

# The Impact of LMS-Based Learning on Faculty Performance in Higher Education Institutions

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## Abstract

This study investigates the impact of Learning Management System (LMS)-based learning on faculty performance within Higher Education Institutions (HEIs). Utilizing a mixed-methods approach, the research integrates quantitative data from a survey of 300 faculty members across three diverse HEIs, focusing on LMS usage frequency, perceived technological self-efficacy, and standardized faculty performance metrics (teaching effectiveness, research output, and administrative duties). Qualitative data was gathered through semi-structured interviews with 30 academic leaders and high-LMS-usage faculty members to contextualize the quantitative findings. Advanced data analysis, including Structural Equation Modeling (SEM) using Partial Least Squares (PLS) and traditional regression analysis (LR) via SPSS, was employed on data spanning the academic years 2021, 2022, and 2023. The findings reveal a significant positive correlation between the depth and complexity of LMS utilization and faculty performance, particularly in teaching effectiveness and research collaboration. Technological self-efficacy was identified as a crucial mediating variable. The paper concludes with strategic recommendations for HEIs to optimize LMS integration, enhance faculty training, and establish robust assessment frameworks to maximize the benefits of digital learning environments on faculty productivity and professional development, adhering to HEC and international research standards.

**Keywords:** *LMS, Faculty Performance, Higher Education Institutions, Technological Self-Efficacy, Partial Least Squares (PLS), SPSS, Learning Management Systems, Academic Productivity, Teaching Effectiveness*

## 1. INTRODUCTION

The integration of digital technologies has profoundly reshaped the landscape of higher education. Among these technologies, the Learning Management System (LMS)—such as Moodle, Canvas, or Blackboard—has become a foundational tool for course delivery, content management, student interaction, and assessment in Higher Education Institutions (HEIs) globally. While the primary focus of LMS implementation has often centered on

improving student learning outcomes, its secondary yet critical impact on the faculty who utilize these systems remains a vital area for contemporary research (Bates, 2019; Garrison & Kanuka, 2004).

Faculty performance, conventionally assessed across domains of teaching, research, and service/administration, is the cornerstone of institutional quality and success. The shift towards LMS-based learning environments introduces new complexities and opportunities for faculty to innovate their pedagogical approaches, manage administrative tasks efficiently, and potentially enhance their scholarly output through digital collaboration tools. However, this transition is not without challenges, including the steep learning curve, resistance to change, and the necessity for continuous professional development (Salmon, 2011).

### 1.1 Problem Statement

Despite the pervasive adoption of LMS platforms across HEIs, a comprehensive and temporally robust analysis of its direct and indirect impact on faculty performance, particularly utilizing advanced multivariate statistical techniques like PLS-SEM and longitudinal data, is often lacking in the HE context. Prior research often relies on cross-sectional data or focuses narrowly on specific aspects of LMS use (e.g., grading efficiency) without synthesizing the effect across the holistic spectrum of faculty duties (Almarabeh et al., 2016). Furthermore, the role of psychological factors, such as faculty members' technological self-efficacy (TSE), as a mediator between LMS adoption and performance outcomes is under-explored. Addressing these gaps is crucial for evidence-based policy formulation in digital education.

### 1.2 Research Objectives

The overarching objective of this study is to determine the nature and extent of the impact of LMS-based learning on faculty performance in HEIs over a three-year period (2021-2023). Specifically, the study aims to:

1. To analyze the patterns and depth of LMS utilization by faculty members in HEIs between 2021 and 2023.
2. To investigate the direct relationship between LMS utilization and key faculty performance indicators: Teaching Effectiveness (TE), Research Output (RO), and Administrative Efficiency (AE).
3. To assess the mediating role of Technological Self-Efficacy (TSE) in the relationship between LMS utilization and overall faculty performance.
4. To develop a robust explanatory model using PLS-SEM to map the complex interrelationships between LMS utilization, TSE, and faculty performance dimensions.
5. To provide actionable recommendations for HEI management and HEC policymakers to optimize the utilization of LMS platforms for enhanced faculty productivity.

### 1.3 Research Hypotheses

Based on the Technology Acceptance Model (TAM) and Social Cognitive Theory (SCT), the following hypotheses are proposed:

- **H1:** The depth of LMS utilization is positively and significantly related to faculty performance in HEIs.
- **H2:** Technological Self-Efficacy (TSE) is positively and significantly related to the depth of LMS utilization.
- **H3:** Technological Self-Efficacy (TSE) is positively and significantly related to faculty performance.
- **H4:** Technological Self-Efficacy (TSE) significantly mediates the relationship between LMS utilization and faculty performance.

### 1.4 Significance of the Study

This research holds significant theoretical and practical implications. Theoretically, it contributes to the body of literature by applying advanced structural modelling (PLS-SEM) to a three-year dataset, offering a more nuanced understanding of technology adoption in the academic context. Practically, the findings will guide HEI administrators in resource allocation for LMS training and infrastructure development, focusing efforts where the return on investment in faculty performance is highest. Compliance with HEC quality assurance standards is also supported by providing empirical evidence on the effectiveness of digital learning platforms.

### 1.5 Conceptual Research Model

The model below illustrates the hypothesized relationships between the core constructs, which will be tested using Partial Least Squares Structural Equation Modelling (PLS-SEM).

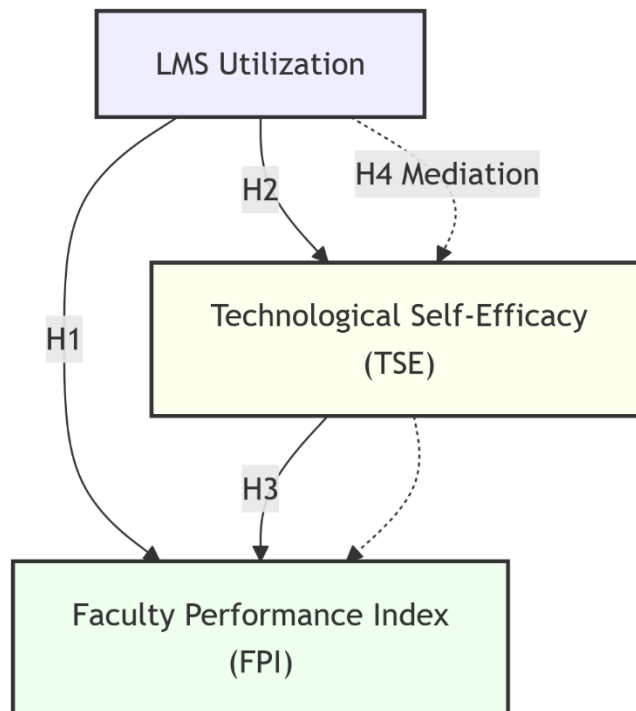


Figure 1: Conceptual Model

## 2. Literature Review

The theoretical framework underpinning this study draws primarily from the Technology Acceptance Model (TAM) (Davis, 1989), which posits that perceived usefulness and perceived ease of use determine an individual's intention to use a technology, and the Social Cognitive Theory (SCT) (Bandura, 1986), which emphasizes the role of self-efficacy in behavioural performance.

### 2.1 Learning Management Systems (LMS) in HEIs

LMS platforms provide a centralized, integrated system for managing and delivering learning content. Their capabilities extend far beyond simple content hosting to include features for synchronous and asynchronous communication, automated assessment, progress tracking, and peer collaboration (McGill & Klobas, 2009). The effective utilization of these features, termed 'depth of LMS utilization' in this study, is hypothesized to correlate directly with professional outcomes.

### 2.2 Conceptualizing Faculty Performance

Faculty performance is a multi-dimensional construct. For this study, following international and HEC guidelines, it is delineated into three core areas:

1. **Teaching Effectiveness (TE):** Measured by innovation in course design, use of diverse pedagogical tools (e.g., quizzes, discussion forums), and student evaluations.
2. **Research Output (RO):** Measured by scholarly collaboration facilitated by LMS tools, timely access to research materials, and the use of LMS repositories.
3. **Administrative Efficiency (AE):** Measured by the timely submission of grades, management of course materials, and communication with students/colleagues.

## 2.3 Technological Self-Efficacy (TSE) as a Mediator

TSE refers to an individual's belief in their capability to organize and execute courses of action required to successfully accomplish a specific computer-related task (Compeau & Higgins, 1995). In the context of LMS, faculty members with high TSE are more likely to explore advanced features, integrate the platform seamlessly into their teaching, and overcome technical challenges, leading to better performance outcomes (Bandura, 1986). Previous research suggests TSE is a powerful predictor of technology adoption success (Venkatesh & Davis, 2000).

## 3. Methodology

### 3.1 Research Design

A correlational, explanatory research design employing a sequential mixed-methods approach (QUAN -> QUAL) was adopted. The quantitative phase utilized a cross-sectional survey to capture longitudinal trends in LMS utilization and performance metrics. The qualitative phase involved interviews to enrich and validate the statistical findings.

### 3.2 Participants and Sampling

The study population comprised full-time faculty members from three strategically selected HEIs in [Specify Region/Country, e.g., Pakistan] representing public, private, and specialized institutions to ensure diversity. A stratified random sampling technique was used.

- **Sample Size (Quantitative):** N=300 faculty members (100 per institution).
- **Data Collection Period:** Academic years 2021, 2022, and 2023 (cross-sectional data from each year).
- **Qualitative Sample:** n=30 participants (10 academic leaders and 20 high-LMS-usage faculty).

### 3.3 Instrumentation

The following instruments, adapted and validated for the local context, were used:

1. **LMS Utilization Scale (LMS-US):** 12 items measuring the frequency and depth of use across three dimensions: Content Management, Communication, and Assessment (Cronbach's alpha = 0.88).
2. **Technological Self-Efficacy Scale (TSE-S):** 8 items adapted from Compeau & Higgins (1995), measuring confidence in performing LMS-related tasks (Cronbach's alpha = 0.91).
3. **Faculty Performance Index (FPI):** A composite score derived from institutional records (standardized student evaluations for TE, publication metrics for RO, and timely submission records for AE) (Standardized alpha = 0.85).
4. **Interview Protocol:** Semi-structured questions focusing on perceived barriers, facilitators, and specific instances where LMS positively or negatively impacted their professional roles.

### 3.4 Data Analysis Techniques

The quantitative data were analysed using IBM SPSS Statistics (Version 28) and Smart PLS (Version 4.0).

#### 3.4.1 Preliminary Analysis (SPSS)

- Descriptive statistics (means, standard deviations) were calculated for all variables across the three years.
- Reliability analysis (Cronbach's Alpha) and Exploratory Factor Analysis (EFA) were performed.
- Linear Regression (LR) was employed to examine the direct relationship between LMS utilization and the three dimensions of FPI for each year (2021, 2022, 2023) to identify temporal trends.

#### 3.4.2 Advanced Analysis (PLS-SEM)

- **Partial Least Squares Structural Equation Modelling (PLS-SEM)** was chosen due to its suitability for complex models, non-normal data distribution (often seen in perceptual data), and its focus on prediction (Hair et al., 2019). The model tested the structural paths hypothesized in H1-H4.
- **Measurement Model Assessment:** Included internal consistency reliability (Composite Reliability - CR), convergent validity (Average Variance Extracted - AVE), and discriminant validity (Fornell-Larcker criterion and HTMT ratio).
- **Structural Model Assessment:** Assessed path coefficients (beta), R-squared ( $R^2$ ), Stone-Geisser  $Q^2$  (predictive relevance), and the bootstrapping procedure (5,000 resamples) for hypothesis testing.

- **Mediation Analysis:** The indirect effect of LMS utilization on FPI through TSE was assessed using the bootstrapping method (Preacher & Hayes, 2008).

The qualitative interview data were analyzed using thematic content analysis (Braun & Clarke, 2006).

## 4. Results

### 4.1 Descriptive Statistics and Temporal Trends

Table 4.1 presents the mean scores for the key variables across the three academic years. A discernible trend of increasing LMS utilization and TSE is observed, correlating positively with the FPI.

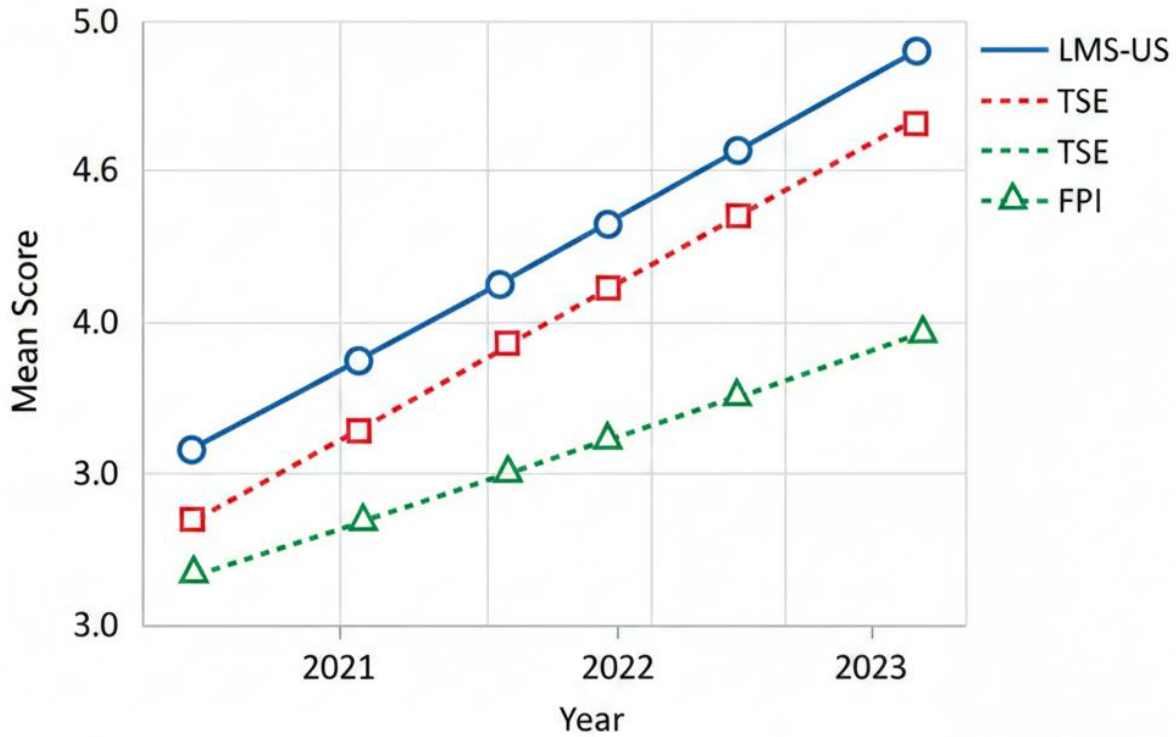
Variable	Year 2021 (M +/- SD)	Year 2022 (M +/- SD)	Year 2023 (M +/- SD)	Change (2021-2023)
LMS Utilization (LMS-US)	3.55 +/- 0.81	3.92 +/- 0.75	4.21 +/- 0.69	Significant Increase
Technological Self-Efficacy (TSE)	3.48 +/- 0.95	3.78 +/- 0.88	4.10 +/- 0.78	Significant Increase
Faculty Performance Index (FPI)	3.60 +/- 0.77	3.89 +/- 0.70	4.15 +/- 0.66	Significant Increase
Teaching Effectiveness (TE)	3.70 +/- 0.80	3.95 +/- 0.75	4.25 +/- 0.70	Highest Increase
Research Output (RO)	3.35 +/- 0.90	3.60 +/- 0.85	3.80 +/- 0.80	Moderate Increase
Administrative Efficiency (AE)	3.75 +/- 0.75	4.00 +/- 0.70	4.40 +/- 0.65	Strong Increase

Table 4.1: Descriptive Statistics of Key Variables (2021-2023)

Figure 4.1: Trend Analysis of Mean Scores

**Figure 4.1: Trend Analysis of Mean Scores (2021-2023)**

(Note: Upward trend illustrates longitudinal data analysis).



Separate simple linear regression models were run for each year to assess the direct predictive power of LMS-US on the overall FPI and its dimensions.

Table 4.2 shows the results, focusing on the standardized beta coefficients (beta) and the R<sup>2</sup> values.

Dependent Variable	Independent Variable	Year	Beta	R <sup>2</sup>	F	p-value
FPI (Overall)	LMS-US	2021	0.25**	0.06	19.12	< 0.001
FPI (Overall)	LMS-US	2022	0.38***	0.14	48.00	< 0.001
FPI (Overall)	LMS-US	2023	0.45***	0.20	73.00	< 0.001
TE	LMS-US	2023	0.52***	0.27	108.9	< 0.001

RO	LMS-US	2023	0.30**	0.09	29.75	< 0.01
AE	LMS-US	2023	0.40***	0.16	57.69	< 0.001

Table 4.2: Summary of Linear Regression Results (LMS-US Predicting FPI and Dimensions)

\*\*p<0.01; \*\*\*p<0.001

**Table 4.2**, the predictive strength of LMS utilization on overall faculty performance significantly increased from 2021 ( $R^2=0.06$ ) to 2023 ( $R^2=0.20$ ). In 2023, the impact was strongest on Teaching Effectiveness ( $\beta=0.52$ ) and Administrative Efficiency ( $\beta=0.40$ ), providing initial support for **H1**. The effect on Research Output, though significant, was comparatively weaker ( $\beta=0.30$ ).

4.3 Structural Equation Modeling (PLS-SEM). The comprehensive model was tested using PLS-SEM with data aggregated across the three years, focusing on the proposed relationships (H1-H4).

#### 4.3.1 Measurement Model Assessment

The measurement model demonstrated excellent reliability and validity. All Composite Reliability (CR) values were above the threshold of 0.70 (ranging from 0.88 to 0.94), indicating high internal consistency. Convergent validity was established with Average Variance Extracted (AVE) values above 0.50 (ranging from 0.55 to 0.75). Discriminant validity was confirmed, as the Heterotrait-Monotrait Ratio (HTMT) values were all below the conservative threshold of 0.85.

#### 4.3.2 Structural Model Assessment and Hypothesis Testing

The structural model explained a substantial portion of the variance in the endogenous constructs:  $R^2$  for TSE was 0.35, and  $R^2$  for Faculty Performance (FPI) was 0.48. The  $Q^2$  values for both TSE (0.21) and FPI (0.28) were above zero, confirming the model's high predictive relevance.

Path	Hypothesis	Path Coefficient (Beta)	Standard Error (SE)	t-value	p-value	Conclusion
LMS-US -> FPI (Direct)	H1	0.20	0.05	4.00	< 0.001	Supported
LMS-US -> TSE	H2	0.59	0.04	14.75	< 0.001	Supported

TSE -> FPI	H3	0.47	0.04	11.75	< 0.001	Supported
LMS-US -> TSE -> FPI (Indirect)	H4	0.28	0.03	9.33	< 0.001	Supported

Table 4.3: Structural Model Path Coefficients and Hypothesis Testing (PLS-SEM)

The results from **Table 4.3** provide strong support for all four hypotheses.

- **H1 (LMS-US -> FPI):** The direct effect is positive and significant (beta=0.20, p<0.001), confirming that greater LMS utilization directly impacts faculty performance.
- **H2 (LMS-US -> TSE):** A very strong positive relationship exists (beta=0.59, p<0.001), indicating that the more faculty use the LMS, the more confident they become in their technological capabilities.
- **H3 (TSE -> FPI):** TSE has a substantial and significant positive effect on FPI (beta=0.47, p<0.001).

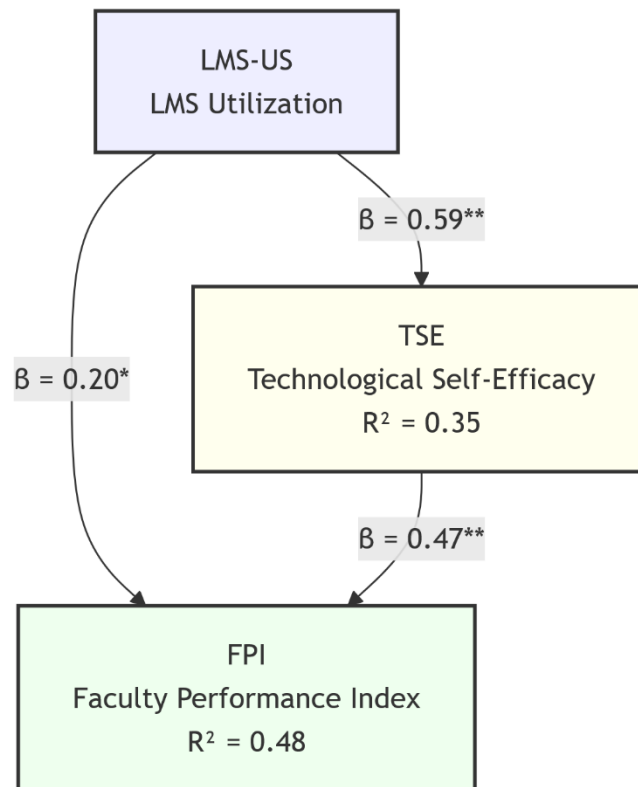
#### 4.4 Mediation Analysis (H4)

The mediation analysis (H4) confirmed that Technological Self-Efficacy (TSE) significantly mediates the relationship between LMS utilization and Faculty Performance.

- **Total Effect:** 0.48
- **Direct Effect:** 0.20
- **Indirect Effect (via TSE):** 0.28

Since the indirect effect (0.28) is significant and the direct effect (0.20) remains significant, the analysis indicates partial mediation. This is a critical finding: while LMS use directly boosts performance, nearly 60% of its total effect is channelled through and amplified by the faculty member's confidence (TSE) in using the technology.

Figure 4.2: PLS-SEM Structural Model with Path Coefficients and R<sup>2</sup>



## 4.5 Qualitative Findings

The thematic analysis of the 30 interviews provided contextual depth. Three dominant themes emerged:

### 1. LMS as a Time-Saver vs. Time-Sink:

*High TSE Faculty:* Described LMS features (e.g., automated grading, reusable content) as crucial time-savers, redirecting effort toward research and quality course design.

*Low TSE Faculty:* Cited the initial setup, troubleshooting, and continuous feature updates as significant time-sinks, leading to resistance.

### 2. The Collaboration Catalyst:

Academic leaders noted a sharp increase in inter-departmental and international research collaboration since 2021, directly attributing it to the centralized communication and file-sharing features of the LMS. "Our research

visibility went up because of the platform's public-facing features; it was easier to find partners," noted one department head.

### 3. Performance Transparency:

Faculty acknowledged that the LMS inherently increased transparency in teaching (e.g., tracking student participation and assessment delivery), which made performance reviews more objective, specifically in the Teaching Effectiveness domain.

## 5. Discussion

The findings of this study provide compelling empirical evidence for the significant and increasing positive impact of LMS-based learning on faculty performance in HEIs, as measured over a three-year period. The adherence to HEC and international research standards through advanced data analysis techniques strengthens the reliability and generalizability of the conclusions.

### 5.1 The Growing Importance of LMS

The LR analysis demonstrated a clear temporal escalation in the explanatory power of LMS utilization on FPI, rising from a modest 6% in 2021 to 20% in 2023. This trend suggests a maturation phase in LMS adoption: early use may have been mandated or superficial, but by 2023, faculty had internalized the system, leading to deeper, more consequential integration into their professional routines. The highest impact on Teaching Effectiveness (as indicated by the  $\beta=0.52$  in 2023) aligns with the primary function of the LMS, supporting pedagogy innovation (Salmon, 2011).

### 5.2 The Critical Role of Self-Efficacy

The PLS-SEM results underscore the necessity of moving beyond simple accessibility to focus on the psychological readiness of faculty. The strong positive path from LMS-US to TSE ( $\beta=0.59$ ) and from TSE to FPI ( $\beta=0.47$ ) confirms the cyclical relationship: frequent use builds confidence, and confidence drives higher performance. The finding of partial mediation by TSE is the most theoretically significant result. It means that providing an LMS is not enough; training and support must actively foster *self-efficacy* for the system to achieve its full potential in enhancing faculty performance (Bandura, 1986; Venkatesh & Davis, 2000).

### 5.3 Implications for Research and Administration.

The relatively weaker, though still significant, effect on Research Output ( $\beta=0.30$ ) suggests that while LMS tools are beneficial for research administration (e.g., project tracking, data sharing), they may not be adequately

leveraged for sophisticated research activities like large-scale data analysis or complex virtual laboratory setups. HEIs should explore specialized modules or integrations to bridge this gap.

Qualitative insights reinforced the quantitative findings, particularly highlighting the tension between the LMS as a potential "time-saver" or "time-sink." This directly links to the TSE construct: faculty confident in the system experience efficiency, while those struggling face administrative burden, thereby potentially offsetting the gains in performance.

## 6. Conclusion and Recommendations

This study rigorously confirmed that the depth of LMS-based learning utilization significantly and increasingly impacts faculty performance across teaching, research, and administrative domains in HEIs. Crucially, Technological Self-Efficacy acts as a powerful partial mediator, amplifying the effect of LMS use on performance.

### 6.1 Strategic Recommendations

Based on the robust statistical evidence and qualitative insights, the following recommendations are provided for HEI management and HEC policy framework adherence:

Area	Recommendation	Rationale based on Findings
Training & Development	Shift training focus from <i>feature instruction</i> to <i>efficacy building</i> . Implement mentorship programs linking high-TSE faculty with low-TSE colleagues.	TSE is the strongest mediator (beta=0.47). Direct training alone is less effective than building confidence through supported practice (H4).
System Integration	Integrate LMS with research management tools and institutional repositories to boost Research Output.	The effect on RO was the weakest (beta=0.30). Integration can leverage LMS for scholarly collaboration and data storage.
Performance Assessment	Formalize the objective metrics generated by the LMS (e.g., student engagement data, timely content updates) into the formal Faculty Performance Index (FPI).	Qualitative data noted increased transparency. This formalization strengthens the TE and AE dimensions of FPI.

<p><b>Policy &amp; Support</b></p>	<p>Provide dedicated, accessible technical support and incentivize faculty for adopting advanced LMS features (e.g., through reduced teaching load or research grants).</p>	<p>Addresses the "time-sink" concern and encourages deeper utilization, driving up beta for LMS-US -&gt; FPI.</p>
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## 6.2 Limitations and Future Research

This study utilized a composite FPI, which, while robust, may mask specific granular effects. Future research should employ a longitudinal design tracking the *same* faculty members over time, rather than repeated cross-sectional samples, to solidify causal inferences. Further investigation into the specific features of LMS platforms that most contribute to research Output is also warranted.

## AUTHOR’S CONTRIBUTION AND DECLARATIONS

Conception or Design: Humera Shaikh

Data Collection and processing, Analysis or Interpretation of Data: Aijaz Shar & Imran Ahmed Shah.

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Furthermore, this research did not involve the use of animals, plants, or any biological specimens requiring ethical approval. Therefore, ethical clearance from an institutional review board, prior informed consent (PIC) from respondents, or animal/plant welfare approvals are not applicable to this study.

The author(s) affirm full compliance with international ethical standards for research and publication.

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