDG 9's targets regarding infrastructure development and inclusive industrialization. User evaluations confirmed the platform's usability, highlighting the successful balance between robust features and an intuitive interface. This synergy fosters a positive user experience, ensuring a productive and efficient learning environment. In conclusion, the proposed platform offers a feature-rich, secure, and adaptable solution for ISPSC, with the potential to contribute to broader educational achievement and innovation within the institution and beyond.

Recommendation

This study successfully developed a learning platform using Moodle LMS, providing transferable knowledge for other Higher Education Institutions (HEIs) seeking to strengthen their online learning infrastructure. Moodle's open-source nature offers HEIs a cost-effective and adaptable foundation for building robust virtual learning environments, while also fostering knowledge sharing and collaboration amongst institutions. By leveraging the insights from this study's successful implementation, other HEIs can implement similar solutions, contributing to broader educational attainment and innovation within their contexts.

Future research can further expand on this work by addressing scalability through performance testing with a larger user base. Additionally, exploring long-term sustainability would be valuable, examining factors like maintenance costs, resource needs, and future upgrades required to stay relevant. Finally, a comparative analysis with existing LMS solutions could provide valuable insights into the platform's relative strengths and weaknesses, guiding potential differentiation strategies. Furthermore, while user evaluation prioritized usability, future research should explore user engagement and motivation. Analyzing these factors alongside positive usability results would provide a more holistic understanding of the platform's effectiveness in fostering a positive and productive learning environment for students.

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