

Development and Pilot Evaluation of a Customized Moodle-Based Learning Resource Management Hub for Maritime Education

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Abstract

Background: Maritime higher education requires learning platforms that can centralize instructional resources, support mobile access, and document learner participation while remaining responsive to Standards of Training, Certification and Watchkeeping requirements. **Objective:** This project developed and pilot-evaluated a customized Moodle-based Learning Resource Management (LRM) Hub for Mariners' Polytechnic Colleges Foundation of Canaman (Cam Sur), Inc. **Methods:** A user-centered developmental design was used. A preliminary needs survey obtained 266 student responses. The resulting platform integrated course organization, resource distribution, announcements, assessments, grade management, communication, activity tracking, mobile-responsive access, and an online user manual. Five maritime course modules were tested with 20 third-year Bachelor of Science in Marine Transportation students and five instructors; a subsequent Seamanship 5 implementation involved 10 students. Evaluation used four-point feedback items, system-generated activity records, and descriptive statistics. **Results:** Eighty-five percent of preliminary respondents supported a customized LRM, while limited internet connectivity was the most frequently reported challenge (67.7%). Among 25 pilot feedback responses, the mean ratings for standardized STCW delivery and consistency of teaching materials across instructors were 3.68 and 3.60 out of 4, respectively. Eleven implementation feedback responses yielded mean ratings of 3.82–3.91 for learning experience, resource usefulness, overall satisfaction, and recommendation for institutional implementation. Activity logs confirmed successful access and completion of assigned activities, although slow connectivity remained a constraint. **Conclusion:** The LRM was operational and positively received as a centralized, mobile-responsive platform. Larger, longer-term studies using validated instruments and objective learning outcomes are required before claims of educational effectiveness or institution-wide scalability can be made.

Keywords

Maritime Education; Learning Management System; Moodle; Blended Learning; User-Centered Development.

Introduction

Learning management systems (LMSs) have become central infrastructure in higher education because they consolidate course materials, assessments, communication, and learner records within a common digital environment. Blended learning can support flexible and meaningful learning when technology, pedagogy, and institutional processes are designed as an integrated system rather than as separate initiatives [1]. Research on LMS adoption likewise shows that perceived usefulness, system

and information quality, service support, and user experience influence continued use and satisfaction [2,3].

In maritime education and training, digital delivery also operates within a regulatory context. Maritime Industry Authority (MARINA) Memorandum Circular No. SC-2021-10 specifies requirements for distance learning and e-learning in the training and assessment of seafarers under Regulation I/6 of the Standards of Training, Certification and Watchkeeping (STCW) Convention [4]. These requirements make traceable learner participation, accessible course materials, valid assessment processes, quality assurance, and appropriate monitoring particularly relevant to maritime institutions. Before this project, Mariners' Polytechnic Colleges Foundation of Canaman (Cam Sur), Inc. primarily used Google Classroom. Although this provided a basic online course environment, instructional resources, assessment practices, and communication remained distributed across separate course spaces and workflows. The institution also faced interruptions associated with typhoons, variable internet access, and limited physical classroom availability. A preliminary survey conducted in October 2023 identified strong demand for a centralized institutional platform and showed that connectivity was the most common barrier to online participation.

Moodle was selected as the technical foundation because it could be configured as an institutionally controlled, mobile-responsive, open-source environment. The project did not seek to create a new LMS from the ground up; it customized and organized Moodle functions for the institution's maritime programs, particularly the Bachelor of Science in Marine Transportation (BSMT) curriculum. The design emphasized a consolidated resource repository, progress monitoring, assessment and grade-management tools, announcements, communication, role-based access, and practical user guidance.

The study addressed a local implementation gap: whether a customized Moodle deployment, designed from institutional needs and piloted with maritime courses, could operate as a coherent Learning Resource Management (LRM) Hub and be accepted by its initial users. Accordingly, the project aimed to (1) identify user needs for a centralized digital platform; (2) develop a mobile-responsive Moodle-based LRM Hub; (3) pilot and implement selected BSMT course modules; and (4) evaluate operational functionality and initial user perceptions. The evaluation was developmental and descriptive; it was not designed to establish causal effects on learning outcomes. This explicit boundary is important because LMS studies employ diverse methods, and conclusions must remain proportionate to the evidence produced by the selected design [8].

2. Materials and Methods

2.1 Design and Setting

The project used a user-centered developmental design comprising needs assessment, platform configuration, content development, pilot testing, limited course implementation, and formative evaluation. It was conducted at Mariners' Polytechnic Colleges Foundation of Canaman (Cam Sur), Inc., a Philippine higher education institution offering maritime programs. Development began after project approval in April 2025; the initial web application and centralized resource structure were configured from April to June 2025, the online user manual was completed in March 2026, and pilot testing and implementation were conducted in April 2026.

2.2 Needs Assessment and Design Requirements

A ten-question online preliminary survey was administered to MPCF students in October 2023. The available survey record contained 266 responses, all of which indicated consent to participate. Items covered prior online-learning experience, advantages and disadvantages of the existing platform, interest in a customized LRM, preferred components for lecture and laboratory courses, and desired improvements. Frequencies and percentages were used to identify system priorities. The survey served as a requirements-gathering activity rather than a representative institutional prevalence study.

Table 1. Selected preliminary needs-assessment findings (n = 266)

Domain	Response option	n	%
Adoption preference	Preferred a customized LRM	226	85.0

Reported challenge	Limited internet connectivity	180	67.7
Reported challenge	Multiple learning activities	92	34.6
Reported challenge	Time-limited learning activities	72	27.1
Reported challenge	Limitations in the learning process	68	25.6
Reported challenge	Insufficient learning materials	52	19.5
Preferred component	Class schedule (lecture and laboratory)	204	76.7
Preferred component	Laboratory/simulator schedule	167	62.8
Preferred component	Academic calendar	146	54.9
Preferred component	Online grade viewing	140	52.6
Preferred component	Schoolwork tracking	136	51.1

Note: Multiple-response items do not sum to 100%.

2.3 Platform Development

Moodle was configured as the core web application. Course categories and modules were organized according to the institutional curriculum, and role-based access was assigned to administrators, editing teachers, non-editing teachers, and students. The customized environment incorporated announcements and notifications, a centralized learning-material repository, an academic calendar, online quizzes and assignments, automated and manual grade management, messaging and discussion tools, completion tracking, activity logs, and a responsive interface for smartphones, tablets, and desktop computers.

Faculty members prepared and uploaded syllabi, lecture presentations, PDF modules, multimedia materials, assignments, quizzes, and other course resources. Five BSMT modules were configured for pilot testing: Navigation 1 (Navigational Instruments with Compasses), Navigation 5 (Operational Use of RADAR/ARPA), Seamanship 1 (Ship, Ship Routines and Ship Construction), Seamanship 5 (Ship Handling and Maneuvering), and Basic Marine Engineering. An online manual with screenshots and step-by-step guidance was linked from the platform landing page. The documented cloud-hosting configuration was Linux Ubuntu 22.04, Apache, PHP 8.2, MySQL/PostgreSQL, four virtual CPU cores, 16 GB memory, and 320 GB storage, specified for an estimated maximum of approximately 500 concurrent users. This capacity was a design specification and was not load-tested in the reported study.

User accounts, roles, and access controls were configured to limit system functions to authorized users. The project design also recognized the requirements of the Philippine Data Privacy Act of 2012 for the lawful and secure handling of personal information [5].

2.4 Pilot Testing and Course Implementation

The third-week-of-April 2026 pilot involved 20 selected third-year BSMT students and five faculty members. Participants received an orientation, accessed the five configured modules, navigated resources, completed assigned activities and assessments, and used the platform's communication and monitoring functions. Twenty-five feedback responses were recorded. The pilot instrument contained five four-point agreement items and two open-ended questions. The two pilot indicators reported in the project record concerned consistent STCW delivery and standardization of teaching materials across instructors.

A limited implementation followed during the fourth week of April 2026 in a summer Seamanship 5 class with 10 third-year BSMT students. Learners accessed resources, submitted assignments, completed online assessments, and generated activity records within the system. The implementation feedback record contained 11 responses. Because the source record did not disaggregate the eleventh

response by user role, the analysis reports response counts rather than assigning all responses to students.

The designated LRM Manager separately reviewed the online user manual for clarity, relevance, correspondence with system functions, and ease of navigation. This review constituted an expert operational check by one evaluator, not a multi-rater validation study.

2.5 Data Sources and Analysis

Evidence comprised preliminary survey frequencies, four-point pilot and implementation feedback items, system-generated activity and submission logs, direct observation of platform operation, and the LRM Manager's manual review. Four-point items were summarized using counts, percentages, and arithmetic means, where 1 represented the least favorable and 4 the most favorable response. Ratings of 3 or 4 were treated as positive responses. No inferential tests were performed because the evaluation used small, purposively selected groups and was intended to assess initial functionality and acceptability rather than population effects.

2.6 Ethical and Administrative Safeguards

Institutional permission was secured for the preliminary survey, pilot testing, and implementation. The survey and feedback forms included participant information, voluntary consent, confidentiality assurances, and statements that responses would be used for system-improvement and academic purposes. No personally identifying participant data are reported in this article. The project documentation did not identify a separate research-ethics-board protocol number; therefore, no formal ethics approval is claimed.

3. Results and Discussion

3.1 Needs Assessment and Resulting Design Priorities

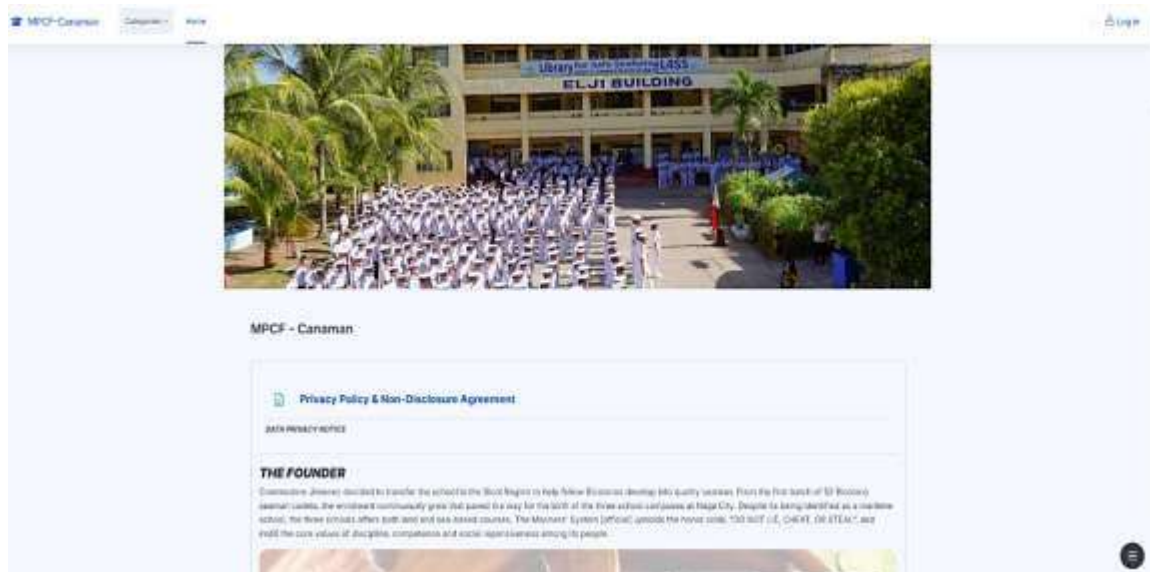
The preliminary survey established a clear institutional rationale for development. Of 266 respondents, 226 (85.0%) preferred a customized LRM. The strongest constraint was limited internet connectivity (180, 67.7%), substantially exceeding other reported challenges. This finding supported a mobile-responsive design and the organization of downloadable materials, but it also demonstrated that platform customization alone could not eliminate infrastructure-related inequities.

Students prioritized practical organization and visibility functions, particularly class schedules (76.7%), laboratory or simulator schedules (62.8%), academic calendars (54.9%), grade viewing (52.6%), and schoolwork tracking (51.1%). These requirements were translated into the course organization, calendar, gradebook, activity-completion, and progress-monitoring functions. This user-centered translation is consistent with evidence that LMS adoption depends not only on technical availability but also on usefulness, usability, content organization, communication, and support [2,3,6].

3.2 Developed LRM Hub

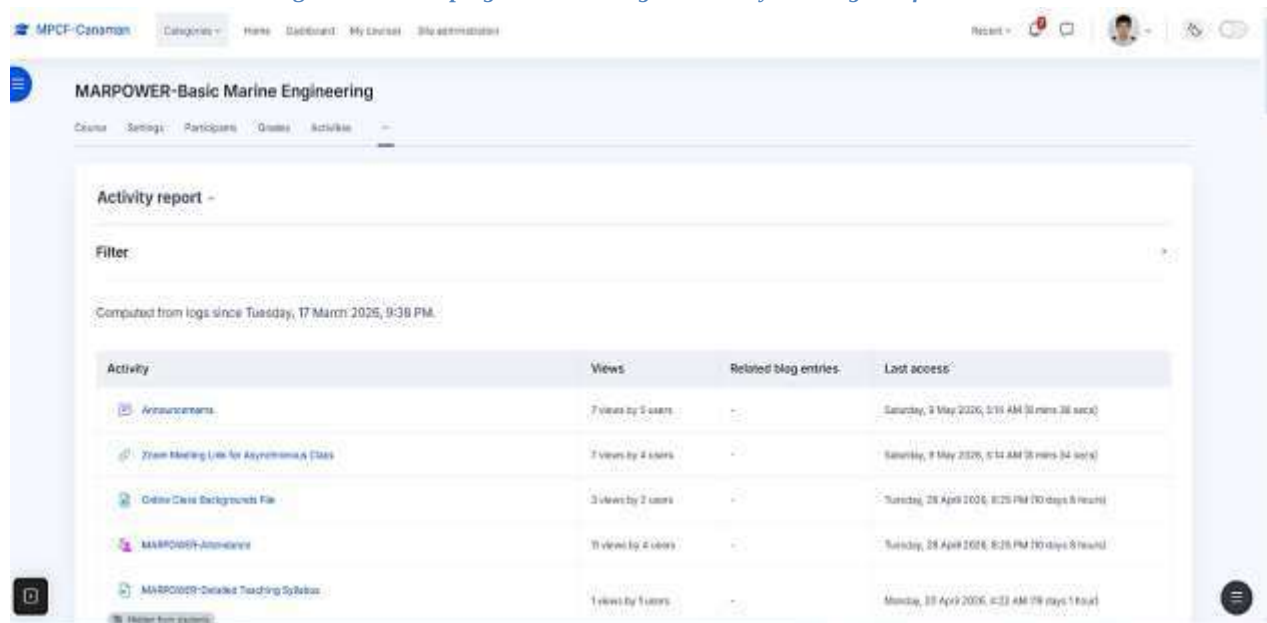
The completed prototype was deployed during testing at <https://mpcfcanaman.duckdns.org/>. It provided a branded landing page, role-based dashboards, organized course spaces, announcements, learning materials, assessment and grade-management tools, messages, progress indicators, and system reports. Figure 1 shows the home page used to direct users to institutional courses and support resources.

Figure 1. Home page of the customized Moodle-based LRM Hub



The course structure allowed instructors to place learning resources, quizzes, assignments, and completion requirements in a consistent sequence. The dashboard and activity-completion functions consolidated information that had previously been distributed across separate course environments (Figure 2).

Figure 2. Student progress monitoring and activity-tracking interface



The responsive interface could be accessed through a smartphone during actual-use conditions (Figure 3). Mobile access addressed device availability but did not fully resolve the connectivity barrier identified in the preliminary survey. Offline-ready resources, bandwidth-conscious content design, and stronger campus connectivity therefore remain important future requirements.

Figure 3. Mobile access to the LRM during testing



3.3 Pilot Feedback

The two reported pilot indicators were positively rated by 24 of 25 respondents (96.0%). The mean rating for the statement that the LRM standardized teaching materials and methodologies for consistent STCW delivery was 3.68 out of 4. The mean for standardization of teaching materials across instructors was 3.60. These results indicate favorable initial perceptions of consistency and relevance, but they should not be interpreted as proof of STCW compliance; formal compliance depends on approved curricula, assessment controls, qualified personnel, quality-assurance processes, and regulatory review beyond user feedback [4].

Table 2. Pilot feedback on standardization functions (n = 25)

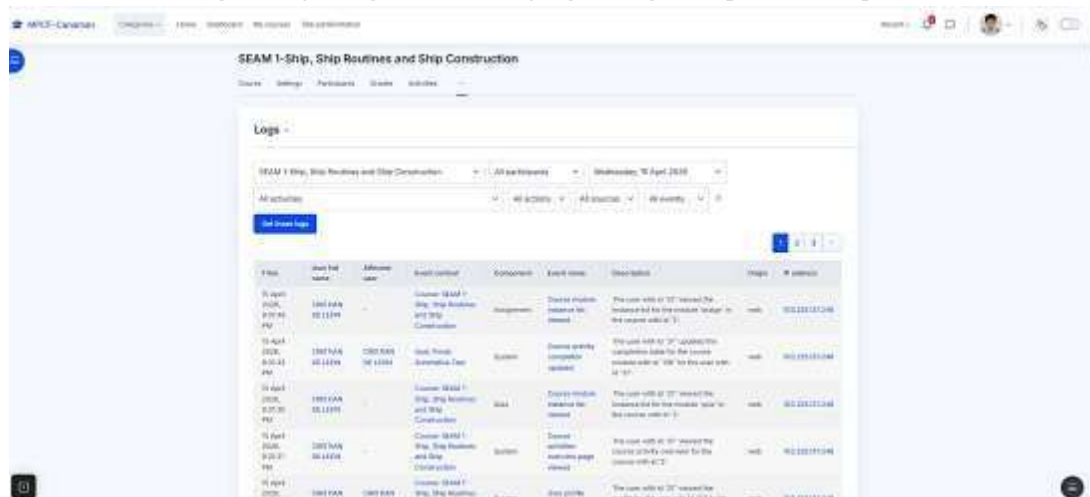
Indicator	Rating 1	Rating 2	Rating 3	Rating 4	Mean	Positive (3–4)
Consistent STCW delivery	1 (4%)	0	5 (20%)	19 (76%)	3.68	24 (96%)
Consistency across instructors	1 (4%)	0	7 (28%)	17 (68%)	3.60	24 (96%)

Note: Four-point scale; 1 = least favorable and 4 = most favorable.

3.4 Seamanship 5 Implementation

System records documented successful account access, assignment submission, assessment participation, and course activity during the Seamanship 5 implementation. The activity logs supplied operational evidence that the system recorded user actions and supported instructor monitoring (Figure 4). Minor access difficulties were attributed to slow internet connections in participants' locations.

Figure 4. System-generated activity logs during the implementation phase



All 11 implementation respondents gave ratings of 3 or 4 for the four reported indicators (Table 3). Learning-experience improvement, usefulness of resources, and recommendation for implementation each received a mean of 3.91; overall satisfaction received a mean of 3.82. The small spread of responses reflects favorable reception within the implementation group. However, satisfaction and perceived usefulness are proximal acceptance outcomes rather than direct measures of competency or learning gain. Research on e-learning success similarly distinguishes system use and satisfaction from educational benefits and recommends evaluation across system, information, service, learner, and instructor dimensions [2].

Table 3. Implementation feedback (n = 11 responses)

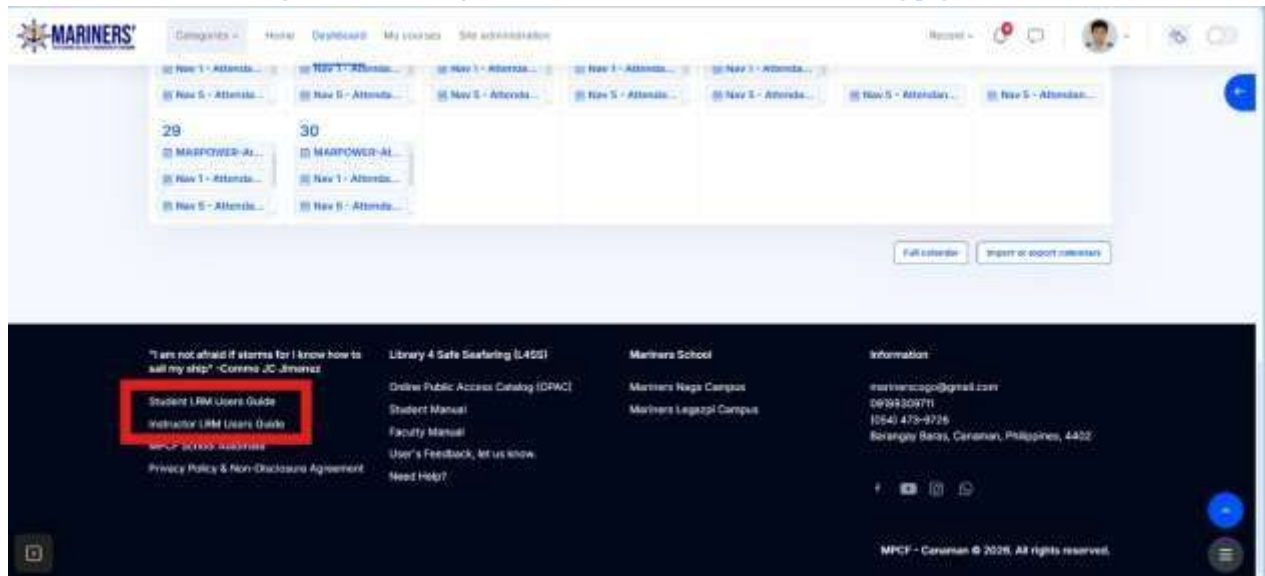
Indicator	Rating 1	Rating 2	Rating 3	Rating 4	Mean	Positive (3–4)
Improved learning experience	0	0	1 (9.1%)	10 (90.9%)	3.91	11 (100%)
Uploaded resources were useful	0	0	1 (9.1%)	10 (90.9%)	3.91	11 (100%)
Overall satisfaction	0	0	2 (18.2%)	9 (81.8%)	3.82	11 (100%)
Recommended institutional implementation	0	0	1 (9.1%)	10 (90.9%)	3.91	11 (100%)

Note: Four-point scale; 1 = least favorable and 4 = most favorable.

3.5 User Manual and Implementation Support

The online manual was integrated into the landing-page footer and organized into student and instructor guidance. It covered account access, dashboard navigation, course participation, assignment submission, assessments, grade viewing, messaging, notifications, and help functions. The LRM Manager reported that the procedures were understandable, matched the platform's actual functions, and benefited from visual and audio instructions. The result supports the inclusion of structured user support, which is repeatedly identified as a component of successful e-learning implementation [2,6]. Because one manager conducted the review, broader user testing of the manual remains necessary.

Figure 5. Location of the online user manual on the LRM landing page



3.6 Implications and Limitations

The project demonstrates a feasible pathway for converting a general-purpose open-source LMS into a locally organized maritime learning hub. The value of the customization was primarily organizational: common course structures, centralized resources, visible progress and assessment records, mobile access, and user guidance. These features align with research emphasizing that communication, course building, monitoring, assessment, content management, and technical support jointly shape LMS user experience [6]. They also support the learner-to-content and learner-to-instructor interactions valued in online education [7].

The findings are nevertheless preliminary. Participants were selected from one institution and one program; pilot and implementation samples were small; the feedback instruments were project-developed and no reliability or validity coefficients were reported; only selected item-level results were retained in the source manuscript; and the study lacked a comparison group, pretest-posttest measures, objective competency outcomes, usability-task metrics, and formal server load testing. The activity logs verified use but did not establish learning effectiveness. Moreover, the preliminary survey was a voluntary requirements survey and should not be treated as a probability sample. These limitations restrict generalization and support a phased rollout accompanied by stronger evaluation.

Future work should evaluate the platform across additional programs and semesters, use validated usability and e-learning-success measures, compare course-completion and competency outcomes before and after implementation, analyze technical performance under realistic concurrent-user loads, and assess accessibility under low-bandwidth conditions. Enhancements such as offline content, student-information-system integration, synchronized assessment, QR- or RFID-supported attendance, shipboard-training monitoring, and AI-assisted support should be subjected to separate privacy, security, educational, and feasibility assessments before adoption.

4. Conclusion

A customized Moodle-based LRM Hub was developed and operationally tested for maritime education at MPCF Canaman. The platform consolidated learning resources, course activities, assessments, communication, grades, progress information, and user support within a mobile-responsive environment. Needs-assessment data justified the design, and pilot and implementation respondents reported favorable initial perceptions of standardization, usefulness, satisfaction, and implementation potential. System logs further confirmed that users could access the platform and complete assigned activities.

The evidence supports the LRM as a functional prototype suitable for phased institutional use and continued evaluation. It does not yet establish improved learning outcomes, formal regulatory compliance, or performance at institution-wide scale. Sustained technical support, faculty training, content governance, low-bandwidth strategies, privacy safeguards, and a more rigorous longitudinal evaluation should accompany any wider deployment.

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Conflict of Interest

The author declares no conflict of interest.

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