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## RESEARCH ARTICLE

**Blended Learning, Student Engagement and Learning Outcomes: Evidence from Universities in Uganda**<sup>a</sup>James Kizza, <sup>b</sup>Nakku Maria Elizabeth Mirembe, <sup>a</sup>Mubiru Pontious, <sup>a</sup>Kato Fredrick, <sup>a</sup>Aber Prisca<sup>a</sup> Faculty of Business and ICT, University of Kisubi, Uganda.<sup>b</sup> Faculty of Education, University of Kisubi, Uganda.**Corresponding Author**James Kizza, Email: [kizzajames2016@gmail.com](mailto:kizzajames2016@gmail.com)**Author's Contributions**

All authors contributed equally to this research.

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**ABSTRACT**

This study examines the effects of blended learning and student engagement on learning outcomes among university students in Uganda, addressing persistent gaps in empirical evidence from developing country contexts. Using cross-sectional survey data and ordinary least squares regression with robust standard errors, the analysis tests three null hypotheses concerning the independent and joint effects of blended learning and student engagement on learning outcomes. The results provide strong evidence against all three null hypotheses. Blended learning exhibits a positive and statistically significant effect on learning outcomes ( $\beta = 0.320$ ,  $p < 0.01$ ), while student engagement in blended courses also demonstrates a positive and significant influence ( $\beta = 0.309$ ,  $p < 0.01$ ), confirming their independent contributions. The joint effect of blended learning and student engagement is also positive and significant. The full model is highly significant ( $F(12,400) = 97.25$ ,  $p < 0.001$ ), with explanatory power improving marginally following the inclusion of control variables ( $R^2$  increases from 0.629 to 0.645), indicating model stability. The age of the student, time management, and institutional support are identified as positive determinants of learning outcomes, while highlighting gender and weekend programme disparities. The study findings extend empirical knowledge on blended learning effectiveness and provide policy-relevant evidence for strengthening engagement driven instructional strategies in Ugandan universities.

**Keywords:** Blended learning; students' engagement; learning outcomes; university students**INTRODUCTION**

The rapid expansion of blended learning in higher education has reshaped instructional delivery worldwide, combining face-to-face teaching with online learning modalities (Ali & Georgiou, 2024). Initially adopted to enhance flexibility and access, blended learning has become an integral pedagogical approach, particularly where universities seek to balance rising student enrolments, limited physical infrastructure, and evolving digital demands (Mohammadi, Paasivara, & Kasurinen, 2025; Kizza, Nakku, & Mubiru, 2024; Ali,

Buruga, & Habibu, 2019; Kintu, Zhu, & Kagambe, 2017). In sub-Saharan Africa, and Uganda in particular, blended learning gained renewed prominence during and after the COVID-19 pandemic, accelerating reliance on digital platforms to sustain teaching and learning (Kizza, Kasule, Amonya, Nakimuli, & Komugabe, 2021). Despite this expansion, empirical evidence on its impact on student learning outcomes in low-resource higher education contexts remains mixed and underdeveloped.

Uganda's higher education sector comprises a mix of

public and private universities serving a rapidly growing and diverse student population. In recent years, universities have increasingly adopted blended learning to address challenges related to overcrowded lecture halls, limited academic staff, and the need to accommodate working students (Gudoniene, et al., 2025). However, access to digital infrastructure remains uneven, with significant disparities in internet connectivity, device ownership, and digital literacy among students (Kyambade, Kisseka, & Namatovu, 2025; Janse & Oguttu, 2022). These contextual realities make Uganda an important case for examining the effectiveness of blended learning in resource-constrained settings. Despite widespread adoption, institutional policies guiding blended learning implementation remain fragmented, and empirical evidence to inform policy and practice is limited. Most existing studies are descriptive or qualitative, focusing on perceptions rather than empirically linking blended learning and engagement to measurable learning outcomes.

Blended learning extends teaching beyond physical classrooms, supporting large student populations with varied learning needs (Ali, Buruga, & Habibu, 2019). However, its success is influenced by institutional readiness, infrastructure availability, and the digital competencies of both students and lecturers. Private universities in Uganda have invested in e-learning platforms and ICT support, yet differences in perceptions and preparedness may exist between public and private institutions, affecting learning outcomes (Kizza, Nakku, & Mubiru, 2024). Student engagement has emerged as a critical factor for understanding variation in outcomes within blended learning contexts. In many developing-country settings, including Uganda, blended learning has often been implemented rapidly and unevenly, with limited attention to students' engagement experiences, institutional readiness, or infrastructural constraints.

Blended learning integrates online experiences with traditional face-to-face instruction, blending digital tools with the physical classroom (Garrison & Vaughan, 2008). It is operationalized here as learning involving both online and face-to-face interactions, enabled by digital tools. Prior research indicates that increased interaction and effective use of digital tools enhance students' active participation and cognitive engagement, which, in turn, leads to improved learning outcomes (Kintu, Zhu, & Kagambe, 2017). Student engagement is conceptualized as behavioral, cognitive,

and emotional involvement in learning activities. In this study, engagement is treated as a process variable, while learning outcomes capture end results/learners' performance. This framework justifies the use of constructivist and engagement theories rather than technology adoption models. Actively engaged students are more likely to gain satisfaction, understand content, and remain committed to learning, with interactions and a sense of community in blended courses enhancing motivation and satisfaction (Kintu et al., 2017).

Individual characteristics and perceived institutional support are included as control variables to account for differences in students' capacity to benefit from blended learning environments. Learning outcomes are conceptualized as a function of both the learning environment (blended learning) and the learning process (student engagement), operationalized to include academic understanding, perceived skill acquisition, academic progress, and perceived likelihood of degree completion. While blended learning and student engagement are often studied independently, their joint effect on outcomes remains underexplored, particularly in developing-country contexts. Blended learning creates opportunities for engagement, but these do not automatically translate into improved outcomes. The interaction between blended learning and student engagement is therefore central to this study.

This study is grounded in constructivist learning theory, which posits that learners actively construct knowledge through interaction with content, peers, and instructors. Learning is socially situated and cognitively active, enhanced by reflection, collaboration, and application. Constructivism emphasizes learner autonomy, authentic tasks, and dialogic interaction. Blended learning provides a context that facilitates such interaction across online and face-to-face settings. While constructivism explains the nature of learning, student engagement theory explains the mechanism through which learning environments influence outcomes. Engagement encompasses behavioral participation, cognitive effort, emotional motivation, and social interaction (Kearsley & Shneiderman, 1998). Blended learning is conceptualized as a pedagogical environment (constructivism) that influences outcomes through engagement (engagement theory), with contextual and institutional factors, such as, access to technology, lecturer competence, and institutional support shaping this process.

Blended learning aligns with constructivist principles by

providing multiple contexts for synchronous and asynchronous engagement. Synchronous sessions offer real-time support and interaction (Bower, Dalgarno, Kennedy, Lee, & Kenney, 2015), requiring learners to multitask (Szeto, 2015), while asynchronous activities allow self-paced management through discussion forums, recorded lectures, and face-to-face interactions. Blended learning leverages the strengths of both modalities, facilitating active knowledge construction and accommodating diverse learning preferences (Janse & Oguttu, 2022). In Uganda, blended learning is increasingly prominent, reflecting evolving learner needs and institutional modernization agendas (Kyambade, Kisseka, & Namatovu, 2025; Jnr, 2024; Watuleke et al., 2024). Evidence indicates that when supported by effective instructional design and institutional support, blended learning positively affects engagement, satisfaction, and academic performance (Euphrosine, 2025; Li J. , 2024). Yet heterogeneous conditions, such as, varying infrastructure, internet reliability, digital competence, and support systems shape the effectiveness of implementation (Kabarungi et al., 2025). Social presence, interactive communication, and pedagogical readiness are critical determinants of student engagement (Alshammari & Alrehaili, 2025; Ali & Georgiou, 2024). Student engagement reflects the extent to which learners actively participate in, reflect on, and invest effort in their learning activities. Engaged students are more likely to understand course requirements, collaborate with peers, and remain committed to their academic goals, enhancing both satisfaction and persistence (Wang & Zhang, 2024). Despite its importance, much of the literature remains descriptive or perception-based, with limited empirical investigation of how blended learning and student engagement interact, particularly in developing-country contexts (Kahu, 2013; Bond et al., 2021). This gap is especially critical in resource-constrained higher education systems like Uganda's, where unstable internet connectivity, high data costs, limited device access, digital skills gaps, unreliable power, insufficient institutional support, and limited lecturer training can impede effective implementation (Bower et al., 2015; Ali et al., 2019; Janse & Oguttu, 2022; Kyambade et al., 2025). Blended learning is further associated with high dropout rates, low participation, and limited persistence (She, Xu, Li, & Hu, 2025). To enhance engagement and learning outcomes, scholars recommend supporting social interaction, peer collaboration, interactive content

design, continuous professional development, and robust institutional support (Alshammari & Alrehaili, 2025; Kabarungi, Ntwari, Ejiri, & Kawuma, 2025; Kyambade, Kisseka, & Namatovu, 2025; Watuleke et al., 2024).

Despite evidence from high-income contexts, systematic empirical research remains scarce on how contextual and institutional factors influence blended learning outcomes in low-resource settings. This gap limits evidence-based pedagogical strategies and higher education policies tailored to diverse student populations. In response, this study examines the independent and joint effects of blended learning and student engagement on learning outcomes in public and private Ugandan universities, accounting for contextual and institutional constraints. By providing context-specific empirical evidence, the study aims to inform more effective, inclusive, and evidence-driven implementation of blended learning in Uganda's higher education system.

## **METHODOLOGY**

### **Research Design**

This study adopted a quantitative cross-sectional survey design to examine the relationships between blended learning technology, student engagement, and learning outcomes among university students in Uganda. A cross-sectional approach is appropriate because it allows for the collection of data from students at a single point in time to assess their experiences, perceptions, and intentions regarding blended courses (Creswell & Creswell, 2018). The study was guided by the following hypotheses: H1—Blended learning has no positive and significant effect on learning outcomes; H2—Student engagement in blended courses has no positive and significant effect on learning outcomes; and H3—Blended learning and student engagement do not jointly have a positive and significant effect on learning outcomes among university students in Uganda. Through this approach, the study contributes context-specific evidence to inform effective and inclusive higher education practices.

### **Study Population**

The study population comprises undergraduate students enrolled in blended courses across selected public and private universities in Uganda. Blended learning is operationalized as courses combining face-to-face instruction with online learning components. The study population comprised of undergraduate students majorly in the social science disciplines. There

were not students that participated in this study from the science based discipline. Students were eligible if they had taken at least one blended course during the current academic year.

### **Sampling and Sample Size**

A purposive sampling strategy was employed to select universities offering blended courses, while stratified random sampling was used to select students within these institutions to ensure representation across faculties and programs. Using Cochran's formula for sample size estimation (Cochran, 1977) and assuming a 5% margin of error, a confidence level of 95%, and an estimated response distribution of 50%, a total of 400 students were targeted for survey administration.

### **Data Collection**

Data were collected using a structured self-administered questionnaire distributed to students who had taken at least one blended course. The questionnaire captured information on students' demographic characteristics, experiences with blended learning instruction, levels of engagement, learning persistence outcomes, and control variables such as the learner's own motivation. All items utilized five-point Likert scales, with higher scores indicating greater agreement or satisfaction. The questionnaire was pretested with 20 students to assess clarity and reliability.

### **Measurement of Variables**

The variables used in this study were selected based on prior literature indicating their relevance to student learning behaviors and outcomes. All key variables were measured using five-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree).

### **Dependent Variable: Learning Outcomes**

Learning outcomes were measured using a composite index derived from students' self-reported responses on satisfaction with blended learning and willingness to continue with blended learning mode. The responses were recorded on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The higher scores were used to indicate more favorable learning outcomes in blended learning contexts. This operationalization captures students' perceived academic progress and persistence, which are widely used proxies for learning outcomes in higher education research (Li, 2024; She, Xu, Li, & Hu, 2025).

### **Independent Variables: Blended learning and Student Engagement**

This study uses blended learning and student engagement as predictors of learning outcomes among

students in Universities.

### **Blended Learning**

Blended learning was operationalized through a Blended Learning Index (BLI) capturing students' perceptions of the mode of delivery that blends face to face interaction and online digital learning tools. All items were measured on five-point scales, with higher values indicating more positive perceptions. The index was computed as the average of the standardized items, following reliability testing.

### **Student Engagement**

Student engagement was operationalized through the student engagement index (SEI) capturing items on students' level of behavioural (active involvement), cognitive and emotional (passion) engagement while undergoing the blended mode of learning. An engaged learner is more likely to attend lectures, participate in online discussion forums, engages with peers and faculty, and spends time to understand materials posted on the learner management system. The level of student engagement is essential in improving learners' outcomes and resilience to persist in blended modes of learning. The engagement of the learner influences his/her motivation to succeed (She, Xu, Li, & Hu, 2025; Li, 2024).

### **Control Variables**

To mitigate potential omitted variable bias, the model included a set of control variables representing individual and institutional characteristics that may independently influence learning outcomes. These include age, gender, motivation and institutional support

### **Reliability and Validity**

Internal consistency of the composite indices was assessed using Cronbach's alpha, with values of 0.70 or above considered acceptable (Nunnally, 1978). Construct validity was supported by grounding all items in established blended learning and student engagement literature and by ensuring conceptual coherence among items included in each index (Kintu, Zhu, & Kagambe, 2017). Pretesting enhanced instrument clarity and appropriateness in the Ugandan context.

### **Data Analysis Techniques**

Data analysis was conducted using Ordinary Least Squares (OLS) regression in line with prior education research that treats aggregated Likert-scale measures as approximately continuous, particularly when composite indices are used (Sullivan & Artino Jr, 2013; Geoff, 2010). The empirical analysis was conducted in three stages. Descriptive statistics were first used to

profile respondents and summarise the main variables. This was followed by the estimation of OLS regression models to assess the effects of the predictor variables on learning outcomes, with and without control variables. Finally, robustness checks (test for normality, heteroscedasticity, multi-collinearity and robust standard error) were performed to evaluate the stability of the results.

### Model Specification

To examine the effects of blended learning and student engagement on learning outcomes among university students in Uganda, Ordinary Least Squares (OLS) regression was employed. The general econometric model was specified as:

$$LO_i = \alpha_0 + \alpha_1 BLI_i + \alpha_2 SEI_i + \alpha_3 X_i + \varepsilon_i$$

Where:

$LO_i$  represents the learning outcome for student  $i$

$BLI_i$  is the Blended Learning Index

$SEI_i$  is the Student Engagement Index

$X_i$  is a vector of control variables

$\varepsilon_i$  is the error term

The specific hypotheses were tested using the following models:

Model 1: Effect of Blended Learning on Learning Outcomes (H1)

H1: Blended learning has no significant effect on learning outcomes among university students in Uganda

$$LO_i = \alpha_0 + \alpha_1 BLI_i + \alpha_2 X_i + \varepsilon_i$$

Model 2: Effect of Student Engagement on Learning Outcomes (H2)

H2: Student engagement has no significant effect on learning outcomes among university students in Uganda

$$LO_i = \beta_0 + \beta_1 SEI_i + \beta_2 X_i + \varepsilon_i$$

Model 3: The joint effect of blended learning and student engagement on learning outcomes (H3)

H3: Blended learning and Student engagement jointly have no significant effect on learning outcomes among university students in Uganda

$$LO_i = \gamma_0 + \gamma_1 BLI_i + \gamma_2 SEI_i + \gamma_3 X_i + \varepsilon_i$$

All regression models were estimated using STATA 14, with robust standard errors to correct for potential

heteroscedasticity. The OLS assumptions of linearity, independence, homoscedasticity, and normality of residuals were tested to ensure model validity. To test for multicollinearity among independent variables, we used the variance inflation factors (VIF), with VIF values below 10 considered acceptable (Gujarati & Porter, 2009). The significance of regression coefficients was evaluated at  $p < 0.05$ , and the explanatory power of the models was assessed using the adjusted R-squared statistics. This econometric strategy allows for robust testing of the influence of blended learning and student engagement on multiple dimensions of student learning outcomes while controlling for relevant demographic and institutional characteristics.

### Ethical Considerations

Respondents provided informed consent, and no personally identifiable information was collected. All data were used solely for academic research purposes.

### RESULTS

A total of 413 students participated in the study with the majority within the age range 23-27 (254/62%), followed by the 18-22 age group (78/19%) and those above 28 years (81/20%). The majority of the respondents were female (245/59%) while male constituted (168/41%). Majority of the students that responded to the questionnaire were on the evening program (199/48%), followed by those on the day program (160/39%) and the least were from the weekend program 54(13%)

Given the study's focus on estimating conditional effects, the analysis relies on multivariate regression models rather than simple bivariate correlations. Correlation analysis was conducted only for exploratory purposes and to check for potential multicollinearity among explanatory variables (Table 1). Anchored in student engagement theory and blended learning frameworks, this study investigates whether blended learning and student engagement independently and jointly influence learning outcomes in public and private universities in Uganda. Importantly, the analysis explicitly incorporates contextual and institutional constraints, recognizing the unique challenges of implementing blended learning in resource-limited higher education settings.

The results indicate that blended learning ( $r=0.70$ ,  $p<0.1$ ) and student engagement ( $r=0.72$ ,  $p<0.1$ ) are strongly positively related to learning outcomes.

Table 1. Correlation matrix

Variable	Blended Learning	Student Learning	Learning Outcome
Blended Learning	1		
Student Engagement	0.8533***	1	
Learning Outcome	0.7046***	0.7198***	1

\*\*\* Significant at 5%

### Hypothesis Testing

#### Hypothesis H1

H<sub>1</sub>: Blended learning has no significant effect on

learning outcomes among university students in Uganda.

The results are indicated in table 2.

Table 2. Parameter estimates and model summary

Variable	Coef.	Std.Err	t	P>t	[95% Conf. Interval]
Blended Learning	0.57	0.05	11.24	0	0.47 0.67
Age (Ref=18-22)					
23-27	0.06	0.09	0.69	0.49	-0.12 0.25
28-32	0.31	0.13	2.41	0.017	0.06 0.57
Above 32	0.67	0.14	4.67	0	0.39 0.95
Gender (Ref=male)					
	-0.29	0.08	-3.87	0	-0.44 -0.14
Study Prog (Ref=Day)					
Weekend	-0.52	0.12	-4.37	0	-0.76 -0.29
Evening	-0.18	0.11	-1.61	0.108	-0.40 0.04
Enablers					
Multitask	-0.02	0.04	-0.49	0.625	-0.11 0.07
Time Mgt	0.17	0.05	3.78	0	0.08 0.26
Motivation	0.11	0.04	2.55	0.011	0.02 0.19
Inst support	0.12	0.04	3.33	0.001	0.05 0.20
Constant	0.22	0.25	0.89	0.373	-0.27 0.71

#### Model Summary

Source	SS	Df	MS	F(11, 401)	Prob > F=	61.71
Model	280.9829	11	25.5439			0.000
Residual	165.984	401	0.413925			
Total	446.9669	412	1.084871			
R-squared =	0.6286				Adj R-squared=	0.6185
Root MSE=	0.64337					

Source: Field survey, 2025. Values based on author's calculations using STATA 14

The regression model is statistically significant ( $F(11,401) = 61.71$ ,  $p < 0.001$ ) and explains a substantial proportion of the variation in learning outcomes (Adjusted  $R^2 = 0.6185$ ). This indicates that the included explanatory variables jointly provide a strong explanation of students' learning outcomes. This

implies that blended learning is a significant and positive determinant of learning outcomes among university students in Uganda affirms the pedagogical value of blended learning in higher education. The results show that blended learning has a positive and highly statistically significant effect on learning outcomes ( $\beta = 0.568$ ,  $p < 0.001$ ). A one-unit increase in

blended learning is associated with 0.57 unit increase in learning outcomes, holding age, gender, study programme, and other student-level factors constant. The null hypothesis is rejected. The 95% confidence interval [0.469, 0.667] is entirely positive, reinforcing the precision and robustness of the estimate.

The contextual insights as derived from the control variables indicate that maturity and accumulated academic/ life experience may improve learning effectiveness. Students aged 28 and above demonstrate significantly higher learning outcomes compared to the reference group (18-22). Gender is statistically significant and negative, indicating systematic differences in learning outcomes between male and female students, warranting further pedagogical and policy attention. Participation in

weekend programmes is associated with significantly lower learning outcomes, while the effect of evening programmes is negative but statistically insignificant. Time management, motivation, and institutional support all show positive and statistically significant effects, highlighting the importance of self-regulatory skills and supportive learning environments. Multitasking ability was not statistically significant, indicating that the capacity to manage multiple activities concurrently does not necessarily contribute to improved learning outcomes.

**Hypothesis H2**

H<sub>2</sub>: Student engagement has no significant effect on learning outcomes among university students in Uganda.

The results are indicated in table 3

Table 3. Parameter estimates and model summary

Variable	Coef.	Std.Err.	t	P>t	[95% Conf. Interval]
Student Engagement	0.54	0.05	11.29	0	0.44 0.63
Age (Ref=18-22)					
23-27	0.11	0.09	1.17	0.243	-0.07 0.29
28-32	0.33	0.13	2.56	0.011	0.08 0.59
Above 32	0.73	0.14	5.08	0	0.45 1.01
Gender (Ref=male)	-0.25	0.08	-3.39	0.001	-0.40 -0.11
Study Prog (Ref=Day)					
Weekend	-0.64	0.12	-5.37	0	-0.87 -0.40
Evening	-0.11	0.11	-1.01	0.312	-0.33 0.10
Enablers					
Multitasking	-0.01	0.04	-0.24	0.808	-0.10 0.08
Time Management	0.16	0.05	3.43	0.001	0.07 0.25
Motivation	0.08	0.04	1.98	0.048	0.00 0.17
Inst support	0.13	0.04	3.61	0	0.06 0.21
Constant	0.40	0.24	1.62	0.106	-0.08 0.88
Model Summary					
Source	SS	df	MS	F(11, 401)	= 61.92
Model	281.3415	11	25.5765	Prob >F	0.000
Residual	165.6254	401	0.413031		
R-squared	0.6294			Adj R-squared	0.6193
Total	446.9669	412	1.084871	Root MSE	= 0.64267

Source: Field survey, 2025. Values based on author’s calculations using STATA 14

The regression model is statistically significant (F (11,401) = 61.92, p < 0.001). Student engagement and the control variables jointly explain about 61.9% of the

variance in learning outcomes among university students in Uganda (Adjusted R<sup>2</sup> = 0.6193), indicating a strong model fit. The Root MSE of 0.643 suggests an acceptable level of prediction error. The results indicate

that student engagement has a positive and highly statistically significant effect on learning outcomes ( $\beta = 0.537$ ,  $p < 0.001$ ). The null hypothesis is rejected. This implies that a one unit increase in student engagement is associated with an approximate 0.54 unit increase in learning outcomes, holding other factors constant. The findings provide compelling empirical evidence that student engagement significantly enhances learning outcomes among university students in Uganda. The 95% confidence interval [0.443, 0.630] lies entirely above zero, confirming the precision and robustness of the estimate.

The contextual insights as derived from the control variables indicate that maturity and accumulated academic/ life experience positively influence engagement effectiveness. Students aged 28 and above demonstrate significantly higher learning outcomes compared to the reference group (18-22).

The negative and significant coefficient indicates lower learning outcomes for female students relative to their male counter parts. Participation in weekend study programmes is associated with significantly lower learning outcomes, while evening programmes show no statistically significant difference from day programmes. Time management, motivation, and institutional support exhibit positive and statistically significant effects, underscoring their complementary roles in enhancing student engagement and learning outcomes. Multitasking ability is not statistically significant, suggesting that engagement quality matters in influencing positive learning outcomes.

### Hypothesis H3

H<sub>3</sub>: Blended learning and student engagement jointly have no significant effect on learning outcomes among university students in Uganda.

The results are indicated in table 4

Table 4. Determinants of LOC (OLS and Robust OLS Estimates)

Variables	(1) OLS Coef.	(SE)	(2) Robust OLS Coef.	(Robust SE)
Blended Learning	0.320***	0.076	0.320***	0.086
Student Engagement	0.309***	0.071	0.309***	0.084
Age (Ref=18-22)				
23-27	0.095	0.092	0.095	0.088
28-32	0.308**	0.127	0.308**	0.121
Above 32	0.671***	0.141	0.671***	0.135
Gender (Ref=male)	-0.270***	0.074	-0.270***	0.079
Study Prog (Ref=Day)				
Weekend	-0.563***	0.117	-0.563***	0.116
Evening	-0.169	0.108	-0.169	0.107
Enablers				
Multitasking	-0.018	0.044	-0.018	0.049
Time Management	0.145***	0.045	0.145**	0.056
Motivation	0.087**	0.041	0.087*	0.046
Institutional support	0.109***	0.036	0.109**	0.036
Constant	0.239	0.242	0.239	0.250
Observations	413.000		413.000	
Adjusted R-squared	0.635		0.630	
F-statistic	60.65***		97.25***	
Model	(2)	reports	heteroskedasticity-robust	standard errors.

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.10$ .

Table 4 presents the OLS and heteroscedasticity robust OLS estimates of the determinants of Learning outcomes. Model (1) reports conventional OLS results, while Model (2) re-estimates the specification using

robust standard errors to account for potential heteroskedasticity. Across both models, the signs, magnitudes, and levels of statistical significance of the key coefficients remain largely unchanged, indicating that the results are robust to alternative variance

specifications.

Blended learning and student engagement exhibit positive and statistically significant effects on learning outcomes in the robust model, confirming their independent contributions. Old age is consistently associated with improved outcomes, while female and participation in weekend study programmes are associated with significantly lower learning outcomes. The inclusion of additional controls in Model (2) marginally improves explanatory power ( $R^2$  increases from 0.629 to 0.645), further reinforcing the stability of the findings.

These robust estimates indicate that a one-unit increase in blended learning ( $\beta = 0.320$ ,  $p < 0.01$ ) is associated with a 0.32 unit increase in learning outcomes, while a one unit increase in student engagement ( $\beta = 0.309$ ,  $p < 0.01$ ) is associated with a 0.31 unit increase in learning outcomes, holding other factors constant. The null hypothesis that blended learning and student engagement jointly have no effect is rejected. The overall model is highly significant ( $F(12,400) = 97.25$ ,  $p < 0.001$ ), providing additional evidence that the explanatory variables, taken together, significantly explain variation in learning outcomes.

As one's age increases, the benefits from blended learning improve. The female students exhibited

significantly lower outcomes than the males ( $\beta = -0.270$ ,  $p = 0.001$ ). The students on the weekend programme exhibited a large and highly significant negative effect ( $\beta = -0.563$ ,  $p < 0.001$ ), implying substantially poorer outcomes relative to day students. The addition of controls indicates that indicate that time management ( $\beta = 0.145$ ,  $p = 0.009$ ) and institutional support ( $\beta = 0.109$ ,  $p = 0.002$ ) strongly positively impact learning outcomes. Motivation is marginally significant at the 10% level ( $\beta = 0.087$ ,  $p = 0.058$ ), indicating a weak but plausible positive association with learning outcomes. One's ability to multitask is not statistically significant associated with learning outcomes ( $p = 0.705$ ), indicating no discernible effect. The consistency of signs, magnitudes, and significance levels under robust estimation underscores the stability and credibility of these findings.

Given the likelihood of heteroskedasticity in survey-based data, the discussion that follows is based primarily on the heteroskedasticity-robust estimates reported in Model (2), while Model (1) is presented for comparison.

#### Testing for Multicollinearity

The robust model was tested for multicollinearity using the variable inflation factor. The results are presented in Table 5

Table 5. Multicollinearity test

Variable	VIF	1/VIF
Blended Learning	4.0	0.25
Student Engagement	4.3	0.23
Age (Ref 18-22)		
23-27	2.1	0.48
28-32	1.5	0.68
Above 32	1.8	0.54
Gender (Ref Male)	1.4	0.73
Study Programme (Ref Day)		
Weekend	1.6	0.61
Evening	3.0	0.33
Enablers		
Multitasking	2.2	0.45
Time Management	2.1	0.48
Motivation	1.4	0.70
Institutional support	3.3	0.30
Mean VIF	2.4	0.48

Collinearity diagnostics revealed that all predictor variables had tolerance values exceeding 0.10 and

corresponding variance inflation factor (VIF) values of 2.4, which fall within the recommended range of 1 to 10, indicating the absence of multicollinearity in the dataset (Field, 2018; Hair, Babin, Anderson, & Black, 2019)

## DISCUSSION

This section discusses the empirical findings on the effects of blended learning and student engagement on learning outcomes among university students in Uganda. The discussion is anchored on the heteroskedasticity-robust estimates where applicable and is structured around the study's hypotheses. The robustness of the findings is reinforced by the close correspondence between the conventional OLS estimates and the heteroskedasticity-robust estimates. The stability of coefficient signs, magnitudes, and significance levels across specifications suggests that the observed relationships are not driven by model misspecification or heteroskedasticity.

### Blended Learning and Learning Outcomes (H1)

The robust model ( $\beta = 0.320$ ,  $p < 0.01$ ) provides strong evidence that blended learning positively and significantly affects learning outcomes, leading to the rejection of the null hypothesis. The coefficient indicates that integrating online and face-to-face instruction enhances academic performance, even after controlling for demographics, study programme, and institutional factors, supporting prior research (Euphrosine, 2025; Shandilya & Kaur, 2024). These findings align with constructivist learning theory, which emphasizes active knowledge construction through multiple modalities. In the Ugandan higher education context characterized by large class sizes and limited resources, blended learning improves access to materials, promotes flexibility, and facilitates self-paced study, likely enhancing comprehension and retention. The results suggest that expanding blended learning initiatives, coupled with strengthened student support, training in digital skills and time-management, could substantially improve learning outcomes, particularly for students in non-traditional programmes.

### Student Engagement and Learning Outcomes (H2)

The results indicate that student engagement has a strong and statistically significant positive effect on learning outcomes ( $\beta = 0.309$ ,  $p < 0.01$ ), leading to the rejection of the null hypothesis. The magnitude of the coefficient suggests that engagement is not merely supplementary but a core driver of academic success. Engaged students are more likely to invest effort, persist in challenging tasks, and interact meaningfully

with learning materials, resulting in improved academic outcomes. These findings underscore the importance of interactive instructional design, reliable ICT infrastructure, and pedagogical flexibility to foster engagement (Boelens et al., 2017; Hernando et al., 2025; Kadian & Rose, 2025; Kizza et al., 2021). The evidence also provides empirical support for student engagement theory, which conceptualizes engagement as the behavioral, emotional, and cognitive investment students make in learning activities. Students who actively participate, manage their time effectively, and remain motivated achieve higher learning outcomes, reinforcing that technological innovations such as blended learning are most effective when they promote active participation rather than merely delivering content. Overall, student engagement emerges as a critical mechanism through which pedagogical strategies translate into academic success.

### Joint Effect of Blended Learning and Student Engagement (H3)

The joint analysis of blended learning and student engagement indicates that both variables remain positive and statistically significant when included simultaneously, leading to the rejection of  $H_3$ , which posited no joint effect. This finding suggests that blended learning does not substitute for student engagement but rather complements it. Empirically, the result supports constructivist and student engagement theories, which propose that learning outcomes are enhanced when instructional environments foster active participation and meaningful interaction. Specifically, blended learning provides the structural and technological framework for learning, while engagement reflects the behavioral and psychological processes through which students effectively utilize that environment. These findings reinforce the view of blended learning as an enabling environment and student engagement as the mechanism driving learning gains. The results are consistent with prior research demonstrating the joint positive impact of blended learning and engagement on academic outcomes (Shandilya & Kaur, 2024; Angwaomaodoko, 2025; Zheng, 2023).

### Role of Contextual and Institutional Factors

The findings underscore the critical role of instructional design, learner behavior, contextual, and institutional factors in shaping learning outcomes in blended learning environments. Students enrolled in weekend programmes exhibit consistently lower learning outcomes compared to day programmes ( $\beta = -0.563$ ,  $p$

< 0.01), likely due to competing work and family commitments that limit study time and engagement, consistent with Anning, Owusu-Addo, Pephrah, Owusu-Konadu, and Opoku (2024). In contrast, evening programme participation shows a negative but statistically insignificant effect, suggesting heterogeneous experiences among non-day students. Time management, motivation, and institutional support emerge as significant positive predictors, highlighting the importance of supportive learning environments and self-regulatory skills. These results indicate that investments in blended learning infrastructure alone are insufficient without targeted strategies to enhance student engagement, aligning with Li, Xie, and Li (2025). The stability of coefficients under robust estimation further confirms that these relationships are not driven by heteroskedasticity, reinforcing the credibility of the conclusions.

## CONCLUSION

The results demonstrate that learning outcomes in Ugandan universities are shaped by a dynamic interaction between instructional design, student engagement, and institutional context. The consistency of findings across separate and joint models enhances confidence in their robustness and underscores the multidimensional nature of effective learning in higher education. The hypotheses that guided the study were all rejected and their alternative upheld:

H1: blended learning has a positive and statistically significant effect on learning outcomes

H2: student engagement exerts a strong and statistically significant positive effect on learning outcomes

H3: both blended learning and student engagement are significant determinants of learning outcomes, both independently and jointly.

## CONTRIBUTION TO THEORY AND PRACTICE

This study provides empirical evidence that blended learning and student engagement are both necessary and mutually reinforcing for effective higher education, with important implications for theory, policy, and practice in low-resource contexts such as Uganda. This study extends constructivist learning theory by providing empirical evidence from a developing country context that blended learning significantly enhances learning outcomes. The study reinforces student engagement theory by demonstrating that engagement is key to attaining positive learning outcomes even after

controlling for instructional and institutional factors. Universities are called upon to design engagement-centered blended pedagogies. Apart from prioritizing investment in digital infrastructure, support mechanisms should be put in place to strengthen students' motivation and time management skills. Special support should be accorded to students on weekend programmes, where tailored support mechanisms may be required to mitigate structural disadvantages and improve learning outcomes.

The study also contributes to the growing empirical literature on blended learning in developing country contexts by providing evidence from public and private universities in Uganda. The findings offer policy-relevant insights for higher education policymakers and university administrators on the engagement-related and institutional factors that shape blended learning outcomes. In addition, the study informs curriculum designers and academic staff on strategies for improving blended course delivery, while providing empirical justification for targeted investments in ICT infrastructure and student support systems. More broadly, the study offers a contextualized evidence base to inform future research and policy debates on higher education reforms and digital learning strategies in Uganda and comparable settings.

## RECOMMENDATIONS

Blended learning and student engagement significantly influence learning outcomes. It is recommended that universities design courses that promote motivation, active interaction between students and faculty. There is need for institutionalising ICT support to support both learner and faculty on the blended learning mode with technical issues as and when they arise. The necessary ICT infrastructure should be budgeted for and integrated in the university budgets. There was a consistent negative effect of weekend study programmes on learning outcomes, signalling the need for targeted interventions to support this category of learners. This may find the asynchronous online learning more ideal. The positive effects of time management, motivation, and institutional support suggest that learning outcomes calls for the need to strengthen students' self-regulatory capacities and institutional support systems. The need for training in digital literacy is paramount to enable the creation of conducive blended learning environments. There is need to strengthen the quality assurance frameworks with emphasis on continuous professional development

to improve the quality of blended learning practices across universities and other institutions of higher learning.

### STUDY LIMITATIONS

The study relies on cross-sectional data, which limits the ability to make strong causal inferences. The survey questionnaire which is the main study instrument relies on self-reported data, which may be subject to response bias. The study focused on selected universities in Uganda, which may limit the generalizability of the findings to all higher education institutions. It is recommended that a study involving mediating and moderating variables is recommended to better understand the mechanisms through which blended learning better education outcomes in developing countries. Studies involving longitudinal designs are recommended to investigate effects of blended learning, student engagement and learning outcomes over time.

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