

Digital Tool Integration in Hybrid Learning: Examining Pedagogical Practices through TPACK in a Private Islamic Higher Education Institution

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ABSTRACT

The integration of digital tools in hybrid higher education has become a defining pedagogical challenge in the post-pandemic era; however, private Islamic higher education institutions in developing contexts remain significantly underrepresented in the global literature. Grounded in the Technological Pedagogical Content Knowledge (TPACK) framework, this study examines how digital tools are integrated into pedagogical practices within a multi-program private Islamic higher education institution in Indonesia operating a proprietary Learning Management System (LMS) across fully online, face-to-face, and hybrid delivery modes. Adopting a mixed-methods, descriptive-evaluative case study design, data were gathered through an LMS platform documentary analysis, a structured questionnaire administered to 30 lecturers (Cronbach's $\alpha = 0.84$), and semi-structured interviews with eight key academic informants. Quantitative results revealed a high overall level of faculty perception regarding digital tool integration ($M = 4.01$, $SD = 0.71$), with perceived pedagogical impact scoring the highest ($M = 4.20$). Qualitatively, thematic analysis yielded four dominant dimensions: the LMS as a pedagogical enabler, digital attendance as an accountability mechanism, persistent integration barriers, and hybrid learning as an evolving institutional identity. Crucially, the convergent integration of these data strands culminated in a novel six-layer model of technology-enhanced pedagogical practice, introducing a "periphery-to-center" TPACK adoption trajectory. This model offers a theoretically grounded developmental dynamic tailored specifically to resource-constrained, faith-based higher education institutions. The study underscores the critical necessity for structured faculty development programs and formalized institutional hybrid policies to successfully optimize LMS-mediated pedagogical transformation.

Keywords: Hybrid Learning, Learning Management System, TPACK Framework, Private Islamic Higher Education, Periphery-to-Center Adoption



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1. INTRODUCTION

The accelerating integration of digital technology into higher education has fundamentally reshaped pedagogical landscapes worldwide, presenting a profound transformation that was dramatically intensified by the long-lasting aftereffects of the global pandemic on institutional learning systems (Adedoyin & Soykan, 2023; Sahni et al., 2025). As higher education institutions across the globe transitioned from conventional face-to-face instruction toward technology-mediated environments, the paradigm of hybrid learning has emerged as a defining pedagogical model of the contemporary era (Asad & Malik, 2023; Roa

González et al., 2025). This instructional approach, which systematically integrates synchronous in-person and asynchronous digital modalities within a single course framework, is no longer viewed merely as a temporary crisis-response mechanism. Instead, modern scholarship recognizes hybrid learning as a sustainable, student-centered model that effectively mitigates the pedagogical limitations of both isolated online environments and traditional face-to-face instruction (Detyna & Koch, 2023; Kerimbayev et al., 2023). In developing educational jurisdictions such as Indonesia, this macro-level transformation carries heightened stakes because institutions must navigate wide, systemic disparities in digital infrastructure, variable faculty readiness, and volatile institutional capacities, which represent operational challenges that remain acutely concentrated within private and regional higher education sectors (Surjawan et al., 2025).

Despite the burgeoning body of global scholarship documenting digital learning architectures within large, research-intensive universities, private Islamic higher education institutions in developing nations remain markedly underrepresented in the international literature on digital tool integration. This omission in the literature is highly problematic given the unique socio-cultural and operational frictions that these specific institutions experience, particularly regarding the alignment of digital modes with faith-based educational traditions. Faculty members at many private, faith-based institutions frequently encounter a pronounced lack of structured, ongoing professional development in leveraging Learning Management Systems, which subsequently results in deeply fragmented technology adoption across different academic departments (Sulaiman et al., 2023). Compounding this operational strain, empirical evidence within the Indonesian context reveals that 52% of students perceive their instructors as pedagogically unequipped to blend emerging technologies with specialized religious and secular curricula, thereby underscoring a persistent chasm between institutional digital ambitions and ground-level instructional realities (Hasanah et al., 2024). Consequently, there is an urgent empirical necessity to investigate how these resource-constrained, multi-program faith-based institutions operationalize digital pedagogy when shifting away from off-the-shelf commercial software toward proprietary, institution-built digital learning ecosystems.

Theoretically, examining this digital shift requires an analytical lens that effectively bridges infrastructural affordances with cognitive execution. The Technological Pedagogical Content Knowledge framework posits that substantive technology integration relies on the dynamic, non-linear intersection of technological, pedagogical, and content knowledge (Li et al., 2022; Sonsupap et al., 2024). Crucially, the utility of this framework lies not in documenting isolated tool usage, but in unpacking the evolving relational dynamics between emerging digital capabilities, instructional methods, and specific disciplinary domains across fluid educational contexts (Mishra et al., 2023). When paired with the Hybrid-Flexible model (Detyna et al., 2023; Galamba, 2025; Xiao et al., 2025), which mandates flexible, learner-directed multi-modal participation pathways without compounding academic penalties, these frameworks elucidate the mechanisms through which a digital platform transforms from a mere administrative repository into an active pedagogical site. This conceptual synthesis aligns directly with socio-constructivist learning paradigms (Alkhudiry, 2022; Nithidechaiwarachok et al., 2024), which dictate that digital environments must actively sustain, rather than fracture, collaborative and interactive knowledge construction among users.

However, the structural availability of a customized Learning Management System does not inherently guarantee optimized pedagogical transformation. Systemic adoption variables, including relative advantage, task-technological compatibility, and faculty-perceived usefulness, profoundly dictate the depth of technology utilization in everyday instruction (Ahmad et al., 2023; Dahri et al., 2024). Recent findings indicate that while modern learning platforms have evolved into comprehensive ecosystems capable of supporting personalized learning and continuous formative evaluation, implementation barriers such as entrenched faculty resistance to technological disruptions, unsustainable training programs, and unstable digital ecologies persist (Gkrimpizi et al., 2023; Singun, 2025). Within the localized scholarship of private Islamic higher education, existing studies remain heavily siloed because they focus narrowly on disparate graphic applications, isolated online modules, or generic project-based designs (Erfiana & Rohmah, 2025). As noted in a recent systematic literature review by Rofiuddin & Aulia (2025), there remains an acute empirical vacuum regarding how an institution-built platform functions as an integrated pedagogical artifact that shapes teaching trajectories across online, face-to-face, and hybrid spectrums.

This study directly addresses these converging empirical and theoretical gaps by conducting a rigorous, mixed-methods descriptive-evaluative case study of digital tool integration within a representative private Islamic higher education institution in Indonesia. Driven by the overarching need to theorize digital pedagogy in resource-constrained environments, this paper specifically aims to document the functional architecture and embedded digital modules of a proprietary hybrid platform, to critically analyze the pedagogical affordances of these modules through the synthesized lenses of the Technological Pedagogical Content Knowledge and Hybrid-Flexible frameworks, to evaluate faculty perceptions regarding the immediate and systemic impacts of this integrated hybrid architecture on actual instructional delivery, and to propose a scalable conceptual model of technology-enhanced pedagogy tailored for similar faith-based institutions operating under infrastructure constraints. The primary novelty of this investigation lies in its treatment of an operational, institution-built platform as a primary empirical artifact. By shifting the

scholarly narrative away from well-funded, Western-centric digital models, this study offers a contextually grounded, theoretically rich contribution to the global discourse on hybrid pedagogy, introducing a novel trajectory of technology adoption specific to the understudied landscape of private Islamic higher education.

2. METHOD

2.1. Research Design and Approach

This study executed a mixed-methods embedded case study design, systematically combining quantitative and qualitative data generation strands to evaluate technology-mediated instruction within a single institutional boundary (Wallwey & Kajfez, 2023). The choice of a mixed-methods approach was dictated by the dual necessity of mapping broader institutional patterns of digital tool utilization while concurrently unearthing the nuanced, phenomenological experiences of faculty members navigating those tools. The investigation adopted a descriptive-evaluative orientation, utilizing the Technological Pedagogical Content Knowledge framework and the Hybrid-Flexible learning model as the primary analytical grids (Keshavarz, 2023; Rakes et al., 2022; Xiao et al., 2025). To preserve methodological transparency and ensure a rigorous execution sequence, the empirical workflow proceeded through a convergent parallel architecture, meaning that the quantitative and qualitative data strands were collected concurrently, analyzed independently against their respective paradigms, and subsequently merged during the final synthesis stage. To provide a transparent and systematic overview of the research procedures adopted in this study, the overall research flow is presented in Figure 1.

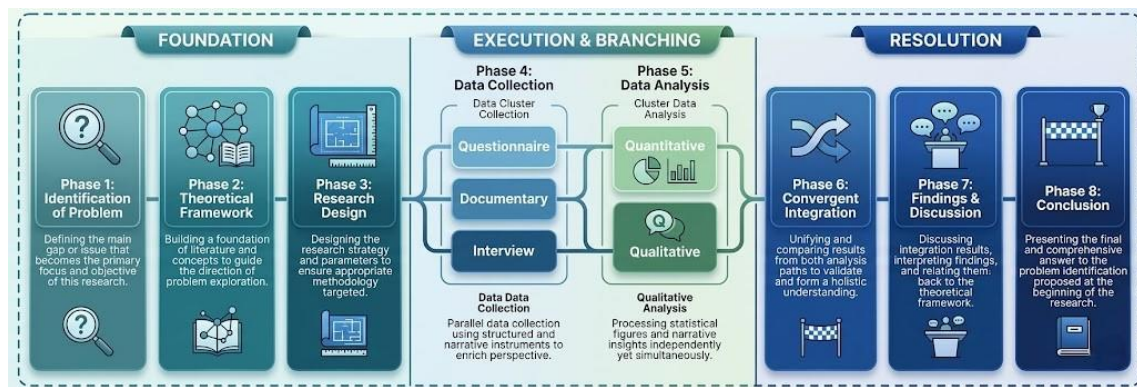


Figure 1. Research Flow Diagram Placeholder

As illustrated in Figure 1, the study proceeds through eight sequential phases, commencing with problem identification and theoretical framework construction, advancing through three-strand parallel data collection, and culminating in convergent data integration, findings, and conclusion. This phased structure ensures that all data strands are collected and analyzed independently before being merged, thereby preserving the integrity of both quantitative and qualitative findings. The conceptual relationships among the theoretical frameworks underpinning this study and its empirical focus within the private Islamic higher education institution are further articulated in Figure 2.

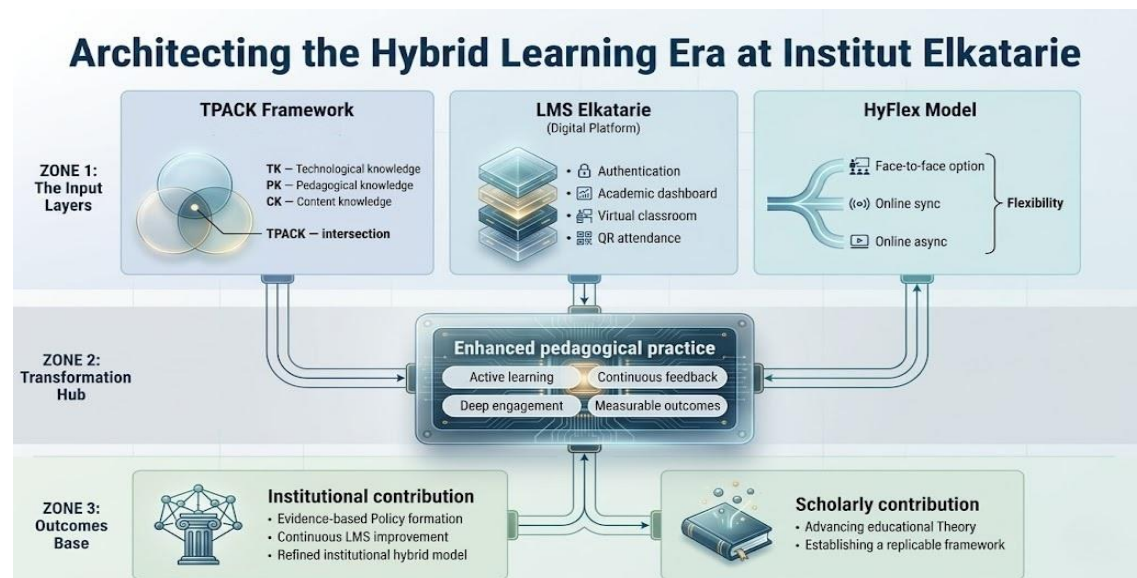


Figure 2. Conceptual Framework Diagram Placeholder

Figure 2 illustrates how the Technological Pedagogical Content Knowledge framework and the Hybrid-Flexible learning model jointly inform the evaluative analysis of the proprietary learning management system. As depicted, the intersection of these two frameworks operationalized through the platform's seven functional digital modules is theorized to produce enhanced pedagogical practice across the institution's three delivery modes, which include fully online, face-to-face, and hybrid pathways, thereby yielding both institutional and scholarly contributions. This conceptual framework functions as the primary analytical lens through which all data collected in this study are interpreted and discussed.

2.2. Data Sources and Collection Instruments

Data were collected from three complementary sources to ensure rigorous methodological triangulation, whereby convergent evidence from multiple independent data strands strengthens the credibility and transferability of the study's findings.

First, a comprehensive documentary analysis was conducted directly on the architectural components, navigational configurations, and digital artifact logs of the institutional platform. The interface, navigational architecture, module structure, and pedagogical affordances of the platform were systematically examined and coded against the seven domains of the Technological Pedagogical Content Knowledge framework, consisting of Technological Knowledge, Pedagogical Knowledge, Content Knowledge, Technological Pedagogical Knowledge, Technological Content Knowledge, Pedagogical Content Knowledge, and their full integrated intersection. Feature descriptions, interaction flows, and functional documentation were recorded as primary evidence for qualitative analysis.

Second, a structured questionnaire was administered to the academic faculty. The instrument comprised 25 items organized across three core dimensions and measured on a five-point Likert scale, ranging from 1 for strongly disagree to 5 for strongly agree. Content validity was established through independent expert reviews by two specialists in educational technology, and instrument reliability was confirmed with a Cronbach's Alpha coefficient of $\alpha=0.84$, which indicates high internal consistency. The complete blueprint of the questionnaire, including item distribution, framework domain mapping, and scale specifications, is presented in Table 1.

Table 1. Instrument Blueprint of the Structured Questionnaire

No.	Dimension	Indicator	Item Statement	TPACK Domain	Item No.	Scale
Dimension 1: Frequency & Confidence of Digital Tool Use						
1		LMS access frequency	Frequency of LMS login per week	TK	1a	1–5
2		Virtual classroom usage	Confidence using virtual classroom features	TPK	1b	1–5
3		Digital attendance	Frequency of QR/digital attendance use	TK	1c	1–5
4		Material upload	Frequency of course material upload to LMS	TPK	1d	1–5
5		Forum discussion	Use of forum discussion module for instruction	TPK	1e	1–5
6		Assignment module	Frequency of assignment module use	TPK	1f	1–5
7		Digital library	Use of digital library and OJS portal	TK	1g	1–5
8		Thesis supervision	Familiarity with thesis supervision log module	TPK	1h	1–5
9		Submission management	Confidence in managing student submissions	TPK	1i	1–5
Subtotal Dimension 1					9 items	
Dimension 2: Perceived Impact on Pedagogical Practice						
10		Student engagement	LMS supports active student engagement	TPACK	2a	1–5
11		Learning flexibility	Hybrid mode improves learning flexibility	TPACK	2b	1–5
12		Attendance accountability	Digital attendance increases student accountability	TPK	2c	1–5
13		Interactive discussion	Forum discussion enriches student-lecturer interaction	PK	2d	1–5

14	Feedback quality	Assignment module improves quality of feedback	PCK	2e	1–5
15	Formative assessment	LMS effectively supports formative assessment	TPACK	2f	1–5
16	Supervision quality	Thesis supervision log improves mentorship quality	PCK	2g	1–5
17	Multi-mode delivery	Platform supports all three delivery modes effectively	TPACK	2h	1–5
18	Overall pedagogical quality	Overall pedagogical quality has improved since LMS adoption	TPACK	2i	1–5
Subtotal Dimension 2				9 items	
Dimension 3: Challenges in Hybrid Learning Delivery					
19	Connectivity	Internet connectivity issues affect LMS utilization	TCK	3a	1–5
20	Student access	Students face difficulties in accessing the platform	TCK	3b	1–5
21	Faculty training	Insufficient training on LMS features is a barrier	TK	3c	1–5
22	Technical disruption	Technical problems frequently disrupt hybrid sessions	TCK	3d	1–5
23	Task management	Difficulty managing synchronous and asynchronous tasks	CK	3e	1–5
24	Participation disparity	Student participation disparity exists across delivery modes	CK	3f	1–5
25	Assessment validity	Assessment validity is difficult to maintain across modes	CK	3g	1–5
Subtotal Dimension 3				7 items	
Total Items				25 items	

Note. Scale: 1 = Strongly Disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; 5 = Strongly Agree. Content validity established through expert review by two educational technology specialists. Reliability: Cronbach's $\alpha = 0.84$ (George & Mallery, 2019), indicating high internal consistency. TK = Technological Knowledge; PK = Pedagogical Knowledge; CK = Content Knowledge; TPK = Technological Pedagogical Knowledge; TCK = Technological Content Knowledge; PCK = Pedagogical Content Knowledge; TPACK = Technological Pedagogical Content Knowledge.

As shown in Table 1, the 25 items are distributed across three dimensions. Dimension 1, which targets the frequency and confidence of digital tool use, comprises 9 items mapped to the Technological Knowledge and Technological Pedagogical Knowledge domains to assess how regularly and confidently instructors utilize each of the system modules in their teaching. Dimension 2, focusing on the perceived impact on pedagogical practice, comprises 9 items mapped to the Pedagogical Knowledge and integrated framework domains to examine faculty perceptions of how digital tool integration has affected the quality and effectiveness of their hybrid instruction. Dimension 3, encompassing challenges in hybrid learning delivery, comprises 7 items mapped to the Technological Content Knowledge and Content Knowledge domains to capture persistent barriers encountered during the implementation of hybrid learning at the institutional level. This structured distribution ensures comprehensive and balanced coverage of the various framework knowledge intersections as they manifest in actual hybrid teaching practices.

Third, semi-structured interviews were conducted with eight key informants comprising five active faculty lecturers and three study program coordinators. Informants were selected based on their sustained and active engagement with the institutional platform across a minimum of two consecutive semesters alongside their direct involvement in at least one of the three delivery modes. The interviews were conducted in the institutional language, audio-recorded with prior informed consent, and transcribed verbatim for systematic qualitative analysis, with each interactive session lasting approximately 45 to 60 minutes.

2.3. Sampling and Participants

Participants were selected using a purposive sampling strategy based on three explicit criteria, which required that individuals must be currently employed as an active teaching lecturer or academic program coordinator within the institution, must have actively used the institutional platform for at least one complete academic semester, and must possess direct experience teaching courses delivered through at least one of the three available instructional modes consisting of fully online, face-to-face, or hybrid formats. Rather than relying on sample generalizations, a total population census was conducted among all 30 lecturers actively utilizing the system to ensure that the quantitative data reflected the exhaustive institutional reality. Student data were incorporated indirectly through the documentary analysis of forum

discussion logs, assignment submission records, and academic dashboard activity data accessible within the platform, which remains consistent with ethical data minimization principles. The detailed profile of all interview informants is summarized in Table 2.

Table 2. Profile of Interview Informants

Code	Role	Academic Program	Teaching Rank	LMS Experience	Primary Delivery Mode	Interview Duration
L-01	Lecturer	Islamic Political Law	Assistant Professor	3 semesters	Fully Online	48 minutes
L-02	Lecturer	Islamic Political Law	Lecturer	2 semesters	Hybrid	45 minutes
L-03	Lecturer	English Language Education	Assistant Professor	4 semesters	Face-to-Face	52 minutes
L-04	Lecturer	English Language Education	Lecturer	3 semesters	Fully Online	46 minutes
L-05	Lecturer	Islamic Elementary School Teacher Education	Assistant Professor	4 semesters	Hybrid	60 minutes
C-01	Coordinator	Islamic Political Law	Associate Professor	5 semesters	All three modes	58 minutes
C-02	Coordinator	English Language Education	Associate Professor	5 semesters	All three modes	55 minutes
C-03	Coordinator	Islamic Elementary School Teacher Education	Assistant Professor	4 semesters	Hybrid / Online	50 minutes
Total	8 informants	3 academic programs		Avg. 3.75 sem.		Avg. 51.75 min

Note. L = Lecturer; C = Study Program Coordinator. All informants were selected through purposive sampling based on active employment, a minimum of two consecutive semesters of platform experience, and direct instructional delivery experience across the three modalities. Participant names have been replaced with alphanumeric codes to protect confidentiality. Interviews were transcribed verbatim prior to thematic analysis.

As presented in Table 2, all eight informants possess a minimum of two semesters of active platform experience, with study program coordinators demonstrating the highest level of system familiarity, ranging from four to five semesters of sustained use. The three academic programs represented, which include Islamic Political Law (*Siyasah Syar'iyah*), English Language Education (*Tadris Bahasa Inggris*), and Islamic Elementary School Teacher Education (PGMI), collectively span the institution's principal disciplinary areas, thereby ensuring that the captured qualitative data reflect diverse pedagogical contexts and hybrid implementation experiences across the academic structure.

2.4. Data Analysis and Systematic Integration

Quantitative data from the structured questionnaire were analyzed using descriptive statistics, including mean scores, standard deviations, and percentage distributions, computed through SPSS version 26 software. Scores were interpreted using a validated five-category classification scale, which classifies values from 1.00 to 1.80 as very low, 1.81 to 2.60 as low, 2.61 to 3.40 as moderate, 3.41 to 4.20 as high, and 4.21 to 5.00 as very high.

Qualitative data derived from the semi-structured interviews and documentary analysis were processed using thematic analysis following a rigorous six-phase procedure, which moved systematically from initial data familiarization and open coding to the generation, review, definition, and naming of dominant themes (Byrne, 2022). NVivo 14 software was deployed to manage, organize, and visualize the coding structure and subsequent theme development. To strengthen the credibility and confirmability of the qualitative findings, member checking protocols were conducted with three primary interview informants who reviewed and validated the accuracy of the themes and interpretations attributed to their accounts.

The quantitative and qualitative findings were subsequently integrated through a convergent parallel mixed-methods procedure. In this synthesis pipeline, results from both data strands were analyzed independently and then merged through a joint-display matrix comparison, which allowed for a direct cross-

referencing of descriptive statistical majorities against the conceptual depth of the thematic dimensions to produce a comprehensive, triangulated model of technology-enhanced pedagogical practice.

2.5. Ethical Considerations

This study was conducted in full accordance with standard ethical principles in educational research. Informed consent was obtained from all participants prior to data collection, and all informants were fully briefed on the purpose, procedures, and voluntary nature of their participation. Participant identities were anonymized throughout all data collection, analysis, and reporting phases, as reflected in the alphanumeric coding system applied in Table 2. The research did not involve any experimental intervention or manipulation of institutional learning processes, and all protocols were executed in strict compliance with the established institutional research ethics and data protection frameworks.

3. RESULTS

3.1. Architectural Mapping and Pedagogical Affordances of the Proprietary LMS

The documentary analysis of the institutional digital learning ecosystem, which operates as a customized hybrid platform, reveals a structured technical architecture designed to operationalize higher education instruction across multiple programmatic lines. The platform implements a dual-authentication mechanism comprising a Google Single Sign-On facility connected directly to institutional university accounts alongside an alternative student identification number-based credential log, which establishes a secure entry sequence aligned with the Technological Knowledge domain. Upon successful authentication, the interface transitions immediately into an automated academic dashboard that provides real-time monitoring of student performance metrics and progress tracking. This centralized dashboard displays an aggregate student attendance rate of 92 percent, a dynamic notification panel displaying two upcoming course assignments, and a cumulative grade point average indicator showing a value of 3.75. Furthermore, the system systematically categorizes course enrollments by attaching explicit, color-coded delivery mode badges that visually distinguish among fully online, face-to-face, and hybrid instructional pathways within the active semester schedule.

Visual documentation derived from the virtual classroom interface, as captured in the composite panels of Figure 3, establishes the operational functionality of these instructional modes across separate academic departments. In the Islamic Political Law department, the course designated as SYS201 operates under a fully online modality managed by the assigned faculty member, integrating a quick response attendance scanner, a direct synchronization link for live video conferencing, and an active classroom forum channel within a unified graphical interface. Conversely, panel d documents the English Language Education course, coded as TBI302, which utilizes a face-to-face delivery framework under the instruction of the respective faculty lecturer, featuring active text communication threads alongside accessible course materials uploaded in a standard portable document format. The hybrid delivery mechanism is explicitly operationalized in panel e through the Islamic Elementary School Teacher Education course, coded as PGM101, which simultaneously pairs synchronous online access links with physical classroom attendance scanners while providing downloadable module files restricted to a 2.4 megabyte file capacity.

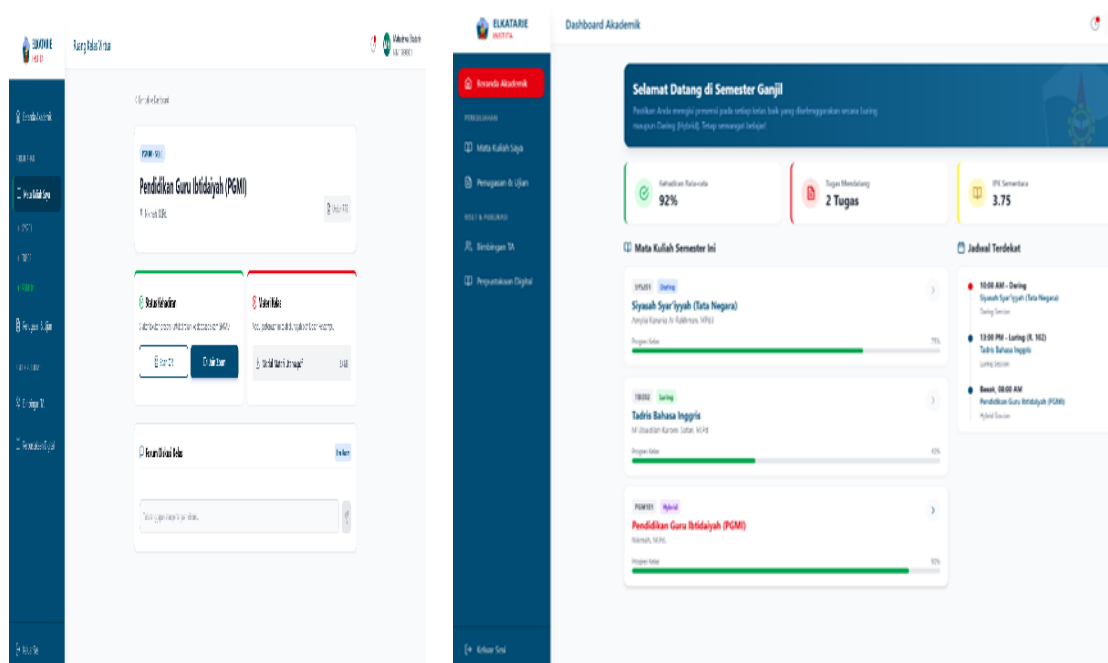


Figure 3. Composite panel arrangement of Elkatarie Institute LMS screenshot

Beyond separating synchronous and asynchronous classroom delivery, the documentary analysis reveals a specialized thesis supervision module that extends the instructional architecture into advanced academic mentorship channels. As illustrated in panel f of Figure 3, this proprietary module generates a chronological, cumulative supervision log featuring automatic timestamps that track student submissions and faculty evaluations over time. The instructor interface allows supervisors to embed detailed annotations and explicit revision instructions directly into the interface, while providing students with a secure transmission portal to upload modified manuscripts or portable document format files up to a maximum capacity of 10 megabytes. The operational workflow of this mentorship interaction is monitored by the system through the deployment of explicit status markers, which display an awaiting feedback notification during the evaluation intervals.

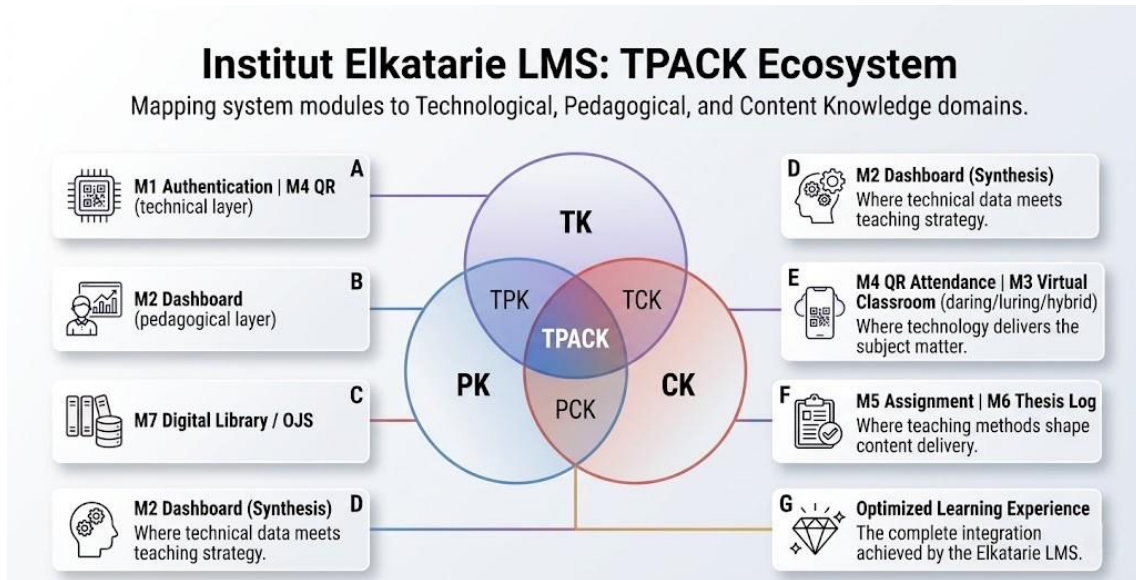


Figure 4. Mapping of Institut Elkatarie LMS modules to TPACK knowledge domains

The systematic mapping of these seven functional modules across the seven core domains of the Technological Pedagogical Content Knowledge framework is visualized objectively in Figure 4. The structural analysis confirms that the proprietary platform spans the entirety of the framework intersections, with different modules occupying distinct conceptual nodes based on their specific technological and instructional properties. The multi-mode virtual classroom module satisfies the requirements of the central technological pedagogical content knowledge intersection, positioning it as the most structurally complex component because it simultaneously demands the alignment of delivery technology, instructional methodology, and specific subject matter content. In contrast, peripheral modules are mapped onto separate standalone or intersection domains, exemplified by the digital library and online journal system portal which position themselves exclusively within the content knowledge domain by acting as a direct institutional repository for external academic literature and internal scholarly journals.

3.2. Quantitative Evaluation of Faculty Perceptions and System Usage

The descriptive statistical analysis of the structured survey dataset gathered from the total population census of thirty instructors yields an overall aggregate mean score of $M = 4.01$ with a standard deviation of $SD = 0.71$, a metric that firmly places faculty perceptions within the high adoption category. When disaggregated by individual analytical dimensions, the metric distribution from Table 3 reveals that Dimension 2, which measures the perceived impact on pedagogical practice, generated the highest positive consensus among the faculty, recording a mean score of $M = 4.20$ with a standard deviation of $SD = 0.63$. This dimension is followed closely by Dimension 1, which tracks the frequency and confidence of digital tool usage, yielding a mean score of $M = 4.09$ and a standard deviation of $SD = 0.65$. Conversely, Dimension 3, which captures the systemic challenges encountered during hybrid learning delivery, registered a mean score of $M = 3.74$ and a standard deviation of $SD = 0.84$, confirming that substantial operational frictions coexist alongside highly positive pedagogical evaluations within the institution.

Table 3. Descriptive Statistics of Faculty Perceptions of Digital Tool Integration Placeholder

No.	Dimension / Item	M	SD	%	Category	TPACK Domain
Dimension 1: Frequency & Confidence of Digital Tool Use						
1a	Frequency of LMS login per week	4.33	0.61	86%	Very High	TK

1b	Confidence using virtual classroom features	3.87	0.74	77%	High	TPK
1c	Frequency of QR/digital attendance use	4.47	0.57	89%	Very High	TK
1d	Frequency of course material upload	3.93	0.66	79%	High	TPK
1e	Use of forum discussion for instruction	3.70	0.72	74%	High	TPK
1f	Frequency of assignment module use	3.77	0.69	75%	High	TPK
1g	Use of digital library / OJS portal	3.53	0.78	71%	High	TK
1h	Familiarity with thesis supervision log	3.60	0.81	72%	High	TPK
1i	Confidence managing student submissions	3.67	0.75	73%	High	TPK
	Dimension 1 Mean	4.09	0.65	82%	High	
	Dimension 2: Perceived Impact on Pedagogical Practice					
2a	LMS supports active student engagement	4.23	0.63	85%	Very High	TPACK
2b	Hybrid mode improves learning flexibility	4.40	0.56	88%	Very High	TPACK
2c	Digital attendance increases accountability	4.37	0.58	87%	Very High	TPK
2d	Forum discussion enriches interaction	4.10	0.67	82%	High	PK
2e	Assignment module improves feedback quality	3.97	0.71	79%	High	PCK
2f	LMS supports formative assessment	4.03	0.69	81%	High	TPACK
2g	Thesis log improves supervision quality	3.90	0.74	78%	High	PCK
2h	Platform supports all three delivery modes	4.27	0.61	85%	Very High	TPACK
2i	Overall pedagogical quality has improved	4.13	0.64	83%	High	TPACK
	Dimension 2 Mean	4.20	0.63	84%	High	
	Dimension 3: Challenges in Hybrid Learning Delivery					
3a	Internet connectivity issues affect LMS use	3.93	0.82	79%	High	TCK
3b	Students face difficulties accessing platform	3.67	0.88	73%	High	TCK
3c	Insufficient training on LMS features	3.83	0.79	77%	High	TK
3d	Technical problems disrupt hybrid sessions	3.70	0.86	74%	High	TCK
3e	Difficulty managing synchronous & async tasks	3.53	0.89	71%	High	CK
3f	Student participation disparity across modes	3.47	0.91	69%	High	CK
3g	Assessment validity across delivery modes	3.53	0.87	71%	High	CK
	Dimension 3 Mean	3.74	0.84	75%	High	
	Overall Mean (all 25 items)	4.01	0.71	80%	High	-

Note. M = Mean; SD = Standard Deviation. Percentage score = $(M/5) \times 100\%$. Score interpretation: 1.00–1.80 = Very Low; 1.81–2.60 = Low; 2.61–3.40 = Moderate; 3.41–4.20 = High; 4.21–5.00 = Very High (Riduwan, 2022). TK = Technological Knowledge; PK = Pedagogical Knowledge; CK = Content Knowledge; TPK = Technological Pedagogical Knowledge; TCK = Technological Content Knowledge; PCK = Pedagogical Content Knowledge; TPACK = Technological Pedagogical Content Knowledge. Cronbach's $\alpha = 0.84$.

Within the behavioral and efficacy domain of Dimension 1, a sharp contrast emerges between highly routinized administrative tasks and advanced instructional functionalities. The highest metrics across the entire instrument were recorded for the frequency of quick response digital attendance usage, which achieved a mean score of $M = 4.47$ and a standard deviation of $SD = 0.57$, followed by the regular frequency of weekly system logins, which yielded a mean score of $M = 4.33$ and a standard deviation of $SD = 0.61$. These high-frequency administrative workflows stand in stark opposition to the lower scores recorded for pedagogically complex platform capabilities. Specifically, faculty confidence in managing interactive virtual classroom features reached a lower mean score of $M = 3.87$ with a standard deviation of $SD = 0.74$, while instructor familiarity with the collaborative thesis supervision logging module registered a mean score of $M = 3.60$ and a standard deviation of $SD = 0.81$, showing that user confidence drops as system modules demand a higher level of pedagogical integration.

The quantitative mapping of institutional barriers within Dimension 3 identifies the primary infrastructural and institutional pain points that limit optimal system deployment. Faculty respondents highlighted unstable internet connectivity as the most prominent structural obstacle, yielding a high challenge mean score of $M = 3.93$ with a standard deviation of $SD = 0.82$. This infrastructural limitation is closely compounded by institutional capacity constraints, as evidenced by the elevated score for insufficient and unsustainable training on specialized system features, which registered a mean score of $M = 3.83$ and a standard deviation of $SD = 0.79$. Furthermore, technical disruptions during active hybrid sessions scored a mean of $M = 3.70$ with a standard deviation of $SD = 0.86$, reinforcing the finding that the technical environment remains highly volatile for the teaching faculty. These elevated friction metrics explain why instructors gravitate toward stable, administratively predictable modules while exhibiting lower adoption rates in complex instructional features.

3.3. Qualitative Dimensions of Faculty Experiences and Frictional Dynamics

The thematic analysis of the verbatim transcripts derived from the semi-structured interviews with eight key academic informants yielded a multi-dimensional qualitative matrix that documents the lived instructional realities of the teaching faculty. This qualitative architecture, which is systematically summarized in Table 4, isolates four dominant dimensions that encompass the operational affordances, administrative parameters, structural barriers, and systemic identity shifts associated with the proprietary platform. To ensure data transparency, the qualitative outputs are presented as direct empirical results without introducing theoretical evaluations or comparisons with external literature.

Table 4. Themes from Thematic Analysis of Semi-Structured Interviews Placeholder

Theme	Theme Label	Sub-theme	Description	Representative Quotation	Supporting Informants
T1	LMS as a Pedagogical Enabler	Multi-mode delivery supports diverse learners	The availability of three delivery modes (daring, luring, hybrid) within a single platform allows lecturers to adapt instruction to varied student needs and circumstances without disrupting course continuity.	"With the LMS, I can reach students whether they are present in class or joining online. The platform makes it possible to teach the same lesson in three different ways without losing any student."	L-01, L-02, L-03, L-05, C-01
		Dashboard increases teaching transparency	The real-time academic dashboard displaying course progress percentages, attendance rates, and upcoming schedules provides lecturers with immediate visibility into student engagement and academic standing.	"The dashboard is very helpful. I can see at a glance which students are falling behind, and I can act quickly without waiting for the end of semester reports."	L-03, C-01, C-02
		Forum discussion extends classroom dialogue	The forum discussion module enables asynchronous academic interaction between lecturers and students, extending pedagogical engagement beyond the temporal and physical boundaries of scheduled class sessions.	"Students who are too shy to speak in class often write very thoughtful responses in the forum. The LMS has given them another way to participate."	L-01, L-05, C-02
T2	Digital Attendance as an Accountability Mechanism	QR scanning reduces attendance errors	The QR code attendance system eliminates manual recording errors and ensures that attendance data is automatically synchronized with the Academic Information System (SIKAD) database, improving accuracy and reducing administrative burden on lecturers.	"Before the QR system, attendance was always a problem students would sign for each other. Now, the system records the exact moment they check in, and it goes directly to Academic Information System (SIKAD)."	L-01, L-04, C-01, C-02, C-03
		Geotagging strengthens attendance authenticity	The geotagging feature embedded within the QR attendance system verifies student physical presence at the designated classroom location, preventing fraudulent remote check-ins during face-to-face sessions.	"The geotagging means students cannot scan the QR from home and pretend they are in class. It has made attendance much more trustworthy."	L-04, C-01, C-03

		Increased student punctuality	Informants consistently reported observable improvements in student punctuality following the implementation of the QR attendance system, attributing this behavioral shift to the system's automatic time-stamping and its direct link to academic records.	"Since we started using QR attendance, students come on time more consistently. They know the system records the exact moment they check in and that it affects their academic record."	L-01, C-01, C-02
T3	Persistent Barriers to Full Integration	Unstable internet connectivity	Unreliable internet access both on campus and in students' residential areas was identified as the most frequently cited structural barrier to consistent and optimal LMS utilization across all three delivery modes.	"When the internet connection drops in the middle of a Zoom session, everything stops. Students in remote areas especially struggle with this, and there is nothing we can do from our side."	L-02, L-04, L-05, C-03
		Insufficient and unsustained LMS training	All informants who identified training as a barrier reported that institutional LMS training had been provided only once at the point of platform introduction with no subsequent refresher sessions, advanced workshops, or ongoing professional development support.	"The training we received was only once, at the beginning. After that, we had to figure things out ourselves. Some features I still do not fully understand how to use effectively."	L-02, L-04, L-05, C-03
		Uneven digital readiness across programs	Informants from different academic programs reported varying levels of faculty digital competence and student platform literacy, resulting in inconsistent LMS adoption rates and pedagogical integration depth across the institution.	"In my program, most lecturers are still only using the platform for attendance and uploading files. The more advanced features, like the supervision log or forum, are barely used."	L-04, C-03
		Student access difficulties	A subset of students particularly those from lower socioeconomic backgrounds or residing in areas with limited digital infrastructure reported recurring difficulties in accessing the LMS platform reliably, creating equity	"Some of my students do not have reliable devices or internet at home. For them, the daring sessions are a real challenge, even though the platform itself works well."	L-02, L-05, C-03

T4	Hybrid Learning as an Evolving Institutional Identity	Institutional commitment visible in LMS investment	concerns in hybrid course delivery. The existence of a proprietary, institution-built LMS platform was interpreted by informants particularly study program coordinators as a concrete signal of institutional commitment to hybrid learning as a long-term pedagogical direction rather than a temporary pandemic response.	"This LMS is not just a tool for the pandemic anymore. The institution clearly wants us to teach this way going forward. The investment in building this platform shows that."	L-03, C-01, C-02, C-03
		Hybrid as future institutional pedagogy	Informants expressed a growing perception that hybrid learning is being positioned as the defining pedagogical model of Institut Elkatarie, with the LMS serving as the institutional infrastructure through which this model is operationalized and sustained.	"I think the direction of this institution is clear hybrid learning is the future here. The LMS is already there. What we need now is the support to use it well."	C-01, C-02, C-03
		Need for policy support and structured development	Despite recognizing the institution's commitment to hybrid learning, informants emphasized the urgent need for formalized policy frameworks, structured faculty development programs, and sustained institutional support to translate the platform's technical capabilities into meaningful pedagogical transformation.	"We need more than just the platform. We need a clear policy, regular training, and someone we can go to when we have problems. Without that, the LMS will never reach its full potential."	L-03, C-01, C-02, C-03

The first and second dimensions track the capacity of the platform to function simultaneously as a pedagogical enabler and a mechanism for institutional accountability. Under the first dimension, faculty members across all three program tracks noted that the integration of multi-mode virtual classrooms provided critical continuity, allowing instructors to reach remote and physical learners simultaneously without sacrificing course substance. Academic coordinators highlighted that the real-time status tracking on the dashboard provided immediate visibility into student progress, which allowed for timely academic interventions before the conclusion of the term. Furthermore, instructors observed that the asynchronous forum discussion module extended classroom dialogue past standard physical limits, encouraging introverted students who typically remained silent during face-to-face sessions to contribute thoughtful text arguments.

Under the second dimension, the implementation of quick response attendance codes paired with automated geotagging validation emerged as a powerful driver of behavioral modification among the student body. Informants reported that this digital configuration successfully eliminated manual tracking errors and fraudulent proxy signatures, as the system captured the exact timestamp of entry and

automatically synchronized the data with the institutional academic database. Instructors noted that the spatial validation enforced by the geotagging mechanism prevented students from attempting remote check-ins during mandatory face-to-face sessions, which ultimately resulted in a measurable and consistent increase in student punctuality.

The third and fourth dimensions capture the systemic frictions that constrain full technology utilization alongside the gradual evolution of the institution's long-term identity. The third dimension reveals that structural barriers continue to cause significant operational strain for both faculty and students. Informants frequently identified unstable internet connectivity within regional and residential sectors as a major disruptive variable that abruptly halted synchronous video sessions. This infrastructure constraint was severely compounded by a perceived deficit in institutional capacity building, with multiple lecturers confirming that the training provided by the university was delivered only once as an incidental session at the point of platform introduction, leaving faculty without advanced workshops or technical refresher support. Program coordinators also reported highly uneven digital readiness across departments, noting that while administrative components like attendance tracking saw rapid adoption, advanced instructional modules such as the collaborative thesis supervision log remained heavily underutilized.

Despite these persistent operational hurdles, the fourth dimension documents a widespread perception that the proprietary platform represents a permanent shift in institutional pedagogy rather than a temporary emergency measure. Academic coordinators interpreted the university's financial and technical investment in building a customized, internal platform as a concrete signal of a long-term commitment to a hybrid institutional future. Informants uniformly emphasized that for this emerging digital identity to achieve its full pedagogical potential, the physical infrastructure must be supported by formalized university policies, standardized modality regulations, and structured, continuous faculty development tracks.

3.4. Convergent Synthesis: The Six-Layer Model of Technology-Enhanced Pedagogical Practice

The final stage of the convergent parallel mixed-methods pipeline involves the systematic integration of the independent qualitative and quantitative datasets into a single, cohesive explanatory architecture. This empirical synthesis culminates in the development of the six-layer model of technology-enhanced pedagogical practice, which is visually conceptualized in Figure 5. By cross-referencing the descriptive survey majorities against the conceptual depth of the thematic dimensions, the model maps how infrastructure constraints, theoretical principles, and human agency interact to dictate the success of digital tool deployment within the higher education ecosystem.

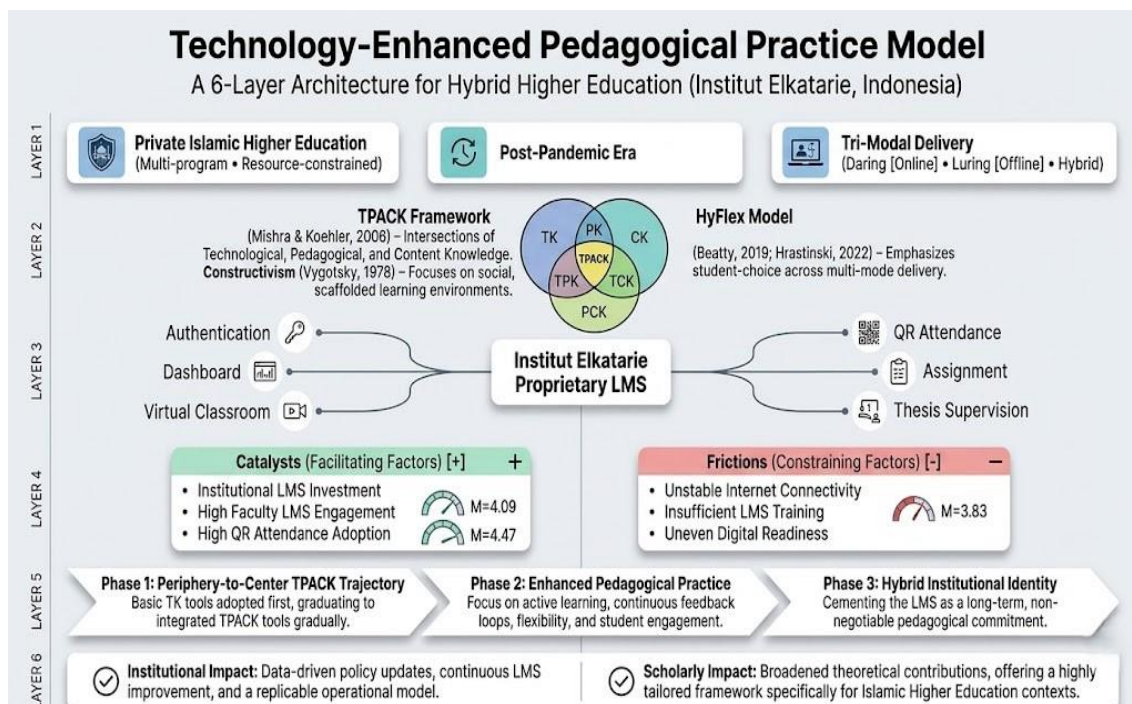


Figure 5. Proposed Model of Technology-Enhanced Pedagogical Practice in Hybrid Higher Education

The structural composition of the model proceeds through six hierarchically ordered layers that read sequentially from the baseline institutional conditions to the final scholarly and institutional outcomes. Layer 1 establishes the operational macro-environment, isolating the specific characteristics of a multi-program, resource-constrained private Islamic higher education institution navigating the post-pandemic instructional landscape through a tri-modal delivery system. Layer 2 introduces the synthesized theoretical foundation layer, displaying how the Technological Pedagogical Content Knowledge framework, the

Hybrid-Flexible course design model, and socio-constructivist learning principles jointly supply the analytical filters necessary to evaluate the digital ecosystem. Layer 3 positions the proprietary institutional platform as the primary digital artifact, showcasing the structural alignment of its seven functional modules, which bridge secure authentication facilities with specialized instructional and mentorship portals.

Layer 4 documents the operational dialectic between facilitating catalysts and constraining frictions, a direct manifestation of the convergence between the parallel research strands. The catalyst quadrant integrates the high quantitative frequency of faculty system engagement, which recorded a mean score of $M = 4.09$, and highly positive pedagogical impact perceptions, which yielded a mean score of $M = 4.20$, with qualitative data celebrating the platform as a major instructional enabler. This enabling track is explicitly anchored by the rapid adoption of quick response digital attendance modules, which registered the highest instrument mean of $M = 4.47$. Conversely, the friction quadrant maps the heavy metrik load of unstable internet connectivity and insufficient, unsustainable faculty training, which generated an elevated challenge mean score of $M = 3.83$, alongside interview data detailing uneven digital readiness across different academic departments.

Layer 5 and Layer 6 outline the developmental dynamics and tangible outcomes resulting from this structural interaction. Layer 5 conceptualizes the three-phase core dynamic of pedagogical transformation, introducing the periphery-to-center trajectory as a critical developmental pathway where instructors build initial confidence using low-complexity administrative features before progressing toward complex instructional integrations. This trajectory advances through enhanced pedagogical practices, which are characterized by active learning and continuous feedback loops, before cementing into an evolving hybrid institutional identity. Finally, Layer 6 establishes the outcomes base of the model, which splits into dual contribution streams. The institutional stream guides data-driven university policies, continuous software refinement, and replicable operational models, while the parallel scholarly stream provides a contextualized theoretical contribution to the global literature regarding digital pedagogy within developing, faith-based educational jurisdictions.

4. DISCUSSION

4.1. The Periphery-to-Center TPACK Adoption Trajectory in Resource-Constrained Environments

The operational variance between the high utilization of administrative platform features and the lower engagement with advanced instructional modules points to a deeper behavioral dynamic that shapes technology adoption within resource-constrained educational environments (Ates & Polat, 2025; Okai-Ugbaje et al., 2022). The rapid, institutionalization of quick response digital attendance and system authentication indicates that faculty members in these contexts prioritize digital utilities that offer immediate relative advantages with minimal pedagogical disruption (Jing et al., 2025; Kaur et al., 2026). Administrative modules provide clear operational parameters and high bureaucratic visibility, which lower the initial psychological barriers to technology adoption for instructors who encounter incidental institutional training (Ahmad et al., 2023). These peripheral features function as a safe entry point because they do not require a fundamental realignment of instructional methodology or content delivery. Conversely, moving into the core instructional modules, such as multimodal virtual classrooms and asynchronous discussion forums, demands a sophisticated orchestration of technological pedagogical content knowledge (Roa González et al., 2025; Xie et al., 2025). This progression increases the cognitive load on faculty members, causing a drop in execution confidence when the surrounding digital ecology remains unstable. The adoption behavior observed within this faith-based institution is therefore not a uniform, systemic transition, but a progressive migration that moves sequentially from the administrative periphery to the pedagogical center.

This evolutionary trajectory provides a vital theoretical extension to traditional technology integration frameworks, specifically expanding the conceptual boundaries of the Technological Pedagogical Content Knowledge model (Mishra et al., 2023; Santos & Castro, 2021; Tseng et al., 2022). Classic formulations of the framework often treat Technological Knowledge as an isolated individual competency or a stable cognitive trait that can be developed independently of structural limitations (Hu & Guo, 2021; Levin, 2022). However, the empirical realities of private, faith-based institutions in developing economies demonstrate that Technological Knowledge is highly volatile and fundamentally bound to localized material conditions. In these settings, an instructor's technological execution is continuously moderated by environmental frictions, including unstable regional internet grids and a lack of continuous technical support systems. By demonstrating that administrative tool adoption acts as a necessary scaffolding phase, this study argues that Technological Knowledge must be reconceptualized as a dynamic, environmentally conditioned construct. The periphery-to-center trajectory shows that in resource-constrained environments, the mastery of low-complexity administrative features builds the foundational familiarity required to eventually navigate full framework intersections, offering a more realistic, contextually grounded developmental pathway for higher education institutions in the Global South.

4.2. Navigating the Frictional Chasm Between Digital Ambitions and Ground-Level Readiness

The friction between macro-level institutional digital mandates and micro-level instructional execution exposes a structural mismatch that frequently plagues private higher education sectors. When an institution invests heavily in building and deploying a customized digital ecosystem, a management bias often occurs where technological availability is falsely equated with pedagogical readiness. This structural divergence creates an operational vacuum because the top-down pressure to adopt the platform outpaces the actual capacity of the faculty to reconfigure their instructional designs.

This ground-level deficit echoes the broader empirical findings of Hasanah et al. (2024), who documented that more than half of surveyed students experienced a profound failure in their instructors' ability to blend digital tools within specialized religious education settings. When faith-based institutions push rapid digital mandates without auditing localized instructional readiness, they inadvertently generate an alienation effect among faculty members who face the dual challenge of mastering complex technological interfaces while maintaining the rigorous traditions of their respective academic disciplines. This division transforms the platform from a learning accelerator into an administrative compliance burden, thereby widening the chasm between macro digital ambitions and real instructional execution.

The root cause of this instructional fragmentation lies in the flawed operational architecture of institutional capacity building, which is typically characterized by incidental, one-off training workshops. Providing a single introductory session at the launch of a proprietary platform ignores the fundamental tenets of continuous professional development frameworks, which dictate that technology mastery requires iterative, scaffolded, and sustained long-term mentorship. This critical structural deficit aligns with the warnings of Sulaiman et al. (2023), who demonstrated that the long-term adoption of learning management systems inevitably collapses when institutions fail to provide ongoing technical and pedagogical accompaniment.

Without a continuous feedback mechanism and advanced technical training tracks, a one-time workshop merely leaves faculty in a state of arrested development. Instructors are left to resolve technological disruptions through trial and error, which directly compromises the stability of the learning environment. To bridge this chasm, institutions must transition away from episodic event-driven IT training toward a formalized model of sustained professional accompaniment that treats digital pedagogy as a developmental process rather than an administrative event.

4.3. Pedagogical Flexibility versus Structural Entrenchment in Faith-Based HEIs

The intersection of flexible digital delivery with the traditional organizational culture of faith-based higher education institutions exposes a profound socio-pedagogical tension between learner autonomy and institutional control. The Hybrid-Flexible learning framework, as advanced by Xiao et al. (2025), Keshavarz (2023), and Detyna & Koch (2023), is fundamentally predicated on educational democratization, offering students absolute agency to select their own participation pathways based on personal convenience and fluid life circumstances. However, when transposed into the ecosystem of private Islamic higher education institutions, this student-centered flexibility directly collides with a deeply entrenched academic culture that values structural discipline, strict behavioral compliance, and the uncompromised transmission of sacred and secular knowledge. Within these traditional environments, physical presence is historically viewed not merely as a spatial requirement for content reception, but as an indispensable moral component of spiritual and academic mentorship. The face-to-face interaction is culturally understood as the primary vehicle for modeling character and values, which creates natural resistance to decentralized online formats. The deployment of a proprietary platform attempts to broker this philosophical divide by formalizing attendance through geotagged quick response codes, a mechanism that effectively repackages traditional institutional surveillance and presence requirements within a modern digital infrastructure. Consequently, the platform becomes a contested site where the fluid, student-directed tenets of global hybridity are systematically disciplined by the rigid accountability structures of a faith-based bureaucracy.

By unearthing these localized dynamics, this study establishes a distinctive contextual position within the global discourse on digital pedagogy, directly addressing the empirical vacuum identified by Küçükuncular & Ertugan (2025). While the contemporary literature on learning management systems remains predominantly focused on global, off-the-shelf software deployed within well-funded secular universities, this investigation demonstrates how an internally built platform can actively renegotiate the boundaries of student engagement within a resource-constrained religious institution. A critical manifestation of this renegotiation is the emergence of a new space for student agency through the asynchronous discussion forum module. In traditional classrooms where cultural hierarchies, senior-junior dynamics, or social anxieties frequently inhibit spontaneous vocal participation, the digital forum provides introverted and marginalized students with a deliberate, low-stakes medium to articulate complex scholarly arguments. This empirical finding provides a unique validation of Vygotsky's social constructivist theory (Alkhudiry, 2022; Wibowo et al., 2025) of learning within a restricted digital sphere, proving that collaborative knowledge construction can thrive even when mediated through an isolated, institutionally controlled environment. Thus, the proprietary platform does not merely replicate traditional instruction online; rather, it introduces a subtle democratization of classroom dialogue, showing that technology-

enhanced pedagogy can serve as an unexpected mechanism for student empowerment within highly structured institutional ecologies.

5. CONCLUSION

This study demonstrates that the proprietary learning management system within a multi-program private Islamic higher education institution serves as a pedagogically comprehensive infrastructure whose functional modules successfully span the entirety of the Technological Pedagogical Content Knowledge domains. The convergent integration of quantitative and qualitative data strands confirms that faculty adoption follows a distinct periphery-to-center trajectory, where instructors demonstrate high utilization and confidence when interacting with low-complexity administrative features, such as quick response attendance scanning and geotagged location validation, while exhibiting decreased efficacy in advanced instructional modules like virtual classrooms and collaborative thesis logging. Prominent structural barriers, including unstable regional internet connectivity and a pronounced deficit in sustained professional development, continuously prevent the complete realization of the platform's pedagogical potential. Because capacity building has historically relied on episodic, one-off training workshops delivered exclusively at the point of platform introduction, faculty members are frequently left without the continuous technical accompaniment necessary to confidently transition from basic digital literacy to comprehensive framework integration.

Theoretically, this investigation enriches global technology integration discourses by demonstrating that administrative tool adoption serves as a necessary scaffolding phase for instructors navigating digital transitions under resource constraints, thereby challenging the universalist assumptions of classic models by proving that Technological Knowledge is an environmentally conditioned construct continuously moderated by localized infrastructure stability. On a practical level, these findings dictate that higher education institutions operating within developing sectors must urgently transition away from incidental training formats toward formalized, multi-stage professional development programs that systematically scaffold faculty progression from basic system mechanics to advanced digital pedagogy. Furthermore, academic administrators must formulate comprehensive institutional hybrid learning frameworks that explicitly codify delivery modality standards and equivalent workload principles, while simultaneously deploying targeted financial investments into campus digital networks to mitigate the persistent connectivity barriers that currently disrupt synchronous instructional delivery.

While this study offers a robust evaluation of hybrid tool integration, the reliance on a total population census of thirty survey respondents and eight qualitative informants within a single institutional unit limits the immediate statistical generalizability of the quantitative outputs beyond the target environment. Methodologically, because student perspectives were captured indirectly through platform artifact logs, the dataset lacks direct, psychometric evaluations of learner satisfaction and cognitive load across the separate delivery modes. Future research should address these cross-sectional boundaries by executing longitudinal investigations to track faculty professional growth across multiple semesters, initiating multi-institutional comparative studies to validate the transferability of the periphery-to-center trajectory model, and designing student-centered empirical evaluations to isolate the direct impacts of proprietary hybrid delivery systems on actual student learning outcomes and digital equity.

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