Journal of Education and Learning (EduLearn)
Vol. 20, No. 4, November 2026, pp. 2565~2579
ISSN: 2089-9823, DOI: 10.11591/edulearn.v20i4.24451

Instructional performance benefits and adoption of learning management systems using task-technology fit theory

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Article Info

Article history:

Received Feb 26, 2025
Revised Feb 13, 2026
Accepted Mar 30, 2026

Keywords:

Higher education
Instructional performance
LMS adoption
PLS-SEM
TTF theory

ABSTRACT

The COVID-19 pandemic propelled the virtualization of traditional classrooms in higher education, prompting institutions to adopt or develop learning management systems (LMS) to sustain academic functions. Although considerable research focused on commercial LMS platforms, the performance and adoption of in-house systems remain underexplored, particularly in resource-constrained settings. In response, this study examined the deployment of Camarines Sur Polytechnic Colleges' (CSPC) in-house LMS, the CSPC-Learning Online Space (CSPC-LeOnS), specifically, to determine its adoption rate, evaluate the influence of task-technology fit (TTF), and LMS adoption on instructional performance benefits (PB), and generate recommendations for system improvement and information and communications technology (ICT) policy. Implementing a multimethod approach, partial least squares-structural equation modeling (PLS-SEM) analyzed the quantitative survey data from 60 faculty members and thematic analysis to explore qualitative insights. The findings revealed a low adoption rate (0%-33%), except for the College of Computer Studies (88%). The structural model uncovered the strong influence of TTF on PB (β=0.765); however, it revealed a weak positive correlation between LMS adoption and PB (β=0.230). This suggests that while adoption is significant, alignment between system features and instructional tasks is critical to achieve better instructional outcomes. Moreover, the study also recommended improvements for LMS design, organizational technology acquisition, and deployment policy.

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1. INTRODUCTION

Digital transformation, or the integration of information technology (IT) in the day-to-day operations of organizations [1], has become an inevitable societal phenomenon. Its influence can be seen across disciplines, most notably in the education sector. It has been integral in educational innovations, enhancing the conventional classroom experience and positively transforming pedagogical practices [2], [3]. Educational technology, serving as a foundation of digital transformation, originated in the early 1970s. Its existence has been amplified during the inception of the internet and has made a significant mark during the COVID-19 pandemic [4]. The health crisis highlighted the essential role of technology in the academe, ensuring the continuity of academic services despite the hurdles of physical distance [4], [5]. One of its noticeable trends includes the increased use of learning management systems (LMS), described as a "powerful system providing an automated mechanism for delivering course content and tracking learners' progress" [6]. However, despite its extensive employment across academic organizations, various universities, and colleges, experienced technical concerns influenced by institutional practices and openness to adoption [7]. Additionally, the institutions' capacity to acquire, manage, and sustain the technology causes schools' apprehensions about its continuous adoption despite its established benefits.

However, the shift of the education system to the new normal forced academic institutions to adopt flexible learning [8]. The health crisis compelled schools to devise a mechanism to transition from face-to-face instruction to online learning. While this posed serious challenges for academic institutions across all levels, it was accepted as part of their societal responsibility. The Camarines Sur Polytechnic Colleges (CSPC) was among the State Universities and Colleges (SUCs) that responded to the Commission on Higher Education (CHED) call for the implementation of flexible learning in the country. With the immediate support and collaboration of the school's two departments (Management Information and Communication Technology and College of Computer Studies), CSPC successfully developed and deployed the CSPC-Learning Online Space (CSPC-LeOnS), a Moodle-based system developed by a faculty member from the College of Computer Studies. Its known features include support for both asynchronous and synchronous activities, customizable course content organization, various assessments and activities, student notifications on course content updates, and generating grades according to the institution's grading system. The main goal of the LMS deployment was to facilitate the teaching-learning process through the online platform, supporting academic operations and task completion. However, while mainstream learning management systems have been extensively studied, there remains a significant gap in evaluating institutionally developed or in-house LMS solutions, particularly those rapidly deployed during the pandemic. This highlights the need for a context-driven investigation that is crucial for generating insights to inform the improvement and long-term sustainability of digital learning solutions, specifically in provincial and resource-limited higher education settings.

Given the continuous growth in the number of developed LMS globally, higher education institutions (HEIs) need to identify which LMS will work following their academic processes and end-users' preferences; hence, it is crucial to assess their features, as highlighted in a systematic literature review [9]. Likewise, without consultation with potential end-users, the drastic implementation of LMS may result in a more problematic environment that encourages resistance to technologically motivated change due to the lack of end-users' readiness, insufficient training support, and sustainability concerns, rather than providing a solution. Hence, a needs assessment should be considered to assess people's preparedness in the organization [10]. Another factor to consider is its information and communication technology (ICT) infrastructure since all these LMS depend entirely on it for effective implementation [11]. Now, given several research undertakings focusing on LMS in HE, several elements are seen to be evident as features: i) transmitting course content; ii) evaluating students; iii) evaluating courses and instructors; iv) creating class discussions; and v) creating computer-based instructors. However, improvements in design and cross-cultural factors provided additional input for developing an LMS for HE, since cultural diversity significantly influences user interaction with online platforms. Therefore, it is essential to integrate culturally responsive LMS design [12]. In addition, HEIs prefer LMS, which augments their academic processes, i.e., a technology that can support and benefit students' performance [11].

The quality of the LMS is one of the motivating factors of its use and adoption, irrespective of its platform, as per students' perception. However, the same paper also revealed that, along with its performance, merit in the value of the teacher is equally a requisite to its successful utilization [7]. Similarly, a study guided by the DeLone and McLean (D&M) IS success model highlighted the technical system quality, information quality, educational system quality, and service quality as influencing factors in the students' intention to use a system [13]. Considering other essential factors, such as the validation of task alignment and the success of the implemented system as indicators of technology adoption, a study suggested that the complexity of the tasks affects their evaluation of a particular system. It is magnified that given two different tasks with variability in their difficulty, end-users tend to have a different point of view regarding their given assessments of the system [14], [15]. Simply put, the end-user's experience with the LMS features significantly impacts the system's effective implementation and adoption [16].

Employing various theories, such as D&M IS success model, TTF theory, diffusion of innovation (DOI), technology acceptance model (TAM), among others, validates the factors that motivate or prevent teachers from adopting LMS in their teaching practices. Asamoah *et al.* [17] examined several constructs within TAM and DOI to understand teachers' perceptions on utilizing LMS in Ghanaian universities. It revealed that the tested data agreed with the measures of the adopted models, indicating theoretical alignment. This uncovered that perceived ease of use and perceived usefulness significantly affect the teacher's actual use of the system. Meanwhile, a contextually similar study of Fearnley and Amora [18], guided by the extended TAM, explored the direct impact of system quality on the perception of ease of use and attitude towards actual technology use. Moreover, perceived self-efficacy has a significant direct influence on perceived usefulness and ease of use. The results suggest that educators with favorable perceptions regarding their ability to utilize the LMS will eventually regard the system as beneficial and user-friendly [18].

The preceding discussion highlights the significance of selecting and designing LMS platforms that offer relevant functionalities and are perceived as accessible and intuitive. Moodle emerges as one of the most utilized open-source LMS, holding approximately 20% and 65% market share in the US/Canada and Europe, respectively [19], and spans even in developing countries [20]. Kasim and Khalid's [9] systematic review regarded the application as highly customizable and, thus, can be programmed according to the institution's needs. The platform can generate significant vital features, encompassing the user's authentication process, distributing learning materials, providing homework, and communicating with students [6]. These are crucial factors deemed essential in any LMS. Similarly, Munoyenda and Whitfield [21] affirmed that Moodle-based LMS was easier to set up and manage and contained substantial functionalities from the teachers' and students' perspectives. Considering the affirmative feedback on the platform, the CSPC developed its own LMS based on Moodle. The following subsection discusses the distinctive features of CSPC-LeOnS, how the LMS was institutionalized, and how it was introduced to the academic community during the pandemic.

At the hype of the COVID-19 pandemic, the CHED issued the "Guidelines on the implementation of flexible learning" to ensure continuity of academic services [22]. It calls for tertiary education delivering units to explore other innovative learning modalities that will enable a transition from conventional to flexible teaching and learning methods. In response, CSPC initiated the development of LMS to cover flexible learning options. This aligns with CHED's call to promote inclusive education through innovative educational technology solutions during the health crisis.

The CSPC-LeOnS includes seven key features: user management, course management, student enrollment, content and resource delivery, activity and assessment, communication and interaction, and gradebook functionality. All these system characteristics cater to both synchronous and asynchronous tasks, which were the primary requirements at that time. However, what separates CSPC-LeOnS from commercial LMSs is the native integration of Google Meet and Jitsi as video conferencing platforms for synchronous sessions. In addition, item analysis for assessments is also a built-in function, an essential system attribute to evaluate the effectiveness of assessments or evaluation tools. Moreover, performance analytics enables instructors to examine the students' performance based on their assessment results. Finally, the gradebook functionality allows customization of grade items according to the institution's policy. This distinctive set of functions is rarely bundled in commercial LMS platforms. Although alternative LMS can replicate these features, they incur a cost, making CSPC-LeOnS a cost-effective and sensible solution, leading to its institutionalization during the pandemic.

Following the institution's directive to adopt the LMS, a series of training sessions was administered, spearheaded by the faculty of the College of Computer Studies. The initial training was conducted online; however, due to low attendance and a limited adoption rate, a face-to-face training was initiated. However, despite efforts to introduce its essential features and highlight its cost-effectiveness, the resistance of the majority was evident. Despite potential benefits, this unforeseen reluctance raised significant questions for the researchers and the entire College of Computer Studies.

TTF theory has been utilized in various research undertakings encompassing multiple disciplines, including education. Scholarly works with the same overall contention on the use or integration of technology in the teaching-learning process of HEIs have been evident in the area. Hence, it indicates the relevance of the theory in the context. Most studies covered restructuring the constructs in consonance with their specific objectives and validating the model. For instance, Elçi and Abubakar [23] and Liu *et al*. [24] extended the TTF theory by introducing the concepts of individual technology (ITF) and environmental technology fit (ETF) and their influence on student engagement, serving as mediating variables, leading to its impact on the student's learning performance. The proposed theoretical research model was evaluated using PLS-SEM. From student engagement, Elçi and Abubakar [23] introduced "technology-induced engagement" and "technology-induced motivation" measures in the model. However, adding age and residential location results in students' learning performance.

Most related literature covered students' learning as the latent construct under assessment about general technology use, such as social media, e-learning systems, e-books, and learning management systems [25]–[30]. On the contrary, McGill *et al*. [31] provided a lens for the study, giving the instructor's performance as the point of analysis. It explored the role of the TTF and the influence of LMS adoption on the faculty's instructional performance. The findings revealed that TTF directly affects instructors' perceptions of how the LMS impacts their performance. This implies that when the LMS characteristics align well with the instructor's skills and the tasks they need to accomplish, it is more likely to favor their performance.

Considering the resumption of full onsite classes, CHED stated that flexible learning will endure over time. Hence, its sustained relevance is a motivation to ensure the usefulness and performance of the LMS and apply improvement, if necessary, through this research undertaking. The focus is to validate the use of the system in its most crucial phase when the academe calls for a medium to continue its purpose beyond the pandemic. Particularly, how the LMS adoption provided instructional benefit to faculty, and explored enhancements to ensure that the technology meets user requirements. This initiative supports the Philippine Higher Education structure by fostering quality and inclusive education, ensuring the delivery of academic services through conventional and non-conventional mediums [32].

Given this motivation, the study evaluated the performance of the implemented LMS, the CSPC-LeOnS, in the CSPC using the TTF theory. The evaluation focused on the extent of LMS support for the faculty's instructional tasks. Specifically, the following objectives were undertaken: i) determine the LMS adoption rate; ii) evaluate its instructional performance benefits; and iii) formulate recommendations to improve the LMS and its adoption rate.

2. THEORETICAL LENS

The main contention of the TTF theory posits that end-users' behavior to use information systems or IS and its performance benefits depend on the suitability of the technology with the end-user tasks [33], as presented in Figure 1. The theory asserts that technology is most effective when it assists users in completing their tasks. Given the substantial contribution of the theory in the IS field, scholars have widely employed it to rationalize empirical data across various domains, resulting in several theoretical extensions. For instance, the model by Rowland *et al*. [27] conceptualized the impact of perceived TTF and the expected consequences of LMS use on student learning. Similarly, McGill and Klobas [30] crafted a model highlighting the influence of perceived TTF, and other factors such as social norms, extracted from the arguments of Rai and Selnes [26], and facilitating conditions as defined within the unified theory of acceptance and use of technology (UTAUT). These were considered the identified gaps in the TTF theory as argued by Staples and Seddon [34], hence the incorporation of these constructs in the extended model, shown in Figure 2.

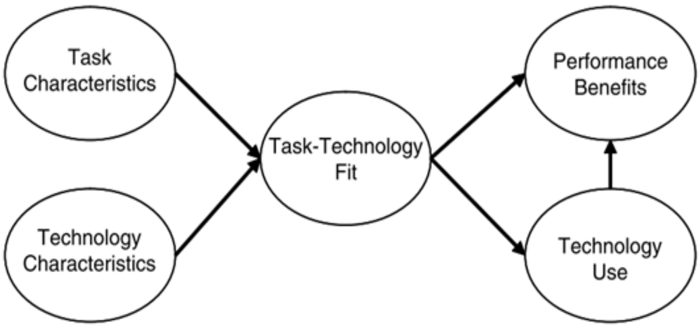

Figure 1. TTF theory

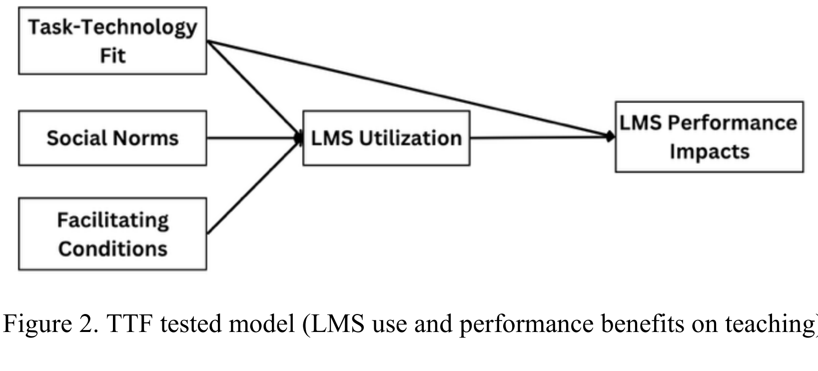

Figure 2. TTF tested model (LMS use and performance benefits on teaching)

All these correspond with the central arguments of the study, emphasizing the influence of the suitability of the LMS features on the faculty's instructional tasks, as conceptualized in the TTF theory. Additionally, considering other critical factors affecting LMS adoption and its associated benefits for faculty in terms of instructional performance. These combined considerations provide a compelling rationale for employing these theoretical frameworks to examine the impact of TTF and LMS adoption in HEIs in the context of instructional performance.

Examining the relationships among the constructs shows the influence of task and technology characteristics on the TTF measures. For instance, individuals who considered their tasks complex because of their non-routineness exhibited lower scores on task-technology fit measures. This may imply that individuals using the technology for non-routine tasks may experience challenges navigating it because of unfamiliarity. Meanwhile, TTF measures and utilization predict performance benefits and impact on individuals.

As for the model of Rowland *et al*. [27], the main argument of the model involves the influences of the expected performance improvement, the task-technology fit, and the expected consequences of LMS use on the perceived impact on students' learning. Although the gap in this research concerns the failure to test the hypotheses due to time constraints, it presented substantial findings in terms of its implications in the locale or the involved HEI. While this model highlighted the performance benefits of LMS for student performance, the subsequent TTF extension emphasized LMS's impact on the teacher's performance. This consideration intentionally elucidates the instructor's actual behavior and experience integrating the LMS into their instruction. The model primarily intends to understand the performance benefits of TTF from the perspective of learning providers. In addition, LMS adoption leads to performance impacts. To conceptually define each construct, the researcher described the following components in consonance with the direction of the study:

- TTF
  This aligns with the measures of Goodhue's and Thompson's theory, with the following elements: data quality (availability of current data, relevance to end-users needs, maintenance of essential data), locatability (ease of locating or retrieval data, recognizability of data elements), authorization (ease of system access), compatibility (ease of consolidating data from various sources), timeliness (on-time task accomplishment), reliability (system dependability and uptime consistency), ease/training (training provided), relationship of IS with users (IS understanding of the organization, interest and dedication, responsiveness, consulting, and performance) [35].
- Social norms
  The original conceptualization of the TTF theory did not incorporate this construct within its technology adoption model. However, studies on technology adoption in an educational environment using TTF Theory as its lens demonstrated its relevance. According to Rai and Selnes [26], this construct describes how well the technology is integrated with the set of interrelated tasks (practices) in a social context.
- Facilitating conditions
  This construct was not included in the original TTF theory. However, specific gaps prompted the inclusion of constructs from the UTAUT, such as facilitating conditions.
- Expected consequences of LMS use
  The users' beliefs as anticipated outcomes (both positive and negative) from using LMS.
- Technology use/LMS utilization
  The extent to which the LMS has been incorporated to assist instructors in their tasks.
- LMS performance impacts
  Degree of influence of LMS on their productivity at work.

2.1. Modeling influencing factors of adoption and instructional performance impact of CSPC LeOnS

Emphasizing the evaluation of CSPC-LeOnS by assessing its impact on user performance, the proposed model integrates constructs from previously established models applied in similar contexts. Moreover, hypotheses were formed based on validated perceptions and the primary assertion of the study. The model consists of two main sections: the direct influence of perceived TTF on instructor performance and the direct impact of LMS adoption on instructor performance, contingent on prerequisite factors for potential LMS adoption (perceived TTF, expected consequences of LMS use, social norms, and facilitating conditions). Figure 3 illustrates the conceptual model.

Given the assertions of the study, the following hypotheses were generated for testing: i) H1: perceived TTF positively influences the faculty's instructional performance; ii) H2: perceived TTF positively influences the faculty's behavior on LMS' (CSPC-LeOnS) adoption; iii) H3: the expected consequences of LMS use positively influence faculty's behavior on LMS (CSPC-LeOnS) adoption; iv) H4: social norms positively influence the faculty's behavior on LMS' (CSPC-LeOnS) adoption; v) H5: facilitating conditions positively influence faculty's behavior on LMS' (CSPC-LeOnS) adoption; and vi) H6: the LMS (CSPC-LeOnS) adoption positively influences the faculty's instructional performance.

These hypotheses, except for H3, have been tested in related studies [27], [30], [33], [36]. However, in this case, the assessment of these relationships was specific to a particular LMS and reflected the faculty's experiences with the technology in facilitating instruction. This led to more detailed and inclusive recommendations for LMS design and implementation, which not only align with organizational needs but may also apply to other HEIs.

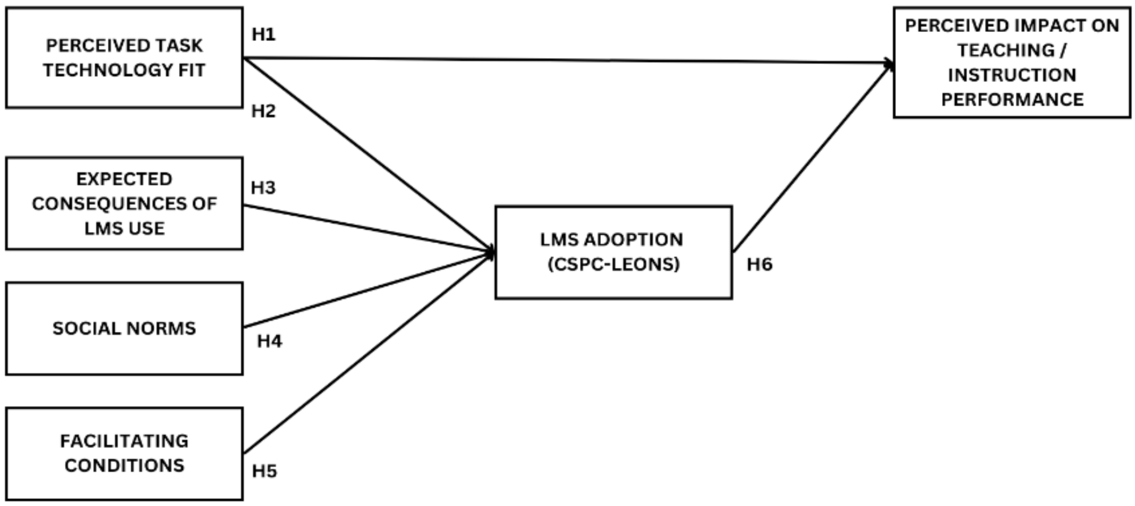

Figure 3. Conceptual model

3. METHOD

3.1. Study design

A multimethod design was employed, integrating quantitative and qualitative approaches, to align with the specific objectives and produce robust results [37]. Combining methods to address the research problems improves the validity and reliability of the data collection and analysis process [38]. To contextualize the research design, quantitative methods were employed using a structured survey to measure LMS adoption rates, with the collected data summarized through descriptive statistics. Hypothesis testing was then conducted to evaluate the perceived benefits of LMS use to faculty instructional performance. On the other hand, qualitative data were gathered through interviews and analyzed using thematic analysis to generate system improvement strategies and policy recommendations based on faculty perceptions and insights.

3.2. Research instruments

A survey questionnaire was used to determine the LMS adoption rate and its performance benefits. Further, an interview guide was developed to collate LMS adoption perceptions, leading to system improvement and policy recommendations. The survey questionnaire included items extracted from various studies that applied the theory within an academic context [27], [30], [31], [35]. Goodhue and Thompson [35], the original authors of TTF, developed eight core factors of task-technology fit: quality, locatability, authorization, compatibility, timeliness, system reliability, ease of use, and relationship with users. These dimensions and their corresponding measurement items were adopted, contributing 17 measurement items under the TTF construct. Additionally, from Rowland *et al.* [27], eight measurement items were considered for the expected consequences of LMS, a construct relevant to evaluating perceived system adoption. Lastly, based on McGill *et al.* [30], [31], the following items were included: three measurement items for social norms, six for facilitating conditions, four for LMS utilization, and three for performance benefits. The 41 items were deliberately synthesized in one instrument based on their conceptual alignment with the basic assumptions and contentions of the study, particularly on the factors affecting LMS use and performance benefits.

To ensure the validity and reliability of the consolidated measures and items, several steps were undertaken. Pilot testing—conducted with a specific set of respondents to assess item effectiveness. Validity testing—using Pearson's correlation to evaluate relationships among the six constructs, confirming that the items accurately reflect the intended construct [39]; and reliability testing—or the measure of internal consistency using Cronbach's alpha, to determine whether items yield similar results [39], [40]. These procedures guaranteed a well-founded instrument, i.e., robust and conceptually sound for data collection.

3.2.1. Instrument testing for validity and reliability

Following the pilot testing involving thirty randomly selected respondents from all departments, the study proceeded with the validity assessment of the measurement items. Pearson's correlation, with a 95% confidence interval (significance level=0.05), evaluated its validity. Table 1 shows the average correlation between the scores of the different constructs.

The obtained Pearson's correlation values for TTF, expected consequences (EXPCON), social norms (SN), facilitating conditions (FC), LMS_USE, and PB were 0.969, 0.935, 0.840, 0.872, 0.473, and 0.906, respectively, all exceeding the critical value of 0.3610 (2-tailed test, df=28). These correlations are highly significant (p-values<0.001); thus, it can be inferred that all constructs have valid measurement items. Subsequently, in terms of the instrument's reliability, Cronbach's alpha was employed. Table 2 displays the constructs measured in the instrument along with their corresponding Cronbach's alpha values. The presented data consists of the calculated scores derived from the data obtained during the pilot testing and after treatment administration, excluding non-significant measurement items.

The two rounds of reliability testing were intended to obtain an adequate Cronbach's alpha value, i.e., 0.8 or higher [40]. The three constructs initially manifested a marginal Cronbach's alpha score below 0.8, indicating that a measurement item or items may not belong in the construct. After evaluating the values, eliminating one measurement item or question from each construct resulted in a notable improvement in the scores. The instrument garnered an overall Cronbach's alpha score of 0.924, which is considered excellent for the adequacy of measures per construct [40].

Table 1. Average correlation between scores among constructs

Constructs	TTF	EXPCON	SN	FC	LMS_ADOPTION	PB
TTF	1					
EXPCON	0.848	1				
SN	0.778	0.832	1			
FC	0.819	0.806	0.676	1		
LMS ADOPTION	0.437	0.433	0.265	0.478	1	
PB	0.831	0.939	0.804	0.759	0.559	1
Person's correlation Sig	0.969<0.001	0.935<0.001	0.840<0.001	0.872<0.001	0.473<0.008	0.906<0.001

Table 2. Cronbach's alpha for the constructs

Constructs	Cronbach's alpha (pilot test)	Cronbach's alpha (after treatment)
TTF	0.899	0.899
SN*	0.786	0.849
FC*	0.668	0.828
EXPCON	0.978	0.978
LMS adoption*	0.759	0.814
PB	0.910	0.910

Note: *with deleted measurement items.

3.3. Setting, sampling technique, and respondents

This study intended to use proportional sampling for the temporary and regular faculty members (hired before 2021) of the CSPC, a state college in the Bicol Region, Philippines. The survey was administered online via Google Forms, with the link distributed through social media platforms, messaging applications, and email. However, during the data collection, constrained by pandemic-related challenges, only 60 faculty members responded, as presented in Table 3.

Table 3. Distribution of respondents

Academic department	Sample size	Percentage (%)
College of Arts and Sciences	3	5
College of Computer Studies	42	70
College of Engineering and Architecture	3	5
College of Health Sciences	1	2
College of Technological and Developmental Education	2	3
College of Tourism, Hospitality, and Business Management	9	15
Total	60	100

Although the respondents represented all academic departments, the distribution was disproportionate. Most respondents came from the College of Computer Studies department, which may have introduced sampling bias. This uneven distribution may limit the generalizability of the quantitative findings [41]. Nonetheless, the participants established an initial empirical foundation for understanding LMS adoption and instructional performance within the institution. In the context of the qualitative phase of the study, this departmental representation remains valuable. The participation of the faculty members from all academic departments ensures that the thematic analysis captures a range of faculty experiences with the in-house LMS and that the data collection proceeded until thematic saturation was reached. This approach is deemed acceptable based on the saturation principle by Johnson *et al*. [42], indicating that saturation can be attained even with a relatively small sample size when substantial and relevant insights are obtained. Hence, supporting the adequacy and credibility of the qualitative findings.

3.4. Ethical considerations

The study adhered to the ethical standards set by CSPC's Research Cluster. Participation in the survey and interview was voluntary, with informed consent obtained electronically through the initial section of the Google Form. Moreover, respondents were assured of the confidentiality and anonymity of their responses, and all collated data were utilized solely for research purposes.

3.5. Data analysis

Frequency counts and percentages were employed to summarize the quantitative data and determine the adoption rate. Moreover, PLS-SEM was applied to address the study's primary purpose, to assess the influence of TTF on performance benefits and factors affecting LMS adoption and its direct impact on performance benefits. PLS-SEM is considered a robust statistical analysis tool that can effectively handle datasets with normality and sample size issues when testing hypotheses, hence its suitability in this study [43], [44]. Finally, thematic analysis developed by Ahmed *et al*. [45] was applied to the qualitative data to formulate a technology improvement and policy development plan.

4. RESULTS AND DISCUSSION

4.1. CSPC-LeOnS adoption rate

Instructors hired before the academic year (AY) 2021 were surveyed to determine their adoption of the LMS. The responses were based on the dichotomous question of whether the instructors integrated the LMS into their instructional practices. Figure 4 provides a concise depiction of the CSPC-LeOnS adoption rate.

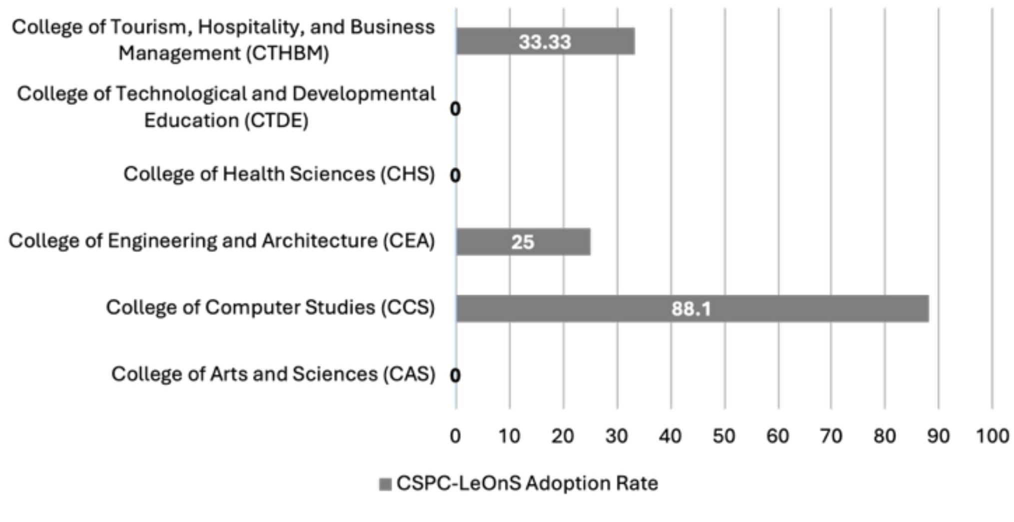

Figure 4. CSPC-LeOnS adoption rate

College of Computer Studies expectedly demonstrated the highest adoption rate (88%), considering this initiative was its key departmental contribution to the institution and the academic community during the pandemic. The department's technical expertise and familiarity with the system's functionalities and comprehensive features manifested as crucial factors in the continued adoption of the LMS. This aligns with one of the contentions of the TTF theory, wherein the end-user's characteristics are determinants of technology use and adoption [30]. Similarly, other IS adoption theories, such as TAM and UTAUT, support the same assertion. Emphasizing individual characteristics, such as user experience and voluntariness, as moderating elements in shaping adoption behavior [45].

Other academic departments, including College of Engineering and Architecture and College of Tourism, Hospitality, and Business Management, showed moderate adoption rates of 25% and 33.33%, respectively. Despite the low overall percentages, these rates suggest an openness among instructors to integrate CSPC-LeOnS into their teaching practices. Moreover, it may be inferred that there was a mismatch between the instructor's tasks and the system's characteristics or that some instructors lacked the required ICT skills [31], [46]. Meanwhile, three departments reported 100% non-adoption of CSPC-LeOnS, opting for other LMS platforms such as Google Classroom and Schoology. A task-technology misfit may be implied, conveying either too many or too few features, hence opting for a better alternative [47].

These implications reinforced theoretical assertions from TTF, TAM, and UTAUT by demonstrating the critical role of individual characteristics in shaping adoption behavior. Additionally, the study supported the notion of task-technology misfit in the context of non-adoption, where system complexity or lack of needed functionality drove faculty to seek alternative platforms. This insight extends current theoretical applications by illustrating that adoption is not solely determined by system quality, but by how well the technology aligns with the instructional needs of different academic units.

4.2. CSPC-LeOnS performance benefits

The analysis sought to validate the influences of identified variables on LMS adoption and its direct impact on instructional performance benefits. The initial step in this phase involved the normality test to ensure the appropriateness of the succeeding statistical tools for analysis. Considering the Shapiro-Wilk's Test results, since p-values for all measures were less than 0.05 (TTF=0.007, EXPCON<0.001, SN<0.001, FC<0.001, LMS adoption<0.001, and performance benefits<0.001), hence the data are not normally distributed; consequently, the selection of PLS-SEM as a quantitative statistical analysis method.

4.2.1. Structural model

Using PLS-SEM, it uncovered the relationship among the constructs, particularly the prerequisites (TTF, EXPCON, SN, FC) for LMS (CSPC-LeOnS) adoption, and the influence of TTF and LMS (CSPC-LeOnS) adoption on the instructional performance of the faculty. Three key indicators were used as evaluation criteria: the path coefficient, the p-value through significance testing, and the R-squared value for the model's explanatory power. Figure 5 shows the SmartPLS-generated model, and Table 4 presents the overview of the path analysis result of the proposed hypotheses.

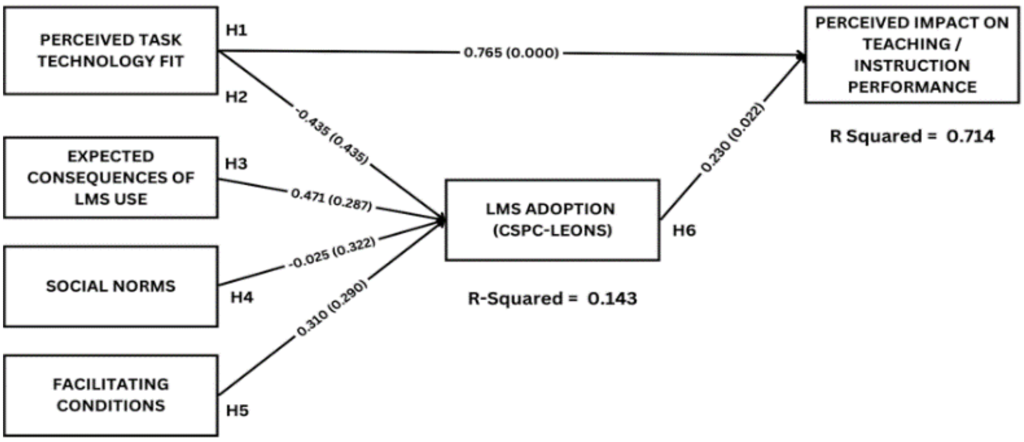

Figure 5. Structural model

Table 4. PLS-SEM path analysis result per hypothesis

Hypothesis	Path coefficient	p-value	Conclusion
Task-technology fit → Performance benefits (H1)	0.765	0.000	Supported
Task-technology fit → CSPC-LeOnS adoption (H2)	-0.435	0.402	Not supported
Expected consequences of LMS use → CSPC-LeOnS adoption (H3)	0.471	0.287	Not supported
Social norms → CSPC-LeOnS Adoption (H4)	-0.025	0.322	Not supported
Facilitating condition → CSPC-LeOnS adoption (H5)	0.310	0.290	Not supported
CSPC-LeOnS adoption → Performance benefits (H6)	0.230	0.022	Supported

Examining the relationship between constructs, two hypotheses were supported, H1 and H6, with p-values of 0.00 and 0.02, respectively, demonstrating statistically significant relationships between TTF and PB, as well as between LMS adoption and PB. Notably, the association between TTF and PB exhibited a strong positive correlation, with a path coefficient (β) of 0.765, indicating the faculty's belief that TTF significantly contributes to the faculty's instructional performance. Hence, for adopters, it can be inferred that the existing features are relevant to their needs in organizing and implementing teaching strategies using CSPC-LeOnS, and therefore, result in augmenting instructional functions. This reinforces earlier findings by McGill and Klobas [30] and Lin and Wang [48], emphasizing that LMS functional alignment with pedagogical tasks enhances teaching outcomes. Conversely, LMS adoption showed a weaker but positive relationship with PB, with a path coefficient (β) of 0.230. It suggests that while LMS Adoption influences the faculty's instructional performance, its impact is less significant than TTF. This corroborates the findings of Schoonenboom [49], which argue that technology use alone, and the components of TAM, do not guarantee performance gains unless integrated with user-task alignment and substantive user engagement.

R^2 or the coefficient of determination revealed that LMS adoption and performance benefits obtained R^2=0.143 and R^2=0.714, respectively. This implies that only 14% of the variance in LMS Adoption can be explained by the identified influencing factors (TTF, EXPCON, SN, and FC), which is considered a weak explanatory power for this aspect of the model. The findings highlight the limitations of LMS adoption when viewed solely through conventional adoption predictors (TTF, EXPCON, SN, and FC) without adequate attention to task alignment, consequently suggesting the significance of context-specific parameters. On the contrary, 71% of the variance in the PB can be explained by TTF and LMS Adoption; this is considered substantial evidence of the relationship structured in the model based on the dataset. Figure 6 shows the supported hypotheses.

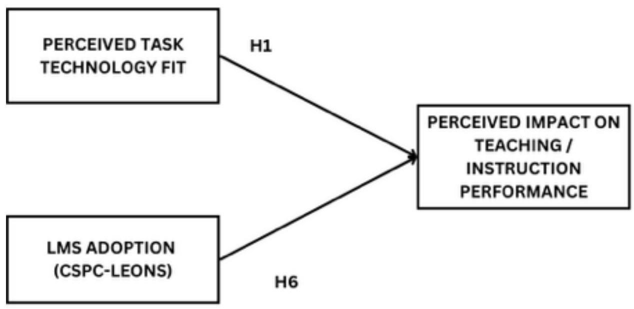

Figure 6. Supported model (based on empirical data)

This outcome may have several implications: the instructors claimed that the fit between the task and the technology CSPC-LeOnS is a crucial determinant of their teaching performance. However, merely integrating the LMS into their day-to-day school instructional tasks does not guarantee performance benefits. It may be considered an insufficient predictor of a positive instructional outcome, i.e., the relationship is neither strong nor sufficient on its own. Similarly, this may signify several user-related and technology-related concerns, such as the inability to use the technology to its full potential because of unfamiliarity due to a lack of proper and adequate training, user perceptions of new technology adoption, deviating from customary habits, and technology usability problems as manifested in the qualitative interview data. In fact, as implied, the lack of proper technology adaptation often weakens the relationship between technology adoption and performance benefits [50].

As for H2, H3, H4, and H5, these hypotheses were not supported based on the computed results with p-values>0.05, i.e., 0.402, 0.287, 0.332, and 0.290, respectively. These imply that TTF, EXPCON, SN, and FC are not determinants or predictors of LMS adoption, contrary to the model specifications. Moreover, based on the plotted dataset, it can be inferred that other influencing components may encourage or hinder the instructors from using the LMS. For instance, a forced adoption (due to organizational mandates) may supersede individual perceptions, a genuine support from the institution's administration may increase faculty buy-in and commitment, political implications may either prioritize or disregard LMS-related initiatives, and other technical challenges that may lead to underutilization or avoidance of the technology. The nonalignment of these findings with respect to the adopted model can be attributed to several factors: i) the samples' characteristics, given the possible differences in the behavior of our students and faculty in terms of new technology adoption [46]; ii) the technological dimension itself, which covers technology features and the institution's ICT infrastructure; and iii) the implemented research methods employed. Hence, these suggest that although the model was effective in other contexts, it did not fully explain LMS adoption in our specific setting.

4.3. Recommendations (system improvement and policy development)

Considering the LMS adoption rate presented in the previous section, interviews were conducted to gather substantial insights as the basis for the recommendation for improvement. The findings identified influencing factors for non-adoption. Table 5 (see Appendix) summarizes the concerns of the non-adopters by themes and the corresponding recommendations for system updates and implementation.

The recommended actions for LMS implementation and management can be categorized into two proposed organizational operations: LMS technical refinement and deployment process, focusing on the relevance of its features to the institution's requirements. This suggests a significant consideration of user perceptions regarding technology characteristics, addressing specific instructional challenges and reinforcing classroom pedagogies [51]. This can be attained through in-depth immersion of developers and educational technologists in the academic environment. Examining user beliefs and experiences may uncover additional factors that require attention in a learning management system in terms of technological compliance and design. This may lead to an enhanced user experience, potentially improving LMS adoption rate and governance and policy support, emphasizing the need for strong policies encompassing technology acquisition, deployment, adoption, and evaluation for sustainable use. One of the primary prerequisites of technology acquisition is the readiness of its ICT infrastructure and stakeholders [52]; therefore, ensuring its maturity is imperative. Similarly, there is a need for institutional policies that enable the correct and unbiased experts to assess and select new educational technology, including stakeholders' consultations and involvement [51]. This ensures advocating for a fair, transparent, and inclusive decision-making process. In addition, substantial support is needed to maximize in-house resources for possible cost-effectiveness. However, alternative options for outsourcing or off-the-shelf solutions remain available to ensure an impartial equipment acquisition procedure. Moreover, in cases of technology deployment, relevant stakeholders shall be highly encouraged to participate in orientation and training sessions to guarantee a smooth transition from the existing practice to integrating technology into the customary method [52].

Meanwhile, in support of continued adoption to establish its relevance to organizational needs, a regular schedule of technology evaluation shall be implemented [53]. This may drive the academic institution into a long-term engagement with educational technology, which is acceptable and functional to most stakeholders. Hence, it may bring efficiency to the organization and improve instructional performance without sacrificing ethical considerations.

5. CONCLUSION

This study offers a meaningful contribution by providing a comprehensive evaluation of an LMS that may establish a solid foundation for incorporating relevant educational tools across various learning modalities. It identified the CSPC-LeOnS' adoption rate, key influencing factors of its utilization, and areas for improvement. While the findings did not fully align with the adopted theoretical model, the results still present useful insights for higher education institutions. The evidence emphasizes how technological intuitiveness, user experience, governance structures, policy support, and ongoing system assessment influence both adoption and instructional performance outcomes among faculty. These findings suggest that additional theoretical work is needed to better understand external factors that shape technology adoption in colleges and universities. Since the research involved only one institution and relied on a cross-sectional approach, future work may benefit from longitudinal designs or time-series data to observe how adoption behaviors and instructional results change over time.

ACKNOWLEDGMENTS

We extend our sincerest gratitude to the following: CSPC for the opportunity and support; the College of Computer Studies, headed by Ms. Rosel Onesa, for the encouragement and assistance; to our former dean, Dr. Challiz D. Omorog, for serving as the authors' mentor; and to the faculty participants across all academic departments for generously sharing their time and insights. Above all, to the Lord Almighty for His abundant blessings throughout this endeavor. To God Be All the Glory.

FUNDING INFORMATION

Authors state no funding involved.

AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
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C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

Authors state no conflict of interest.

INFORMED CONSENT

The authors obtained informed consent from all individuals included in the study.

DATA AVAILABILITY

The data supporting this study's findings are available from the corresponding author, [BB], upon reasonable request.

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APPENDIX

Table 5. Recommendations/plan of action

Themes	Sample response (in verbatim)	Interpretation (if needed)	Recommended action/responsible unit
User preference	"The reason why we are not using the CSPC-LeOnS as the learning management system is that it didn't align with the students' preferences." "Students prefer gclassroom as it is accessible in their part and commonly used by most instructors."		The administrators must ensure that students and faculty members are well-oriented regarding the technology. This can be implemented through the following: i) lobby the commonly used LMS and the CSPC-LeOnS to faculty members; ii) conduct pilot testing for the LMS platforms; and ii) provide in-depth assessment results. The academic unit heads, including the Vice President for Academic Affairs, the College Deans, in-house IT experts from the Information and Communication Technology Unit (ICTU), and the College of Computer Studies, must ensure that the selection of an LMS should be based on data-driven insights.
Cost effectiveness	"Heavier data consumption compared to Google Classroom and Gmeet" "LMS should be accessible and cost-effective, especially to students, with offline access to certain materials or functionalities and mobile data saver mode within."		System improvement may include caching mechanisms for end-users and servers, as well as other bandwidth management and data optimization strategies to reduce overall data consumption. Additionally, developers may explore the inclusion of offline access modes or data-saving features, particularly for asynchronous learning materials. Regarding the system's cost-effectiveness, the CSPC-LeOnS was developed by faculty members from the College of Computer Studies and transferred to the organization for free, making it highly cost-effective from an organizational perspective. While operational costs such as hosting providers, maintenance and upgrades, data management, and other related expenses remain, eliminating acquisition costs represents significant savings for the organization.
User-friendliness and usability	"Not so user friendly for beginners. Daming pasikot sikot sa paggawa pa lang ng sections." "Challenging to navigate, lot of functions/buttons, not user-friendly ✌️ 😁."	"Daming pasikot sikot sa paggawa pa lang ng sections" (conveys the idea of complexity in organizing or creating sections through the LMS).	The LMS developers must simplify complex forms and other design factors; provide tooltips, particularly for beginners. Moreover, A/B testing of the existing CSPC-LeOnS against a simplified version may be implemented to improve the system's usability and inform system refinement. This approach leads to a better evaluation of user satisfaction in terms of ease of use.
Essential features and customizations	"Yung features na kayang maedit yung layout ng LeOnS nakakadagdag din ng lito." "Able to incorporate the format and feature of grade sheet for convenience in the computation of grades."	"Yung features na kayang maedit yung layout ng LeOnS nakakadagdag din ng lito" (translates to the feature that allows editing the layout in the LMS, also adds to the confusion).	The LMS developers may consider implementing any of the following: Consider removing the layout customizations and providing just one layout for each user, OR simplify the layout editing tools, OR set up pre-made layout templates for the user.

Table 5. Recommendations/plan of action (continue)

Themes	Sample response (in verbatim)	Interpretation (if needed)	Recommended action/responsible unit
Training/orientation	"Unable to attend the orientation proper." "I did not attend the whole session for LEONs Training, which is why I don't know some of the functions."		The administrators' support is essential to the success of system implementation and deployment; hence, the following may be considered: Encourage stakeholders to support training or orientation for similar undertakings, through continuous evaluation and follow-up to take advantage of in-house resources. Moreover, the faculty development program should consider LMS workshops and similar training to support effective educational technology onboarding. Develop a policy specific to new technology implementation. Implement regular infrastructure audits to ensure the institution's adaptability to new educational technology. Assess thoroughly any new technology for the consumption of the organization by soliciting the right experts and ensuring adherence to expert advice.

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