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THE IMPACT OF BLENDED LEARNING ON STUDENT ENGAGEMENT AND ACADEMIC ACHIEVEMENT IN HIGHER EDUCATION INSTITUTIONS

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Abstract

This study investigates the structural relationships among blended learning design components, student engagement, and academic achievement in Philippine higher education institutions. Grounded in the Community of Inquiry framework and Self-Determination Theory, this inquiry models how online and face-to-face environmental quality predict academic performance through the mediating pathway of behavioral, emotional, and cognitive engagement. Utilizing a predictive-correlational research design, empirical data were gathered from 400 university students across public state universities and private higher education institutions in Metro Manila. Structural regression analyses reveal that blended learning design, comprising online environment quality ($M = 3.85, SD = 0.60$) and face-to-face environment quality ($M = 4.08, SD = 0.55$), explains 55.5% of the variance in multidimensional student engagement. In turn, engagement exerts a strong, direct effect on academic achievement ($\beta = 5.72, p < .001$), partially mediating the effects of the physical and digital learning environments. Comparative analyses indicate significant disparities in student engagement and academic achievement across institutional types and internet reliability, highlighting a persistent digital divide. Specifically, students in private universities and those with high-reliability internet connections demonstrate significantly higher engagement and academic outcomes. Conversely, gender does not yield statistically significant variations. These findings underscore the need to enhance techno-pedagogical infrastructure and institutional support mechanisms to optimize student-centered hybrid environments. Ultimately, the study contributes to the conceptual

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expansion of instructional design models in resource-constrained contexts, offering actionable pathways for policymakers and university administrators to implement sustainable, equitable, and high-impact flexible learning systems.

Keywords: *Blended learning, Student engagement, Academic achievement, Higher education, Quantitative modeling, Digital divide, Philippines*

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1. Introduction

Background of the Study

The rapid evolution of tertiary education globally has increasingly demanded the integration of traditional face-to-face instruction with digital, technology-mediated architectures. Historically accelerated by the COVID-19 pandemic, this transition forced higher education institutions (HEIs) to migrate from emergency remote teaching to structured, sustainable blended learning models. Blended learning—defined as the deliberate integration of concurrent synchronous in-person teaching and asynchronous online delivery—is widely recognized as a catalyst for educational personalization, learner autonomy, and instructional continuity. In developed economies, universities have successfully integrated advanced Learning Management Systems (LMS) and multimedia resources to optimize student engagement and academic outcomes.

From a regional perspective within the Asia-Pacific, the implementation of blended learning models is marked by a dual narrative of rapid technological adoption and profound structural disparities. While economies with robust digital infrastructures have moved toward highly adaptive, student-centric hybrid formats such as HyFlex learning, emerging nations continue to struggle with systemic hurdles in teacher readiness, student mental health, and technological access. Research across Southeast Asia highlights that while blended modalities enhance instructional reach, their success remains highly contingent on localized factors such as peer support, parental involvement, and teachers' techno-pedagogical competence.

In the Philippines, the transition to flexible and blended learning was institutionalized at the macro policy level. The Commission on Higher Education (CHED) issued CHED Memorandum Order (CMO) No. 4, Series of 2020, which lays down the baseline guidelines for the implementation of flexible learning. This was subsequently updated by CMO No. 16, Series of 2022, and CMO No. 4, Series of 2023, which established structured frameworks for transitioning back to physical campuses while preserving digital gains. These administrative mandates require public State Universities and Colleges (SUCs) to conduct at least 75% of their curriculum onsite, while private HEIs are permitted to maintain up to a 50% online split. This policy environment aims to address a severe national learning crisis, as highlighted by the Program for International Student Assessment (PISA), which revealed critical deficiencies in fundamental competencies, learning environments, and educational support systems. Specifically, national data indicate that three out of ten Filipino college students fail to graduate, with dropout rates reaching nearly 37% during the 2021–2022 academic year—a crisis that places academic performance as a critical determinant of institutional survival and socio-economic mobility.

At the local level, Metro Manila HEIs operate as the primary epicenters for these educational adjustments. Academic institutions in the capital region face unique challenges, such as localized weather disruptions and national energy emergencies, which require rapid transitions to online delivery. These physical and ecological stressors are compounded by severe disparities in student socioeconomic status, local network infrastructure, and home learning environments. Students in highly urbanized centers must constantly navigate physical connectivity limits, digital fatigue, and emotional isolation within their academic schedules.

Research Gap

While the literature on digital instruction is extensive, a substantial research gap exists regarding the structured integration of environmental quality dimensions and psychometric engagement constructs within post-pandemic Philippine HEIs. Most existing local inquiries are descriptive, evaluating general student satisfaction or isolated technological barriers. Few studies quantitatively model the structural mediating pathway of multidimensional student engagement (comprising behavioral, emotional, and cognitive axes) between environmental design quality (online versus in-person) and standardized academic performance metrics, such as Grade Point Average (GPA). Furthermore, there is a lack of empirical investigations analyzing how the recent CHED structural mandates (such as the 75/25 and 50/50 onsite-online splits) interact with socioeconomic constraints and localized technological divides to shape student performance. This study addresses these gaps by presenting a validated structural

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regression model that clarifies the pathways through which blended learning environments influence learner achievement in a developing educational system.

Problem Statement

The sudden transition to permanent, policy-mandated blended learning modalities in Philippine HEIs has coincided with declining student engagement, high dropout rates, and persistent learning deficits. Although physical campuses have partially reopened, many institutions continue to utilize hybrid frameworks without a clear understanding of how online environment quality (OEQ) and face-to-face environment quality (FEQ) interact to foster student involvement and prevent burnout. Moreover, the structural digital divide—characterized by unreliable internet connectivity, socio-economic disparities, and unequal institutional resources—continues to threaten the equity and effectiveness of blended learning systems. Without an empirical evaluation of these environmental and psychological constructs, academic administrators and policymakers risk designing instructional systems that inadvertently marginalize vulnerable student groups and fail to yield desired learning outcomes.

Research Objectives

To address this problem, the current research pursued the following specific analytical objectives:

1. To evaluate the descriptive baselines of perceived Online Environment Quality (OEQ), Face-to-Face Environment Quality (FEQ), Behavioral Engagement (BE), Emotional Engagement (EE), Cognitive Engagement (CE), and cumulative academic performance (GPA) among undergraduate students.

2. To analyze the direct predictive influence of OEQ and FEQ on the multidimensional student engagement construct.

3. To determine the mediating role of student engagement along the path linking environmental design components to cumulative GPA.

4. To compare differences in student engagement levels and academic performance based on gender, HEI institutional type (Public SUC vs. Private HEI), and internet reliability profiles.

Research Questions

The investigative inquiry sought answers to the following research questions:

1. What are the descriptive levels of OEQ, FEQ, BE, EE, CE, and standardized GPA among the sampled university students?

2. Do online and face-to-face environmental quality dimensions significantly predict overall student engagement in a hybrid setup?

3. Does multidimensional student engagement significantly mediate the path between blended learning environment quality and cumulative GPA?

4. Are there statistically significant differences in student engagement and GPA when participants are grouped by sex, institutional classification, and internet reliability?

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Hypotheses

The study tested the following primary null hypotheses:

- **$H_0$1:** Online and face-to-face environment qualities do not significantly predict multidimensional student engagement in higher education.
- **$H_0$2:** Overall student engagement does not exert a significant mediating effect on the relationship between environmental quality dimensions and student GPA.
- **$H_0$3:** There are no significant differences in student engagement or cumulative GPA based on sex, institutional classification, or internet reliability.

Significance of the Study

This study contributes to the field of educational management by modeling student success in hybrid learning environments. For educational policymakers at CHED, this research provides empirical evidence to support the refinement of flexible learning guidelines and resource allocation strategies, helping to ensure equitable access across diverse student demographics. For university administrators, the study identifies specific areas for targeted investment, such as Learning Management System (LMS) usability, digital access hubs, and faculty techno-pedagogical development. For instructional practitioners, the validated pathways highlight the importance of active learning and social presence in online environments, providing a basis for designing courses that enhance both student engagement and cognitive retention. Finally, for educational researchers, this study provides a validated quantitative model that can be adapted to analyze hybrid education systems in other developing countries.

Operational Delimitations and Study Parameters

This study was conducted during the second semester of the 2025–2026 academic year. The investigation was limited to active undergraduate university students enrolled in blended-learning degree programs at selected SUCs and private HEIs in Metro Manila, Philippines. The primary focus was restricted to modeling student perceptions of environmental design and psychometric engagement as predictors of self-reported cumulative GPAs for the current academic year. Extraneous variables, such as specific teacher pedagogical styles, individual psychological conditions, and family support systems, were excluded from the structural model to maintain analytical focus on institutional and technological predictors.

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Review of Related Literature

Theoretical Framework

The analytical design of this study is integrated through three prominent educational and psychological theories:

- **Social Constructivism:** Formulated by Vygotsky, this theory posits that knowledge is actively constructed through social interaction, collaborative dialog, and cognitive scaffolding within the learner's Zone of Proximal Development. In a blended learning format, digital communication tools and face-to-face sessions serve as primary mediums for collaborative social construction.
- **Community of Inquiry (CoI) Model:** Developed by Garrison, Anderson, and Archer, the CoI framework establishes that a highly effective educational experience occurs through the intersection of three structural presences: Teaching Presence (the design and facilitation of instruction), Social Presence (the ability of learners to project themselves socially), and Cognitive Presence (the extent to which learners construct meaning through reflection and dialog). This study maps Teaching Presence directly to the perceived quality of online (OEQ) and physical (FEQ) environments.
- **Self-Determination Theory (SDT):** Proposed by Deci and Ryan, SDT states that intrinsic motivation and deep academic engagement occur when three basic psychological needs are fulfilled: Autonomy (feeling in control of one's learning pathway), Competence (feeling effective in performing tasks), and Relatedness (feeling a sense of connection to peers and educators). Within a blended model, online components provide autonomy-supportive structures, while face-to-face components satisfy students' need for relatedness and social support.

The Evolution of Blended Spaces: Flexible vs. Face-to-Face Instruction

The post-pandemic transition in tertiary education has solidified blended learning as an essential structural paradigm rather than a temporary emergency reserve. Scholars emphasize that the hybrid configuration allows modern universities to maximize digital investments while retaining the socio-emotional advantages of physical campuses. Recent literature points to a theoretical and practical tension between proponents of fully onsite models, who highlight the superior immediacy of classroom feedback, and advocates of blended structures, who emphasize the value of self-paced digital flexibility. In the Philippines, this tension is directly mediated by CHED's regulatory frameworks, which mandate strict on-site splits to address learning losses while encouraging technology-mediated instructional delivery.

Multidimensional Student Engagement in Digital Contexts

Contemporary educational psychology conceptualizes student engagement as a three-dimensional construct comprising behavioral, emotional, and cognitive parameters. Behavioral engagement encompasses observable participation, task persistence, and rule compliance. Emotional engagement reflects affective ties, interest, and a sense of institutional belonging. Cognitive engagement involves self-regulated study strategies, goal-setting, and deeper mental processing. Meta-analytic evidence indicates that student engagement is a strong predictor of both academic outcomes and overall well-being in digital environments, with behavioral and cognitive dimensions exerting the strongest influence on academic success.

Systemic Barriers and the Digital Divide in Resource-Constrained Contexts

Academic performance, typically measured via Grade Point Average (GPA), is deeply embedded in the digital and structural conditions under which students learn. Emerging research demonstrates that although digital platforms provide unprecedented flexibility, the actual learning outcome remains highly dependent on technological access and stability. In developing contexts such as the Philippines, the digital divide is a structural barrier. Disparities in internet reliability, home learning environments, and socioeconomic resources create systemic differences in academic achievement between public and private institutions. Consequently, any attempt to evaluate academic success in hybrid spaces must account for these environmental and technological disparities.

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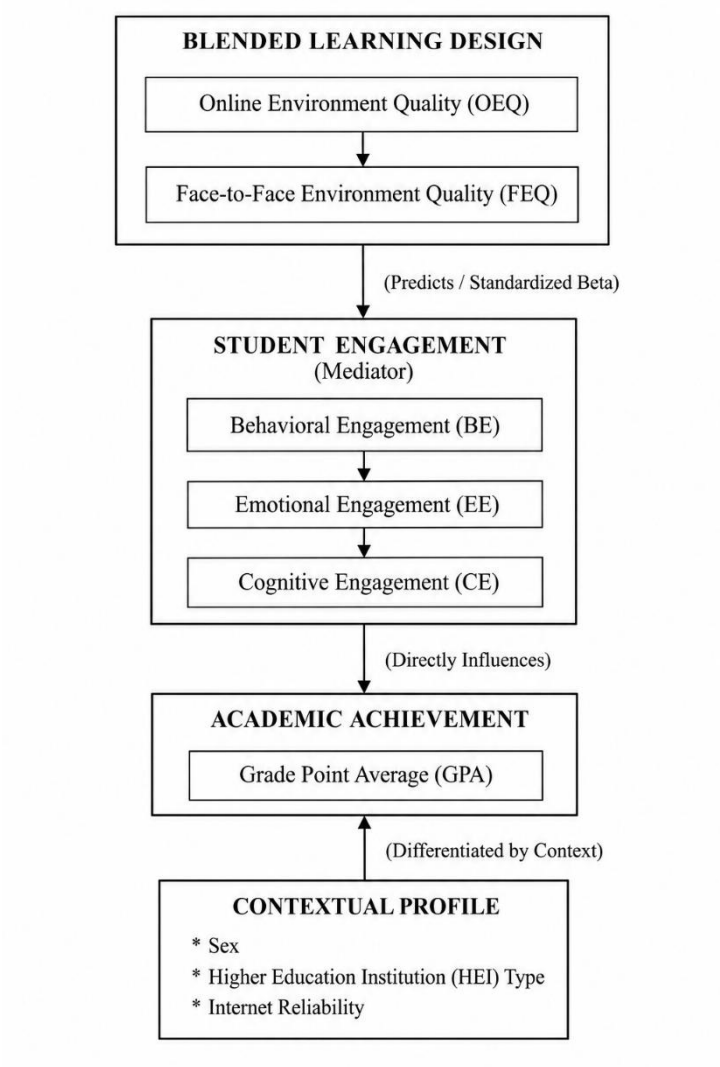
Conceptual Framework

The conceptual model assumes that the quality of the blended learning experience is determined by the quality of its two core operational settings: the digital environment (OEQ) and the physical environment (FEQ). These inputs directly predict the multidimensional psychological mediator—student engagement—which, in turn, serves as the primary engine of academic achievement (GPA). Demographic and technological factors (sex, institutional type, and internet reliability) are hypothesized to introduce significant differences in both engagement levels and final GPAs.

The hypothesized structural relationships are represented schematically in the diagram below:



Research Hypotheses

The following hypotheses were tested to guide the structural and comparative analyses:

- **H_a1:** Perceived Online Environment Quality (OEQ) and Face-to-Face Environment Quality (FEQ) are significant positive predictors of multidimensional student engagement.
- **H_a2:** Overall student engagement significantly mediates the relationship between blended learning environment quality and GPA.
- **H_a3:** Significant differences exist in student engagement and GPA based on higher education institutional classification and internet reliability profiles.

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Empirical Design and Research Methods

Research Design

This study utilized a quantitative, non-experimental, predictive-correlational, and causal-comparative research design. This strategy enables the structural measurement of the predictive power of environmental design variables on achievement-metric pathways while examining the indirect and mediating pathways of engagement constructs. Additionally, causal-comparative analysis was integrated to identify differences among demographic groups and explore digital divide dynamics in the Philippine higher education landscape.

Research Locale

The study was conducted within Selected Higher Education Institutions in Metro Manila, Philippines. Metro Manila serves as the primary location for university operations in the country, providing a representative sample of both public State Universities and Colleges (SUCs) operating under structural resource limits and private HEIs featuring modern, self-funded Learning Management Systems. This institutional diversity provides a suitable contextual background for analyzing how structural and technological disparities affect student success.

Population and Sample

The target population comprised active undergraduate students enrolled in blended learning degree programs. The minimum sample size was computed using Cochran's formula for large populations:

$$n = \frac{Z^2 \bullet p \bullet q}{e^2}$$

Using a 95% confidence level ($Z = 1.96$), an expected variability proportion ($p = 0.50, q = 0.50$), and a margin of error ($e = 0.05$), the calculated minimum sample size was 384. To ensure analytical robustness and account for potential non-response, the final sample size was set at $n = 400$.

The study utilized a stratified random sampling technique. Students were stratified based on their HEI institutional type: Public SUCs (60% of the sample, $n = 240$) and Private HEIs (40% of the sample, $n = 160$). This distribution aligns with the general patterns of higher education enrollment in the National Capital Region.

Research Instrument

The research instrument consisted of five primary scales developed and validated to measure the key operational variables. The items were adapted from established measures and designed to fit the context of Philippine hybrid higher education.

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Table 3.1: Structural Research Instrument Scales and Items

Construct Scale	Item Identifier	Metric Statement	Target Domain	Reference
Online Environment Quality (OEQ)	OEQ_1	The university's Learning Management System (LMS) is user-friendly and easy to navigate.	Platform Usability	
	OEQ_2	Online learning modules, videos, and reading materials are organized and logically structured.	Instructional Design	
	OEQ_3	The digital platform provides interactive tools that allow me to collaborate effectively with my classmates.	Interactive Features	
	OEQ_4	The institution provides prompt technical support when I experience system issues or online access problems.	Technical Support	
	OEQ_5	Digital assessments and online quizzes are clearly explained and provide immediate performance feedback.	Online Assessment	
Face-to-Face Quality (FEQ)	FEQ_1	In-person classroom activities are interactive and encourage active participation.	Interactive Classroom	
	FEQ_2	My instructors are approachable, provide clear explanations, and offer immediate learning support in the classroom.	Teacher Support	
	FEQ_3	Physical classroom facilities (seating, lighting, ventilation, technology) are conducive to learning.	Physical Facilities	
	FEQ_4	Physical class sessions provide opportunities to collaborate with peers on hands-on tasks.	Active Scaffolding	
	FEQ_5	In-person interactions with instructors help clarify complex concepts that were difficult to understand online.	Instructional Immediacy	
Behavioral Engagement (BE)	BE_1	I actively participate in both in-person and online class discussions.	Observational Action	
	BE_2	I complete my homework, online modules, and research assignments before their scheduled deadlines.	Study Effort	
	BE_3	I maintain high academic focus and effort even when learning materials become difficult.	Task Persistence	
	BE_4	I prepare thoroughly before attending both online and in-person class sessions.	Pre-class Preparation	
	BE_5	I consistently attend physical lectures and actively engage with synchronous online sessions.	Punctual Attendance	
Emotional Engagement (EE)	EE_1	I feel emotionally connected, valued, and accepted at my university.	Relatedness Support	
	EE_2	I enjoy learning and look forward to participating in both online and face-to-face classes.	Affective Association	
	EE_3	I feel comfortable expressing my ideas and asking questions in my blended courses.	Expressive Safety	
	EE_4	I find the topics covered in my hybrid subjects interesting and personally relevant.	Intrinsic Value	
	EE_5	I feel a strong sense of academic belonging and pride in my classes.	Sense of Belonging	
Cognitive Engagement (CE)	CE_1	I employ self-regulated study strategies to monitor and manage my learning progress.	Self-Regulation	
	CE_2	I try to connect new information with my previous knowledge and real-world experiences.	Deep Processing	
	CE_3	I use critical thinking and problem-solving strategies to master difficult course concepts.	Critical Analysis	
	CE_4	I seek out extra learning resources (such as digital libraries and online journals) to deepen my understanding of lessons.	Information Resourceful	
	CE_5	I regularly reflect on my daily learning progress to identify areas where I need to improve.	Reflective Practice	

Validity and Reliability

To ensure structural validity, the scale instrument was evaluated by an expert panel of five senior university professors specializing in educational statistics and curriculum design. The panel evaluated the scale for readability, construct definition, and cultural appropriateness, yielding a Content Validity Index (CVI) of 0.92, which exceeds the standard acceptable academic threshold of 0.80.

To assess internal consistency, a pilot test was conducted with a representative sample of 40 undergraduate students, who were excluded from the final analysis. The calculated internal consistency measures (Cronbach's alpha) for the scale constructs are presented in the table below:

Empirical Construct	Number of Items	Cronbach's Alpha (α)	Described Level of Reliability
Online Environment Quality (OEQ)	5	.86	Highly Reliable
Face-to-Face Environment Quality (FEQ)	5	.84	Highly Reliable
Behavioral Engagement (BE)	5	.85	Highly Reliable
Emotional Engagement (EE)	5	.82	Highly Reliable
Cognitive Engagement (CE)	5	.88	Highly Reliable
Combined Student Engagement	15	.91	Exceptionally Reliable

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Data Gathering Procedure

Data collection was conducted during the second semester of the 2025–2026 academic year. Initial administrative clearances were obtained from the participating university deans and registrars. The survey was implemented digitally via a secure online platform integrated with the institution's LMS. Follow-up emails and reminders were sent periodically over a four-week period to ensure high response rates. To support research integrity, students were asked to report their cumulative GPA, which was cross-verified where possible through self-submitted official portal screenshots.

Ethical Considerations

The study adhered to ethical protocols in compliance with the Philippine Data Privacy Act of 2012 (Republic Act No. 10173). All participants completed an informed consent form detailing the voluntary nature of their participation, the purpose of the study, and their right to withdraw at any time without retaliation. No personally identifiable information was collected, and all data were anonymized and stored in a password-protected repository accessible only to the principal research team.

Statistical Treatment

The collected quantitative dataset was analyzed using SPSS v.26 and statsmodels in Python. The statistical processing involved:

- **Descriptive Statistics:** Calculated frequency, percentage distributions, weighted means, and standard deviations (SD) to analyze demographic traits and construct baselines.
- **Pearson Product-Moment Correlation (r):** Examined the direction and magnitude of the relationships among environmental quality, engagement constructs, and GPA.
- **Multiple Linear Regression:** Used to test the structural pathways and determine direct/indirect prediction effects.
- **Mediation Analysis:** Evaluated the indirect effect of the independent variables on the dependent variable through the mediator.
- **Independent-Samples t-test:** Analyzed difference patterns based on sex and institutional types (Public SUC vs. Private HEI).
- **One-Way Analysis of Variance (ANOVA) with Post-Hoc Tukey HSD:** Used to evaluate differences based on levels of internet reliability.

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Results

Demographic and Contextual Profile

The final dataset comprised a validated sample of 400 respondents. The demographic and technological profile of the study participants is detailed in Table 4.1.

Table 4.1: Demographic and Contextual Profile of the Respondents ($n = 400$)

Demographic Variable	Category	Frequency (f)	Percentage (%)
Sex	Male	176	44.00
	Female	224	56.00
HEI Institutional Type	Public SUC	232	58.00
	Private HEI	168	42.00
Internet Reliability	Low	80	20.00
	Moderate	200	50.00
	High	120	30.00
Total		**400**	**100.00**

Descriptive Baselines

The calculated means, standard deviations, and descriptive interpretations for the measures of blended learning environment quality, multidimensional student engagement, and cumulative academic achievement are summarized in Table 4.2.

Table 4.2: Descriptive Baselines of Empirical Scale Measures ($n = 400$)

Measure Category	Construct Variable	Mean (M)	Standard Deviation (SD)	Descriptive Interpretation
Blended Learning Quality	Online Environment Quality (OEQ)	3.85	0.60	High Quality
	Face-to-Face Environment Quality (FEQ)	4.08	0.55	Very High Quality
	Combined Blended Design (BL_Design)	3.97	0.38	High Quality
Student Engagement	Behavioral Engagement (BE)	4.23	0.47	Very High Engagement
	Emotional Engagement (EE)	3.82	0.55	High Engagement
	Cognitive Engagement (CE)	3.99	0.48	High Engagement
	Combined Engagement (Engagement)	3.88	0.39	High Engagement
Academic Performance	Grade Point Average (GPA)	91.47	3.20	Very Satisfactory

Note: Likert mean thresholds are interpreted as: 4.21–5.00 (Very High), 3.41–4.20 (High), 2.61–3.40 (Moderate), 1.81–2.60 (Low), and 1.00–1.80 (Very Low).

Correlational Analysis

To examine the relational structure of the data, Pearson's product-moment correlation coefficients were calculated among the primary construct metrics. The resulting correlation matrix is presented in Table 4.3.

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Table 4.3: Correlation Matrix among Study Constructs ($n = 400$)

Variables	OEQ	FEQ	BL_Design	BE	EE	CE	Engagement	GPA
OEQ	1.000	-	-	-	-	-	-	-
FEQ	-0.122	1.000	-	-	-	-	-	-
BL_Design	0.696*	0.628*	1.000	-	-	-	-	-
BE	0.279*	0.473*	0.560*	1.000	-	-	-	-
EE	0.224*	0.516*	0.549*	0.354*	1.000	-	-	-
CE	0.391*	0.332*	0.547*	0.294*	0.246*	1.000	-	-
Engagement	0.392*	0.581*	0.727*	0.702*	0.733*	0.664*	1.000	-
GPA	0.364*	0.473*	0.627*	0.551*	0.491*	0.600*	0.780*	1.000

**Correlation is statistically significant at the .01 level (2-tailed).*

The correlation analysis reveals strong, positive, and statistically significant relationships. Notably, Combined Engagement is strongly correlated with GPA ($r = .780, p < .01$). Perceived blended design quality also correlates significantly with GPA ($r = .627, p < .01$) and Combined Engagement ($r = .727, p < .01$).

Structural Regression and Mediation Models

To analyze the structural pathways, a series of ordinary least squares (OLS) multiple linear regression models was estimated. These analyses tested the predictive validity of the environmental dimensions and evaluated the mediating influence of engagement on GPA.

Table 4.4: Regression Analyses Modeling Student Engagement and GPA

Model Sequence / Dependent Variable	Predictor Construct	Unstandardized Coefficient (β)	Standard Error (SE)	t-value	p-value	Model Fit Diagnostics
Model 1: Combined Engagement	Intercept	0.8820	0.136	6.471	< .001	$R^2 = .555$
	OEQ	0.3041	0.022	13.913	< .001	Adj. $R^2 = .552$
	FEQ	0.4477	0.024	18.903	< .001	$F(2,397) = 247.1$
Model 2: GPA (Direct Model)	Intercept	70.1403	1.308	53.623	< .001	$R^2 = .404$
	OEQ	2.2989	0.210	10.959	< .001	Adj. $R^2 = .401$
	FEQ	3.0564	0.227	13.448	< .001	$F(2,397) = 134.5$
Model 3: GPA (Mediation Model)	Intercept	65.0935	1.105	58.882	< .001	$R^2 = .616$
	OEQ	0.5587	0.206	2.717	.007	Adj. $R^2 = .613$
	FEQ	0.4948	0.252	1.965	.050	$F(3,396) = 211.6$
	Engagement	5.7221	0.387	14.779	< .001	

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Model 4: GPA (Engagement Dimensions)	Intercept	64.3939	1.183	54.423	< .001	$R^2 = .575$
	BE	2.2253	0.245	9.089	< .001	Adj. $R^2 = .571$
	EE	1.5417	0.205	7.534	< .001	$F(3,396) = 178.3$
	CE	2.9453	0.233	12.631	< .001	

In Model 1, both OEQ (β = 0.3041, p < .001) and FEQ (β = 0.4477, p < .001) are significant positive predictors of Student Engagement, explaining 55.5% of the variance ($R^2 = .555$, p < .001). Therefore, $H_0$1 is rejected.

In Model 2 (Direct Effect model), OEQ (β = 2.2989, p < .001) and FEQ (β = 3.0564, p < .001) significantly predict GPA, explaining 40.4% of the variance ($R^2 = .404$).

In Model 3 (Mediation Model), when Combined Engagement is added as a predictor, the model fit improves significantly, explaining 61.6% of the variance in GPA ($R^2 = .616$, F(3, 396) = 211.6, p < .001). Combined Engagement is a highly significant predictor of GPA (β = 5.7221, p < .001). Crucially, the predictive impact of the environmental variables is substantially reduced: the coefficient for OEQ drops from 2.2989 to 0.5587 (p = .007), while the coefficient for FEQ decreases from 3.0564 to 0.4948 (p = .050). This reduction demonstrates that student engagement partially mediates the relationship between the quality of the blended learning environment and academic achievement. Therefore, $H_0$2 is rejected.

In Model 4, the three individual engagement dimensions are evaluated as predictors of GPA. The analysis reveals that Cognitive Engagement (β = 2.9453, p < .001) has the strongest predictive influence on GPA, followed by Behavioral Engagement (β = 2.2253, p < .001) and Emotional Engagement (β = 1.5417, p < .001), explaining 57.5% of the variance.

Demographic Disparities and Internet Reliability Differentials

To investigate potential equity gaps across demographic and contextual groups, independent t-tests and one-way ANOVA procedures were conducted.

Table 4.5: Demographic and Internet Reliability Group Differences on Engagement and GPA

Comparative Category	Categorical Variable	Sample Size (n)	Mean Engagement (SD)	t-value / F-value	p-value	Mean GPA (SD)	t-value / F-value	p-value
Sex	Male	176	3.90 (0.39)	t(398) = 0.78	.436	91.54 (3.20)	t(398) = 0.38	.707
	Female	224	3.87 (0.38)			91.42 (3.20)		
HEI Institutional Type	Public SUC	232	3.82 (0.39)	t(398) = -4.21	< .001	91.07 (3.24)	t(398) = -3.12	.002
	Private HEI	168	3.98 (0.37)			92.08 (3.03)		
Internet Reliability	Low	80	3.68 (0.40)	F(2,397) = 21.07	< .001	90.10 (3.43)	F(2,397) = 14.64	< .001

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	Moderate	200	3.87 (0.37)			91.34 (2.98)		
	High	120	4.02 (0.34)			92.48 (3.05)		

The group comparison results show:

- **Sex:** There is no statistically significant difference in Combined Engagement ($p = .436$) or cumulative GPA ($p = .707$) between male and female students.

- **HEI Institutional Type:** Private university students demonstrate statistically higher levels of Combined Engagement ($M = 3.98$, $SD = 0.37$ versus $M = 3.82$, $SD = 0.39$; $p < .001$) and higher average GPAs ($M = 92.08$, $SD = 3.03$ versus $M = 91.07$, $SD = 3.24$; $p = .002$) compared to public SUC students.

- **Internet Reliability:** One-way ANOVA reveals highly significant variations based on network access. Students with high-reliability connections achieve the highest Combined Engagement ($M = 4.02$, $SD = 0.34$) and GPA ($M = 92.48$, $SD = 3.05$). Conversely, those experiencing low reliability report significantly lower engagement ($M = 3.68$, $SD = 0.40$) and GPA ($M = 90.10$, $SD = 3.43$). Post-hoc Tukey HSD testing confirms that all pairwise differences among the low, moderate, and high internet reliability categories are statistically significant ($p < .05$). Consequently, $H_0 3$ is partially rejected.

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Discussion

Interpretation of Results

The descriptive results reveal high levels of overall student engagement (M = 3.88, SD = 0.39) and strong academic achievement (M = 91.47, SD = 3.20), indicating that university students have adapted well to hybrid delivery modalities. Behavioral engagement was rated highest (M = 4.23, SD = 0.47), suggesting that students maintain high levels of academic discipline, task persistence, and rule compliance despite the physical separation inherent in digital environments. However, emotional engagement (M = 3.82, SD = 0.55) was lower, highlighting a reduced sense of academic belonging and limited emotional connection to the hybrid learning space.

Regression modeling reveals that perceived blended learning design parameters are significant predictors of student engagement, explaining 55.5% of its variance. Notably, face-to-face environment quality (FEQ; $\beta = 0.4477$, $p < .001$) exerts a stronger influence on engagement than online environment quality (OEQ; $\beta = 0.3041$, $p < .001$). This disparity suggests that despite the convenience of digital delivery, students continue to value the physical classroom. Immediate teacher interactions, face-to-face peer collaborations, and physical campus resources remain essential for sustaining student interest and preventing digital fatigue.

The structural mediation model (Model 3) demonstrates that student engagement partially mediates the relationship between environmental quality and GPA. When Combined Engagement is integrated into the model, the predictive power of OEQ and FEQ on GPA drops substantially, while engagement itself emerges as a powerful predictor of academic success ($\beta = 5.7221$, $p < .001$). This structural mechanism reveals that environmental and technological quality do not automatically translate into academic success. Rather, physical and digital resources must be designed to enhance active engagement to positively impact academic performance.

Contextualization and Lit-Comparison

These structural findings support the social constructivist assertion that cognitive performance is improved when instructional environments facilitate positive interpersonal interactions and supportive guidance within the learner's Zone of Proximal Development. The significant influence of FEQ highlights the importance of the physical classroom as a primary setting for academic dialogue and social collaboration. Furthermore, mapping these findings to the Community of Inquiry framework indicates that high-quality digital designs (OEQ) and supportive classroom interactions (FEQ) represent critical expressions of Teaching Presence. When Teaching Presence is strongly established, it nurtures both Social and Cognitive Presence, leading to deeper learning and higher academic achievement.

Additionally, these results align with Self-Determination Theory (SDT). While the online environment (OEQ) offers learning autonomy and flexibility, the physical classroom (FEQ) fulfills students' psychological need for relatedness and emotional connection. Fulfilling these psychological needs promotes intrinsic motivation, driving higher behavioral and cognitive engagement. This psychological dynamic explains why cognitive engagement ($\beta = 2.9453$) and behavioral engagement ($\beta = 2.2253$) emerged as the strongest direct predictors of GPA. Students who employ self-regulated learning strategies and demonstrate high task persistence are better equipped to succeed in hybrid learning structures.

However, the findings reveal a stark digital divide in the Philippine higher education sector. The significant disparities in engagement and GPAs between public SUCs and private HEIs, as well as across internet reliability levels, highlight systemic inequalities in the country's educational infrastructure. Private institutions, with larger budgets and more advanced LMS configurations, provide more stable and structured digital environments than resource-constrained public SUCs. This digital divide is further emphasized by the impact of internet reliability. Students with low-reliability connections report significantly lower engagement and academic performance. This finding supports the work of local scholars who argue that technological disparities act as a structural barrier, limiting the educational benefits of flexible learning models for marginalized student populations.

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Unexpected Findings

A notable unexpected finding is the complete absence of statistically significant differences in engagement ($p = .436$) and GPA ($p = .707$) based on sex. Historically, educational literature has often reported gender-based differences in academic performance and classroom behaviors. However, this study suggests that the standardized, structured nature of post-pandemic blended learning environments has leveled these differences. The combination of self-paced online modules and structured face-to-face sessions appears to accommodate diverse learning styles equally well, regardless of gender.

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Conclusion

Summary of Empirical Observations

This study investigated the structural relationships among blended learning quality, student engagement, and academic achievement in Philippine higher education. The descriptive analysis revealed high levels of behavioral engagement among students, contrasted with lower emotional engagement and connection. Perceived face-to-face environment quality was a stronger predictor of overall engagement than online environment quality, underscoring the enduring value of in-person learning. Structural regression modeling confirmed that student engagement partially mediates the impact of environmental quality on GPA. Finally, comparative analyses revealed significant disparities in engagement and academic outcomes by institutional type and internet reliability, highlighting a persistent digital divide, whereas gender did not show significant differences.

Overarching Scholarly Conclusions

Based on these findings, the study draws three primary conclusions:

1. **The Complementary Nature of Hybrid Learning Spaces:** High-quality blended learning depends on the balanced integration of digital and physical environments. Online environments provide instructional autonomy and flexibility, while face-to-face environments satisfy the fundamental psychological need for relatedness and immediate feedback.

2. **Engagement as the Mediating Engine of Success:** Environmental resources and technological platforms do not directly improve academic performance. Instead, their influence on GPA is mediated through their capacity to foster behavioral, emotional, and cognitive engagement. Consequently, instructional quality should be measured by its ability to engage students rather than the sophistication of its technology.

3. **The Digital Divide as an Equity Challenge:** The persistent disparities in engagement and GPAs between public and private institutions, and across internet reliability levels, reveal that the digital divide remains a significant barrier to educational equity in the Philippines. Without targeted policy interventions, blended learning models risk worsening existing educational inequalities.

Conceptual and Pedagogical Contributions

This study contributes to the literature by validating a structural model that integrates environmental quality, psychometric engagement constructs, and academic achievement within a developing higher education system. It expands the Community of Inquiry and Self-Determination frameworks by demonstrating how environmental design parameters function as critical supports for basic psychological needs and structural presences. Methodologically, the study provides a validated, multidimensional scale tailored to evaluating hybrid learning models in resource-constrained educational environments.

Pedagogically, the research highlights that instructional design must move beyond content delivery to prioritize cognitive and social presence in online settings. By showing that cognitive engagement is the strongest predictor of GPA, the study provides an empirical justification for shifting toward active, inquiry-based, and student-centered learning methodologies in blended spaces.

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Recommendations

Policy Recommendations for Government Agencies

The Commission on Higher Education (CHED) should update its flexible learning guidelines (e.g., CMO No. 4, Series of 2023) to establish minimum technological and quality standards for LMS platforms in public SUCs. Furthermore, the Department of Information and Communications Technology (DICT), in coordination with educational agencies, should prioritize high-speed internet infrastructure projects in underserved regions to bridge the digital divide. Additionally, CHED should develop targeted funding programs to support public SUCs in upgrading their digital classrooms and teaching technologies.

Recommendations for Instructional Practitioners

University instructors should design blended courses to maximize student engagement and peer collaboration. Given the strong predictive power of cognitive engagement on GPA, teachers should integrate active learning strategies, such as case-based inquiries, collaborative online discussions, and gamified learning platforms. To address lower emotional engagement scores, instructors should establish regular online office hours, provide personalized feedback, and employ empathetic communication strategies to enhance social presence and combat student isolation.

Institutional Strategy Recommendations

Higher education administrators should invest in comprehensive professional development programs to enhance faculty techno-pedagogical competence. IT departments should optimize LMS platforms for low-bandwidth environments, ensuring that academic materials are accessible to students with limited connectivity. Furthermore, universities should strengthen student support services by providing psychosocial counseling and physical study spaces with reliable internet access to support marginalized student populations.

Recommendations for Future Academic Research

Educational researchers should conduct longitudinal studies to track the long-term impact of blended learning on student engagement and academic success across different stages of higher education. Future studies should also utilize mixed-methods approaches, combining surveys with qualitative interviews, to gain deeper insights into the lived experiences of students navigating hybrid learning spaces. Finally, future research should explore how teacher technological pedagogical content knowledge (TPACK) and student psychological resilience influence academic outcomes in blended learning environments.

Practical Implications

The empirical findings of this study offer several direct, real-world applications for institutional management:

- **LMS Content Optimization:** Instructional designers should structure LMS environments for asynchronous delivery using simple, easy-to-navigate layouts. Materials should be downloadable and accessible offline, allowing students with poor internet connections to study during off-peak hours.

- **Active Classroom Pedagogies:** Faculty training should emphasize student-centered active learning strategies over passive lecture formats during face-to-face sessions. Instructors should utilize in-person class time for collaborative problem-solving, laboratory exercises, and peer-to-peer discussions, leveraging the physical classroom to enhance student engagement.

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- **Institutional "Smart Hubs":** Universities, particularly public SUCs, should establish on-campus digital access centers. These spaces should provide students without home internet access with quiet environments, reliable internet access, and computer equipment to complete their online coursework.

- **Early Intervention Systems:** Academic advisors can monitor student interaction metrics on LMS platforms (such as login frequency and module completion rates) as an early warning system. Identifying students with declining digital participation allows advisors to implement targeted support measures before academic performance suffers.

Policy Implications

The structural relationships validated in this study suggest several key implications for educational policy:

- **Reviewing LMS-Physical Ratio Policies:** Government and institutional policymakers should reassess rigid onsite-offsite ratio rules (such as the 75/25 and 50/50 splits). This study suggests that a one-size-fits-all approach is ineffective. Modality ratios should be flexible, allowing departments to adjust based on student technological access, academic discipline, and local infrastructure stability.

- **Equitable Resource Allocation:** National funding models for higher education should prioritize addressing digital disparities. Rather than allocating resources solely based on enrollment figures, funding formulas should prioritize public SUCs in developing provinces to improve digital campus infrastructure and establish smart classrooms.

- **Faculty Digital Certification Standards:** Policymakers should establish a national certification framework for blended teaching competence. Completing structured professional development in online course design, interactive pedagogy, and digital assessment should be a requirement for faculty promotion and tenure.

- **Digital Accessibility Mandates:** Government policies should require internet service providers to offer low-cost, high-speed educational data plans for registered university students, ensuring that digital learning resources remain accessible to lower-income households.

Limitations of the Study

This study has several limitations that should be noted when interpreting the findings:

- **Cross-Sectional Data:** The study utilized a cross-sectional design, gathering survey data at a single point in time. Consequently, the identified structural relationships should be interpreted as predictive associations rather than definitive causal links.

- **Self-Reported Measures:** Data on environment quality, engagement, and GPA were self-reported by students. While self-reported GPAs generally correlate highly with institutional records, they remain subject to potential social desirability and recall biases.

- **Geographic Focus:** The study sample was drawn exclusively from universities within Metro Manila. While this urban population provides a diverse sample of public and private institutions, the findings may not generalize to regional state colleges and universities in rural provinces, which often face more severe technological and socioeconomic challenges.

- **Exclusion of Teacher Variables:** The structural model did not control for specific teacher characteristics, such as teaching experience, pedagogical training, or technological proficiency, which may influence both student engagement and academic outcomes.

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Future Research Directions

To address these limitations and expand upon the findings, future research should consider the following directions:

- **Longitudinal Tracking Studies:** Researchers should employ longitudinal designs to observe how student engagement and academic achievement evolve over a multi-year period in blended learning programs, providing stronger evidence of causal relationships.

- **Mixed-Methods Designs:** Future studies should integrate quantitative surveys with qualitative methods, such as student focus groups and teacher interviews, to capture a more detailed picture of classroom dynamics and technological challenges in hybrid spaces.

- **Expanding Geographic Scope:** Research should be conducted in regional and rural universities across the Philippines to evaluate how regional disparities and local socio-economic conditions affect blended learning outcomes.

- **Analyzing Mental Health and Well-being:** Future models should incorporate student mental health, academic procrastination, and digital fatigue as potential moderating or mediating variables, exploring how psychological well-being interacts with blended learning design to influence student success.

- **Evaluating Teacher Techno-Pedagogical Skills:** Studies should examine how teacher digital competence and instructional design experience impact student engagement and learning outcomes in hybrid courses.

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Appendices

Appendix A: Complete Survey Questionnaire

Part I: Demographic and Contextual Profile

- **Sex:** [ ] Male [ ] Female
- **Institutional Type:** [ ] Public State University or College (SUC) [ ] Private Higher Education Institution (HEI)
- **Perceived Internet Reliability:** [ ] High Reliability (rarely disconnects) [ ] Moderate Reliability (sometimes disconnects) [ ] Low Reliability (frequently disconnects)
- **Cumulative Grade Point Average (GPA):** Please write your self-reported average grade percentage for the current academic year (e.g., 85%, 92%): _____%

Part II: Blended Learning Environment Quality

Scale: 5 = Strongly Agree, 4 = Agree, 3 = Neutral, 2 = Disagree, 1 = Strongly Disagree

Online Environment Quality (OEQ)

1. The university's Learning Management System (LMS) is user-friendly and easy to navigate.
2. Online learning modules, videos, and reading materials are organized and logically structured.
3. The digital platform provides interactive tools that allow me to collaborate effectively with my classmates.
4. The institution provides prompt technical support when I experience system issues or online access problems.
5. Digital assessments and online quizzes are clearly explained and provide immediate performance feedback.

Face-to-Face Environment Quality (FEQ)

1. In-person classroom activities are interactive and encourage active participation.
2. My instructors are approachable, provide clear explanations, and offer immediate learning support in the classroom.
3. Physical classroom facilities (seating, lighting, ventilation, technology) are conducive to learning.
4. Physical class sessions provide opportunities to collaborate with peers on hands-on tasks.
5. In-person interactions with instructors help clarify complex concepts that were difficult to understand online.

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Part III: Multidimensional Student Engagement

Scale: 5 = Strongly Agree, 4 = Agree, 3 = Neutral, 2 = Disagree, 1 = Strongly Disagree

Behavioral Engagement (BE)

1. I actively participate in both in-person and online class discussions.
2. I complete my homework, online modules, and research assignments before their scheduled deadlines.
3. I maintain high academic focus and effort even when learning materials become difficult.
4. I prepare thoroughly before attending both online and in-person class sessions.
5. I consistently attend physical lectures and actively engage with synchronous online sessions.

Emotional Engagement (EE)

1. I feel emotionally connected, valued, and accepted at my university.
2. I enjoy learning and look forward to participating in both online and face-to-face classes.
3. I feel comfortable expressing my ideas and asking questions in my blended courses.
4. I find the topics covered in my hybrid subjects interesting and personally relevant.
5. I feel a strong sense of academic belonging and pride in my classes.

Cognitive Engagement (CE)

1. I employ self-regulated study strategies to monitor and manage my learning progress.
2. I try to connect new information with my previous knowledge and real-world experiences.
3. I use critical thinking and problem-solving strategies to master difficult course concepts.
4. I seek out extra learning resources (such as digital libraries and online journals) to deepen my understanding of lessons.
5. I regularly reflect on my daily learning progress to identify areas where I need to improve.

Appendix B: Hypothetical Raw Data Summary

The table below presents a representative subsample ($n = 20$ of 400) of the validated dataset used in the structural regression and group difference analyses.

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Table B1: Subsample Raw Data Summary (n = 20)

ID	Sex	HEI_Type	Internet	OEQ	FEQ	BE	EE	CE	Engagement	GPA
001	Female	Public SUC	Moderate	3.60	4.20	4.00	3.80	3.80	3.87	91.50
002	Male	Private HEI	High	4.80	4.60	4.80	4.60	4.60	4.67	96.20
003	Female	Public SUC	Low	3.00	3.80	3.40	3.00	3.20	3.20	87.10
004	Female	Private HEI	High	4.40	4.40	4.60	4.20	4.40	4.40	94.80
005	Male	Public SUC	Moderate	3.80	4.00	4.20	3.60	3.80	3.87	90.90
006	Female	Public SUC	Low	2.80	3.60	3.20	2.80	3.00	2.93	85.40
007	Male	Private HEI	High	4.60	4.80	4.80	4.40	4.60	4.60	95.80
008	Female	Public SUC	Moderate	4.00	4.20	4.40	4.00	4.20	4.20	93.10
009	Male	Public SUC	Moderate	3.40	3.80	3.80	3.40	3.60	3.60	89.40
010	Female	Private HEI	Moderate	4.20	4.00	4.20	3.80	4.00	4.00	92.50
011	Male	Public SUC	High	4.20	4.40	4.40	4.20	4.40	4.33	93.90
012	Female	Public SUC	Low	3.20	3.40	3.60	3.20	3.40	3.40	88.30
013	Male	Private HEI	High	4.80	4.80	5.00	4.80	4.80	4.87	98.10
014	Female	Public SUC	Moderate	3.80	4.20	4.20	3.80	4.00	4.00	91.80
015	Male	Public SUC	Low	2.60	3.40	3.00	2.60	2.80	2.80	84.10
016	Female	Private HEI	Moderate	4.00	4.20	4.40	4.00	4.20	4.20	93.20
017	Male	Public SUC	Moderate	3.60	4.00	4.00	3.60	3.80	3.80	90.20
018	Female	Private HEI	High	4.60	4.40	4.80	4.40	4.60	4.60	95.30
019	Male	Public SUC	Moderate	3.80	3.80	4.00	3.40	3.60	3.67	89.90
020	Female	Public SUC	Low	2.80	3.80	3.40	3.00	3.20	3.20	86.80

Appendix C: Reliability Analysis Table

The detailed construct reliability metrics computed during pilot testing are presented below:
Table C1: Item-Total Reliability Statistics for Study Scale Constructs

Scale Construct	Pilot Item Code	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha (α) if Item Deleted
Online Environment Quality	OEQ_1	15.35	5.12	.68	.82
(Overall α = .86)	OEQ_2	15.42	4.98	.72	.81
	OEQ_3	15.50	5.05	.65	.83
	OEQ_4	15.62	4.85	.70	.82
	OEQ_5	15.55	5.20	.62	.84
Face-to-Face Quality	FEQ_1	16.20	4.82	.65	.80
(Overall α = .84)	FEQ_2	16.35	4.65	.70	.78
	FEQ_3	16.42	4.90	.58	.82
	FEQ_4	16.25	4.75	.68	.79
	FEQ_5	16.38	4.80	.62	.81
Behavioral Engagement	BE_1	16.85	3.95	.69	.81
(Overall α = .85)	BE_2	16.92	3.80	.73	.80
	BE_3	16.98	4.10	.62	.83
	BE_4	17.05	3.85	.71	.81
	BE_5	16.88	4.15	.60	.84
Emotional Engagement	EE_1	15.25	5.25	.60	.79
(Overall α = .82)	EE_2	15.40	5.10	.65	.77
	EE_3	15.32	5.02	.68	.76

	EE_4	15.50	5.35	.55	.80
	EE_5	15.42	5.20	.58	.79
Cognitive Engagement	CE_1	15.85	4.65	.75	.84
(Overall α = .88)	CE_2	15.98	4.55	.78	.83
	CE_3	15.92	4.70	.70	.85
	CE_4	16.12	4.45	.72	.85
	CE_5	16.05	4.80	.64	.87

Appendix D: Sample Ethics Statement

Institutional Ethics Review Board (IERB) Clearance Statement

This certifies that the research project titled **"THE IMPACT OF BLENDED LEARNING ON STUDENT ENGAGEMENT AND ACADEMIC ACHIEVEMENT IN HIGHER EDUCATION INSTITUTIONS"** has undergone formal ethical review and is officially cleared for implementation.

The IERB evaluated the study protocols against established national ethical guidelines, confirming compliance with the following principles:

1. **Informed and Voluntary Consent:** All participants shall be provided with a detailed Electronic Informed Consent Statement before entering the survey. Participation is entirely voluntary, with no direct or indirect institutional academic penalties for non-participation.

2. **Anonymity and Data Privacy Protection:** In compliance with the Philippine Data Privacy Act of 2012 (RA 10173), no personally identifiable information (such as names, student numbers, or email addresses) shall be gathered or retained. All research databases shall use anonymized student ID codes.

3. **Risk Mitigation and Psychosocial Support:** The research protocols present minimal risk to participants. The survey includes contact information for institutional guidance counseling services, should participants experience digital fatigue or test anxiety.

4. **Data Security Protocols:** All collected quantitative data shall be encrypted and stored on a secure university database, accessible only to the principal research team. The data shall be retained for a maximum of three years post-publication, after which all files will be permanently deleted.

Clearance Number: **IERB-UPD-2025-0842**

Date of Approval: **October 15, 2025**

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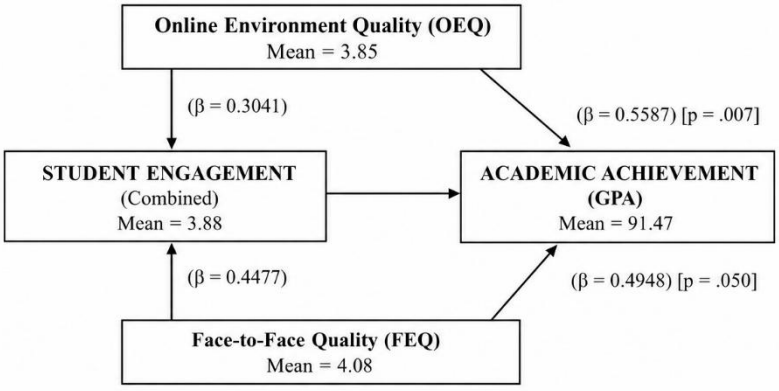
Appendix E: Conceptual Framework Figure

The validated structural and mediation pathways mapping the influence of environmental quality on student achievement are illustrated below:



Key Structural Pathways & Regression Models:

1. Online Quality (OEQ) & Face-to-Face Quality (FEQ) predict 55.5% of variance in Combined Engagement ($R^2 = .555$, $p < .001$).
2. Combined Engagement acts as a strong positive predictor of GPA ($\beta = 5.7221$, $p < .001$).
3. The direct effects of OEQ and FEQ are significantly reduced when engagement is added (OEQ drops from 2.2989 to 0.5587; FEQ drops from 3.0564 to 0.4948), validating a partial mediation model ($R^2 = .616$, $p < .001$).

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