

Hybrid Learning Practices and Their Effects on Student Learning Experiences in Ethiopian Public Universities

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Abstract: Hybrid learning has become an important approach to improving the quality, flexibility, and accessibility of higher education, particularly within Ethiopia's digital transformation initiative (e-SHE). This study assessed the practice of hybrid learning and its effect on students' learning experiences in Adama Science and Technology University, Jimma University, and Hawassa University. A convergent parallel mixed-methods research design was employed, combining questionnaire data from undergraduate students who had completed at least one hybrid course with focus group discussions and key informant interviews involving instructors, e-learning directors, ICT professionals, and university administrators. Quantitative data were analyzed using descriptive statistics, the Kruskal–Wallis test, Ordered Logit, Ordered Probit, and Ordinary Least Squares (OLS) regression models, while qualitative data were analyzed thematically. The findings showed that hybrid learning significantly enhanced students' learning experiences by promoting flexibility, learner autonomy, digital skill development, and active engagement. Students reported moderate to high levels of engagement and satisfaction, and significant differences in hybrid learning implementation were observed among the universities, with Adama Science and Technology University demonstrating comparatively stronger performance. Regression analyses consistently revealed that hybrid learning practice, student engagement, sustainability of hybrid learning, and student satisfaction positively and significantly influenced students' learning experiences ($p < 0.01$), with student satisfaction emerging as the strongest predictor. However, challenges related to instructional design, digital infrastructure, faculty preparedness, online interaction, and institutional support remain. The study concludes that strengthening digital infrastructure, faculty capacity, learner-centered instructional design, and institutional support is essential for the effective and sustainable implementation of hybrid learning in Ethiopian higher education.

Keywords: Hybrid learning; student engagement; student satisfaction; sustainability of hybrid learning; student learning experience; higher education; Ethiopia.

1. Introduction

The global higher education landscape is undergoing a major transformation driven by the integration of digital technologies and the rapid expansion of hybrid learning models. By combining face-to-face instruction with online learning components, hybrid education enhances flexibility, accessibility, and student engagement. Evidence from global studies shows that, when supported by adequate infrastructure, trained faculty, and strong pedagogical design, hybrid learning can achieve outcomes equal to or better than traditional teaching methods. The COVID-19 pandemic further accelerated this shift by forcing universities worldwide to adopt Learning Management Systems (LMS) and digital teaching tools. However, the effectiveness of hybrid learning remains highly dependent on digital equity, including access to reliable internet, devices, and interactive learning environments.

In Sub-Saharan Africa, hybrid learning has been introduced as a response to structural challenges such as overcrowded classrooms, faculty shortages, and inequalities in access to education. Countries like Kenya, Ghana, and South Africa have made progress through national ICT strategies and international

partnerships, with evidence showing improvements in learner autonomy, motivation, and digital literacy. In Ethiopia, however, the transition remains uneven due to persistent barriers such as unreliable electricity, high internet costs, limited localized content, and inadequate faculty training. Although ICT integration and LMS pilots began in the mid-2000s and expanded after the COVID-19 pandemic, implementation gaps remain significant. The government's recent e-Learning for Strengthening Higher Education (e-SHE) initiative (2023) seeks to institutionalize hybrid learning through LMS standardization, multimedia studio development, and large-scale faculty training, yet current evidence indicates low LMS usage and limited institutional readiness across universities.

Against this backdrop, there is a critical need to move beyond infrastructure-focused indicators and examine how digital transformation is actually influencing classroom practices, teaching behavior, and student learning experiences. This study therefore investigates the ongoing hybrid learning transition in selected Ethiopian public universities—Adama Science and Technology University, Jimma University, and Hawassa University—to generate

empirical evidence on how policy intentions are translating into lived educational realities.

1.1. Research Questions of the Study

To bridge the gap between traditional delivery and the new hybrid reality, this study addresses three primary questions.

1. How has the adoption of hybrid learning fundamentally shifted instructional methods, pedagogical strategies, and the day-to-day use of delivery tools within selected public universities?
2. What are the actual effects of these hybrid formats on the student experience specifically regarding their classroom engagement and overall academic satisfaction?
3. Which institutional, technological, pedagogical, and policy-related factors act as either barriers or challenges, and how do these forces shape the equity and long-term sustainability of hybrid learning across the Ethiopian higher education ecosystem?

3. Research Methodology

3.1. Research Philosophy

There are different types of research philosophy. In this study a pragmatic philosophy view is utilized. Now a day researchers have been divided into two major groups. These include the post-positivists rely on measurable numbers, and the constructivists with subjective personal interpretation. Pragmatism does not agree to take these two strict categorizations, but they argued that the methods researchers used should be based on the relevance of the methods to the problems. This type of thoughts admitted that the interconnectedness of statistical and qualitative discernments played a significant role. Pragmatic research philosophy permits the study to quantity existing practices of hybrid learning and student experiences among selected higher educations. On the other hand, the qualitative parts of the study tried to discovers the real-world difficulties faced the students in the hybrid learning environments.

1.2. Research Approach

This study employed a mixed-method research approach which merges both quantitative and qualitative research views. It is based on collection, analysis, and integration of quantitative and qualitative data. The combination of the two methods helps to get complementarity in which the weakness of one method would be compensated by the strengths of others. Numerical

1.2. Objectives of the Study

1.2.1. General objective

The general objective of this study is to examine the practical implementation of hybrid learning and evaluate its effects on student learning experiences in select Ethiopian public universities.

1.2.2. Specific objectives

To achieve this, the study addresses three specific objectives:

1. to analyze how hybrid teaching formats have transformed traditional instruction, including changes in teaching strategies, the integration of digital tools, and the redesign of course content.
2. to evaluate the direct impact of these practices on student engagement, learning experiences, and satisfaction.
3. to identify and map the localized challenges and enablers categorized by institutional, technological, pedagogical, and policy dimensions that determine whether hybrid teaching succeeds and lasts.

information can offer the extent of hybrid learning and student experiences phenomenon, emphasizing and enabling broader conclusions among selected universities. However, numbers alone can't capture the specific universities context, the day to day struggles, and the actual lived experiences of students, instructors and hybrid learning information communication experts. Qualitative insights can fill such gaps. It enables researcher to understand the human and behind the statistical conclusions. By using the mixed approach, the study can provide a much more complete and realistic investigation (Creswell and Creswell, 2023).

1.3. Research Design

The study employed descriptive and explanatory research designs. The descriptive parts would help to assess the extent of practices of hybrid learning and student experiences in sampled universities. On the other hand, an explanatory design was used to estimate the effect of hybrid learning variables such as technical infrastructure, faculty pedagogical readiness, and administrative support systems, directly determine student experiences. By using both designs, the study delivers both a clear picture of existing practices and the influences of hybrid learning on students' experiences (Saunders, Lewis, and Thornhill, 2023).

3.4. Target Population and Sampling Techniques

The samples of this research are Jimma University, Adama Science and Technology University, and Hawassa

University. These universities were selected randomly because they all offer a hybrid learning system within their institutions. This study mainly targets three different sets of people who are directly involved with each other within the hybrid learning environment. The first set is undergraduate students enrolled in any of the three universities who have previously taken a hybrid course. The second group of people engaged within the hybrid learning community is the instructors who develop and facilitate the blended courses, as well as the Information Technology professionals who support and maintain the learning management systems. The last category is composed of campus leaders such as e-learning coordinators, deans and department heads.

Hybrid learning is not widespread enough as a teaching modality in the public Higher Education setting in Ethiopia. If a lottery or random sampling method were to be used, it would take a lot of time and resources, while students who do not have experience with such technologies may also be sampled.

To ensure respondents have experience to share, the purposive sampling method was employed as the major sampling strategy. In the purposive sampling technique, participants are selected based on some predetermined criteria to ensure that the respondents can provide rich information that can answer research questions/project objectives. The explicit rule that was used to sample students is that one has to have taken a complete course in hybrid mode.

This assures that every respondent has experience with the phenomenon under study. On the qualitative side, which includes both focus group discussions and key informant interviews, a purposive selection was also used. For focus group discussion, course instructors, Information Technology specialists, and administrators who have been directly responsible for rolling out or managing these hybrid platforms. Finally, key informant interviews were conducted with the college's deans and eLearning coordinators of the course.

3.5. Instruments of Data Collection

The study utilized three data collection instruments, namely, survey questionnaire, focus group discussions and key informant interview. The survey questionnaire is structured with five-level Likert Scale prepared to the selected students. It includes background information of respondents, hybrid learning, and student experiences related questions. The second tools were focus group discussion prepared for hybrid course instructors and e-learning experts' to uncover the shared problems and bottlenecks. This interactive group would focus on pedagogical shifts, technical infrastructure barriers, and solutions to the problems. There were a separate sessions run for instructors and e-learning expert so preserve their unique perspectives. Finally,

key informant interview were conducted with semi-structured questions relevant to hybrid learning and student experiences.

To maintain the reliability and validity of the data, the survey questionnaire, the researchers made a review by an expert in the field. A follow-up pilot study with a separate student group evaluates internal consistency, retaining only those dimensions that reach a Cronbach alpha coefficient greater than zero point seven (Saunders, Lewis, and Thornhill, 2023).

For the qualitative components, rigorous standards of trustworthiness guide the process through consistency, and transferability. Credibility was preserved by sharing transcript summaries back with participants to verify accuracy, while dependability is preserved through a systematic research audit trail. In conclusion, detailed descriptions of Jimma, Adama, and Hawassa universities provide the necessary context to establish transferability for future studies (Braun and Clarke, 2022).

3.6. Methods of Data Analysis

The study tried to investigate the collected quantitative and qualitative data through different mechanisms. Descriptive statistics using frequencies means, and standard deviations across the universities were utilized to understand the current practices hybrid learning and student experiences of selected sample universities. Furthermore, a multiple linear regression model was employed to estimate the effect of hybrid learning on student experiences in their teaching and learning process. Concurrently, focus groups' and interviews are analyzed and evaluated via thematic analysis.

3.7. Ethical Considerations

Ethical consideration is one of the basic pillars of research hence, before data collection started, getting permission from the universities was secured. Individuals who participated in the survey hold the freedom to withdraw from the sessions at any time without confronting any penalties. Before any data collection started, researchers provided explicit informed consent. Impartiality guides the entire gathering process, establishing a balanced environment that treats all students, instructors, and administrators equally while actively preventing institutional hierarchies from biasing the research outcomes. Finally, complete confidentiality is guaranteed by removing all personal and identification details.

4. Finding and discussion

4.1. Summary of Table

The table below presents the number of respondents from University, Adama Science and Technology University, and the three selected universities included in this study: Hawassa Jimma University.

Table 1: University you are currently working/learning

		Frequency	Percent	Response rate (%)
Valid	Hawasa University	211	31.4	84.4 %
	Adama Science and Technology University	221	32.9	88.4 %
	Jimma University	240	35.7	89.5 %
	Total	672	100.0	87.5 %

Of the total respondents in this study, 211 (31.4%) were from Hawassa University, 221 (32.9%) were from Adama

Science and Technology University, and 240 (35.7%) were from Jimma University.

4.2. Practice of Hybrid Learning

The following table presents respondents' experiences regarding the practice of hybrid learning in selected public universities in Ethiopia. It examines key dimensions of online learning practice, including learning flexibility, technological accessibility, collaboration tools, institutional support, instructional practices, and the availability of digital learning resources.

Each item was measured using a five-point Likert scale ranging from "strongly disagree" to "strongly agree." To assess the relative importance of each variable and the level of agreement across statements, mean scores and mean ranks were computed and presented.

Table 2: Practice of Hybrid Learning

Observed Variable		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean
The hybrid learning allows students to learn course materials at their own pace.	N %	32 4.8%	64 9.6%	125 18.8%	325 48.9%	119 17.9%	3.65
Students have reliable access to a stable internet connection & computer in the university.	N %	44 6.6%	58 8.8%	134 20.2%	301 45.5%	125 18.9%	3.61
The hybrid format gives students organized ways to work together using digital tools.	N %	44 6.7%	69 10.5%	110 16.7%	344 52.3%	91 13.8%	3.56
The university provides reliable IT support and follows the digital policies set by the Ministry of Education.	N %	45 6.7%	70 10.5%	149 22.3%	277 41.5%	127 19.0%	3.56
Digital exercises are directly linked to the learning objectives of the course.	N %	38 5.7%	88 13.2%	120 17.9%	320 47.8%	103 15.4%	3.54

Instructors give clear guidance on how to use the required digital software.	N %	47 7.1%	89 13.4%	127 19.1%	303 45.5%	100 15.0%	3.48
Students receive regular digital feedback to help them monitor their academic progress.	N %	45 6.8%	91 13.7%	125 18.8%	320 48.0%	85 12.8%	3.46
Students use specific software to complete their practical course assignments.	N %	43 6.4%	99 14.8%	145 21.7%	277 41.5%	103 15.4%	3.45
Instructors provide digital videos and documents that are easy to understand.	N %	54 8.0%	92 13.7%	116 17.3%	318 47.3%	92 13.7%	3.42
The instructors use teaching methods designed for digital learning instead of just sharing recordings of regular lectures.	N %	47 7.0%	110 16.5%	157 23.5%	259 38.8%	95 14.2%	3.37
The university ensures all resources are uploaded to the platform on time.	N %	56 8.4%	108 16.2%	165 24.7%	241 36.1%	97 14.5%	3.32
Instructors actively lead online discussions and interactive sessions.	N %	65 9.7%	106 15.9%	136 20.4%	274 41.1%	86 12.9%	3.31

The findings presented in the above table indicate that the majority of respondents support the importance of hybrid learning, as all observed variables recorded mean values above 3.00. Among the 12 variables examined, the statement “*hybrid learning allows students to learn course materials at their own pace*” achieved the highest mean score, indicating that hybrid learning is strongly associated with flexibility and self-paced learning.

Similarly, the variable assessing whether students have reliable access to stable internet connectivity and computers at their universities ranked second. This suggests that technological accessibility is relatively adequate in the selected universities. The third-ranked variable, with a mean score of 3.56, relates to the provision of reliable digital tools and institutional IT support that facilitates collaborative learning in line with Ministry of Education standards. This finding indicates that collaborative learning opportunities and institutional technological support are generally positive.

Furthermore, the variable assessing the alignment of digital learning tools with learning objectives recorded a mean score of 3.54, implying that most respondents agree that hybrid learning activities are aligned with educational goals.

Conversely, the lowest mean scores were observed in items related to instructional delivery and hybrid learning practices. These include instructors providing clear guidance on required software ($M = 3.48$), students receiving regular digital feedback ($M = 3.46$), the use of software for practical assignments ($M = 3.45$), and the provision of understandable digital learning materials ($M = 3.42$). The lowest-rated item concerned whether teaching methods are specifically designed for digital learning rather than merely transferring traditional lectures into recorded formats.

Overall, the findings suggest that although hybrid learning is being implemented across the selected universities, there remains a need to strengthen instructional design and enhance the adoption of more innovative and purposefully designed digital teaching strategies.

4.3. Practice of Hybrid Learning: Comparison across the Universities

The following table presents the results of the comparison of indexed hybrid learning practices across Hawassa University, Adama Science and Technology University, and Jimma University, using the Kruskal–Wallis test. The findings indicate

that there is a statistically significant difference in the implementation and practice of the hybrid learning modality among the selected universities.

Table 3: Practice of Hybrid Learning: Comparison across the Universities

Ranks			
	University you are currently working/learning	N	Mean Rank
Indexed Practice of Hybrid Learning	Hawasa University	211	260.80
	Adama Science and Technology University	221	407.89
	Jimma University	192	259.52
	Total	624	

The descriptive statistics presented in the table show the mean scores and mean ranks for each university. The results indicate that Adama Science and Technology University recorded the highest mean score ($M = 4.00$) and the highest mean rank (407.89), suggesting that respondents from this institution reported a stronger implementation of hybrid learning practices compared to the other universities.

In contrast, Hawassa University ($M = 3.36$, mean rank = 260.80) and Jimma University ($M = 3.32$, mean rank = 259.52) exhibited relatively lower levels of hybrid learning practice.

Table 4: Test Statistics

Test Statistics ^{a,b}	
	Indexed Practice of Hybrid Learning
Kruskal-Wallis H	116.062
df	2
Asymp. Sig.	.000
a. Kruskal Wallis Test	
b. Grouping Variable: University you are currently working/learning	

The Kruskal–Wallis test was used to examine whether there are statistically significant differences in the mean ranks of hybrid learning practices across the selected universities. The null hypothesis assumes that there is no significant difference in the practice of hybrid learning among the universities, while the alternative hypothesis assumes that such a difference exists.

The results show a significance value of 0.000, which is below the conventional significance level. Accordingly, the null hypothesis is rejected at the 1% significance level. This confirms that there is a statistically significant difference in the practice of hybrid learning among the selected universities.

Table 5: Descriptive

Descriptive								
Indexed Practice of Hybrid Learning								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Hawasa University	211	3.3649	.73323	.05048	3.2654	3.4644	1.00	5.00
Adama Science and Technology University	221	4.0045	.39884	.02683	3.9517	4.0574	3.00	5.00
Jimma University	192	3.3177	.96434	.06960	3.1804	3.4550	1.00	5.00
Total	624	3.5769	.78949	.03160	3.5149	3.6390	1.00	5.00

The above findings indicate the existence of differences in the implementation and practice of hybrid learning across the selected universities. Among them, Adama Science and Technology University demonstrates stronger hybrid learning

practices, which may be attributed to relatively better technological infrastructure, stronger institutional support, and more developed digital learning resources compared to Hawassa and Jimma Universities.

4.4. Effects of Hybrid Learning Dimensions on Students' Learning Experience

The following table presents the results of the Ordered Logit, Ordered Probit, and Ordinary Least Squares (OLS) regression models examining the effects of hybrid learning practice, student engagement in hybrid learning, sustainability of hybrid learning, and student satisfaction in hybrid learning on students' learning experience. The three models were estimated

to assess the robustness and consistency of the findings across different statistical approaches. Overall, the results indicate that all four explanatory variables have positive and statistically significant effects on students' learning experience at the 1% significance level, demonstrating consistency across the three estimation methods.

Table 6: Effects of Hybrid Learning Dimensions on Students' Learning Experience

Exogenous Variables	Ordered Logit Model of Student Learning Experience	Ordered Probit Model of Student Learning Experience	OLS Regression Model of Student Learning Experience
Hybrid Learning Practice	1.050*** (0.228)	0.606*** (0.125)	0.226*** (0.0482)
Student Engagement in Hybrid Learning	0.964*** (0.225)	0.510*** (0.119)	0.190*** (0.0448)
Sustainability of Hybrid Learning	0.667*** (0.210)	0.358*** (0.112)	0.132*** (0.0443)
Student Satisfaction in Hybrid Learning	1.399*** (0.206)	0.752*** (0.111)	0.272*** (0.0400)
Constant/Cut-1	4.463*** (0.956)		0.809*** (0.146)
R-Square	0.3972	0.3961	0.563
Standard errors in parentheses			
Observations = 552			
*** p<0.01, ** p<0.05, * p<0.1			

The Ordered Logit model shows that hybrid learning practice has a positive and statistically significant effect on students' learning experience ($\beta = 1.050$, $p < 0.01$). This finding suggests that improvements in the implementation of hybrid learning practices substantially increase the likelihood that students will report a higher level of learning experience. Similarly, the Ordered Probit ($\beta = 0.606$, $p < 0.01$) and OLS ($\beta = 0.226$, $p < 0.01$) models confirm this positive relationship, indicating that effective hybrid learning practices consistently

enhance students' overall learning experience regardless of the estimation technique employed.

Student engagement in hybrid learning also exhibits a positive and highly significant relationship with students' learning experience across all three models. The Ordered Logit coefficient ($\beta = 0.964$, $p < 0.01$) indicates that increased student engagement significantly improves the probability of achieving better learning experiences. This relationship is further supported by the Ordered Probit ($\beta = 0.510$, $p < 0.01$)

and OLS ($\beta = 0.190$, $p < 0.01$) models, suggesting that active participation and involvement in hybrid learning environments contribute substantially to improving students' educational experiences.

The results further reveal that sustainability of hybrid learning positively influences students' learning experience. Although its coefficients are relatively smaller than those of the other explanatory variables, the effect remains statistically significant across all models (Ordered Logit: $\beta = 0.667$, $p < 0.01$; Ordered Probit: $\beta = 0.358$, $p < 0.01$; OLS: $\beta = 0.132$, $p < 0.01$). This finding indicates that maintaining reliable, continuous, and well-supported hybrid learning systems contributes positively to students' learning experiences.

Among all explanatory variables, student satisfaction in hybrid learning demonstrates the strongest positive effect on students' learning experience. The Ordered Logit model reports the largest coefficient ($\beta = 1.399$, $p < 0.01$), followed by the Ordered Probit model ($\beta = 0.752$, $p < 0.01$) and the OLS model ($\beta = 0.272$, $p < 0.01$). These results suggest that higher levels of

satisfaction with hybrid learning significantly increase the likelihood of students reporting more positive learning experiences, making student satisfaction the most influential predictor among the variables included in the analysis.

The model fit statistics indicate that the explanatory variables account for a considerable proportion of the variation in students' learning experience. The pseudo R^2 values for the Ordered Logit (0.3972) and Ordered Probit (0.3961) models indicate moderate explanatory power, while the OLS model explains approximately 56.3% of the variation in students' learning experience ($R^2 = 0.563$). The consistency in coefficient signs and statistical significance across all three models demonstrates the robustness of the findings, suggesting that hybrid learning practice, student engagement, sustainability, and student satisfaction are reliable predictors of students' learning experience. Overall, the evidence indicates that enhancing these dimensions of hybrid learning can substantially improve students' learning experiences in higher education institutions.

4.5. Student Learning Experiences: Comparison across the Universities

Table 7: Student Learning Experiences: Comparison across the Universities

Ranks			
	University you are currently working/learning	N	Mean Rank
Indexed Student Learning Experiences	Hawasa University	210	283.09
	Adama Science and Technology University	221	377.24
	Jimma University	202	286.35
	Total	633	

Table 8: Descriptive statistics

Descriptive								
Indexed Student Learning Experiences								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Hawasa University	210	3.6333	.76642	.05289	3.5291	3.7376	1.00	5.00
Adama Science and Technology University	221	4.0588	.43815	.02947	4.0007	4.1169	3.00	5.00
Jimma University	202	3.6485	.87544	.06160	3.5271	3.7700	1.00	5.00
Total	633	3.7867	.73799	.02933	3.7291	3.8443	1.00	5.00

Table 9: Kruskal Wallis Test Statistics

Test Statistics ^{a,b}	
	Indexed Student Learning Experiences
Kruskal-Wallis H	47.572

df	2
Asymp. Sig.	.000
a. Kruskal Wallis Test	
b. Grouping Variable: University you are currently working/learning	

The Kruskal–Wallis test was conducted to determine whether there are statistically significant differences in students' learning experiences across Hawassa University, Adama Science and Technology University, and Jimma University. The results reveal a statistically significant difference among the three universities (Kruskal–Wallis $H = 47.572$, $df = 2$, $p < 0.01$). Since the p -value is less than 0.01, the null hypothesis of no difference in student learning experiences across the universities is rejected.

The mean rank results indicate that Adama Science and Technology University recorded the highest mean rank (377.24), followed by Jimma University (286.35) and Hawassa University (283.09). Similarly, the descriptive statistics show that Adama Science and Technology University achieved the highest mean score for student learning experiences ($M = 4.06$, $SD = 0.44$), while Jimma University ($M = 3.65$, $SD = 0.88$) and Hawassa University ($M = 3.63$, $SD = 0.77$) reported comparatively lower mean scores.

These findings suggest that students at Adama Science and Technology University experience greater benefits from hybrid learning than students at Hawassa and Jimma Universities. The mean score of 4.06 indicates a high level of agreement among respondents that hybrid learning contributes positively to their confidence, digital skills, self-directed learning, critical thinking, and ability to connect theoretical knowledge with practical applications. In contrast, although students from Hawassa and Jimma Universities also reported positive learning experiences,

their comparatively lower scores indicate that the benefits of hybrid learning may not be realized to the same extent.

The superior performance of Adama Science and Technology University may be associated with its stronger implementation of hybrid learning practices, better technological infrastructure, higher levels of student engagement, and more effective instructional practices identified in the preceding sections of this study. Since meaningful learning experiences are often shaped by the quality of instructional delivery, accessibility of digital learning resources, opportunities for interaction, and institutional support, the stronger performance of Adama Science and Technology University in these areas may have contributed to its significantly higher learning experience scores.

Although Hawassa and Jimma Universities reported lower scores, the mean values for both institutions remain above 3.50, indicating that students generally perceive hybrid learning positively. However, the significant differences observed among the universities suggest that students do not experience hybrid learning uniformly across institutions. Variations in technological readiness, instructional quality, learner support systems, and institutional commitment may explain these differences.

4.6. Student Satisfaction on Hybrid Learning: Comparison

To examine whether students' satisfaction with hybrid learning differs across the selected universities, a Kruskal–Wallis H test was conducted. The analysis compared the overall

satisfaction levels of students from Hawassa University, Adama Science and Technology University, and Jimma University. The results are presented in Tables 16, 17, and 18.

Table 10: Overall student Satisfaction on Hybrid Learning Mean Rank

Ranks			
	University you are currently working/learning	N	Mean Rank
Indexed Overall Satisfaction on Hybrid Learning	Hawasa University	211	286.81
	Adama Science and Technology University	221	342.52
	Jimma University	187	297.74
	Total	619	

Table 16 presents the mean rank scores of overall student satisfaction with hybrid learning across the three universities. The findings indicate that Adama Science and Technology University obtained the highest mean rank (342.52), suggesting the highest level of student satisfaction with hybrid learning. Jimma University recorded a mean rank of 297.74, while Hawassa University obtained the lowest mean rank (286.81). These

differences in mean ranks imply variations in students' perceptions and satisfaction levels regarding the implementation of hybrid learning among the universities. The results suggest that students at Adama Science and Technology University are generally more satisfied with their hybrid learning experiences than students at Hawassa and Jimma Universities.

Table 11: Descriptive Statistics

Descriptive								
Indexed Overall Satisfaction on Hybrid Learning								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Hawasa University	211	3.4976	.81284	.05596	3.3873	3.6079	1.00	5.00
Adama Science and Technology University	221	3.7647	.63877	.04297	3.6800	3.8494	2.00	5.00
Jimma University	187	3.5401	.91713	.06707	3.4078	3.6724	1.00	5.00
Total	619	3.6058	.79828	.03209	3.5428	3.6688	1.00	5.00

Table 17 presents the descriptive statistics for overall student satisfaction with hybrid learning. Consistent with the rank results, Adama Science and Technology University recorded the highest mean satisfaction score ($M = 3.76$, $SD = 0.64$), indicating a relatively higher level of satisfaction among its students. Jimma University reported a mean score of 3.54 ($SD = 0.92$), while Hawassa University recorded the lowest mean score of 3.50 (SD

$= 0.81$). The overall mean satisfaction score across the three universities was 3.61 ($SD = 0.80$), indicating a moderate to high level of satisfaction with hybrid learning. Moreover, the lower standard deviation observed at Adama Science and Technology University suggests that students' satisfaction levels were more consistent than those reported by students at the other two universities.

Table 12: Kruskal Wallis Test Statistics

Test Statistics ^{a,b}	
	Indexed Overall Satisfaction on Hybrid Learning
Kruskal-Wallis H	13.708
df	2
Asymp. Sig.	.001
a. Kruskal Wallis Test	
b. Grouping Variable: University you are currently working/learning	

Table 18 presents the results of the Kruskal–Wallis H test conducted to determine whether the observed differences in student satisfaction among the universities are statistically significant. The analysis yielded a Kruskal–Wallis H value of 13.708 with 2 degrees of freedom and a significance value of $p = .001$. Since the p-value is less than the threshold of .05, the null

hypothesis of no difference among the universities is rejected. This result indicates that there is a statistically significant difference in students' overall satisfaction with hybrid learning across the three universities. Therefore, students' satisfaction levels vary significantly depending on the university in which they study.

4.7. Hybrid Learning Sustainability

Table --- presents the results of the Ordered Probit, Ordered Logit, and Multiple Regression models examining the determinants of hybrid learning sustainability. The consistency of

findings across the three estimation techniques strengthens the robustness and reliability of the results.

Table 13: Factors Affecting Hybrid Learning Sustainability

Exogenous Variable	Ordered Probit Result Dep: (Hybrid Learning Sustainability)	Ordered Logit result (Hybrid Learning Sustainability)	Multiple Regression (Hybrid Learning Sustainability)
Hybrid Learning Flexibility	0.178*** (0.0524)	0.283*** (0.0972)	0.148*** (0.0383)
Technical Capacity	0.223*** (0.0510)	0.444*** (0.0935)	0.160*** (0.0372)
Feedback and Improvement Mechanisms	0.170*** (0.0485)	0.298*** (0.0882)	0.116*** (0.0353)
Technical Support Effectiveness	0.105** (0.0526)	0.228** (0.0986)	0.0809** (0.0385)
Instructional Quality	0.244*** (0.0530)	0.447*** (0.0963)	0.177*** (0.0387)
Digital Resource Sustainability	0.0735 (0.0529)	0.159* (0.0956)	0.0469 (0.0390)
User Training and Development	0.0527 (0.0516)	0.112 (0.0950)	0.0346 (0.0379)
Management Commitment	0.0484 (0.0521)	0.121 (0.0929)	0.0419 (0.0382)
Long-Term Reliability of Digital Learning Tools	-0.0171 (0.0477)	-0.0482 (0.0842)	-0.0250 (0.0348)
Observations 640 Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1 Regression models control for university fixed effects and respondent gender.			

The results reveal that instructional quality, technical capacity, hybrid learning flexibility, feedback and improvement mechanisms, and technical support effectiveness significantly influence hybrid learning sustainability across all estimation models. Among these factors, instructional quality emerged as the strongest predictor of hybrid learning sustainability. The ordered probit ($\beta = 0.244$, $p < 0.01$), ordered logit ($\beta = 0.447$, $p < 0.01$), and multiple regression ($\beta = 0.177$, $p < 0.01$) results consistently indicate that improvements in instructional quality substantially increase the likelihood of sustaining hybrid learning practices. This finding suggests that sustainability is fundamentally dependent on the quality of teaching and learning processes rather than the mere availability of technology. The result supports Constructivist Learning Theory, which emphasizes that meaningful learning occurs through active engagement, well-designed learning activities, collaboration, and authentic learning experiences (Piaget, 1972; Vygotsky, 1978). The finding is also consistent with the studies of Means et al. (2010) and Owston et al. (2013), who found that effective instructional design is a critical determinant of successful hybrid learning implementation. In the Ethiopian higher education context, this result implies that sustaining hybrid learning

requires instructors to move beyond using learning management systems as repositories of course materials and instead utilize them as interactive environments that promote engagement and meaningful learning.

Technical capacity was the second strongest predictor of hybrid learning sustainability, exhibiting a positive and statistically significant effect across all models ($\beta = 0.223$, $p < 0.01$ in ordered probit; $\beta = 0.444$, $p < 0.01$ in ordered logit; $\beta = 0.160$, $p < 0.01$ in multiple regression). This finding indicates that institutions with adequate technological infrastructure, digital competencies, and technical readiness are better positioned to sustain hybrid learning initiatives. The result supports the Technology Acceptance Model (Davis, 1989), which argues that users are more likely to adopt and continuously utilize technology when they perceive it as useful and easy to use. Likewise, the finding aligns with the Diffusion of Innovation Theory (Rogers, 2003), which highlights the importance of technological readiness for the successful institutionalization of innovations. Empirically, the result corroborates the findings of Mtebe and Raisamo (2014) and Oye et al. (2012), who identified inadequate ICT

infrastructure and limited digital competencies as major barriers to e-learning implementation in African universities. Therefore, strengthening institutional technological capacity remains a prerequisite for ensuring the long-term sustainability of hybrid learning.

The findings further show that hybrid learning flexibility positively and significantly influences sustainability ($\beta = 0.178$, $p < 0.01$ in ordered probit; $\beta = 0.283$, $p < 0.01$ in ordered logit; $\beta = 0.148$, $p < 0.01$ in multiple regression). This suggests that learning environments that provide students and instructors with flexibility regarding time, place, and pace of learning are more likely to be sustained over time. The finding supports Transformative Learning Theory (Mezirow, 1991), which emphasizes that flexible learning environments encourage learners to take greater responsibility for their own learning and adapt to changing educational contexts. The result is also consistent with Means et al. (2010) and Nortvig et al. (2018), who reported that flexibility is one of the principal advantages of hybrid learning because it accommodates diverse learner needs and promotes accessibility. Consequently, universities seeking to sustain hybrid learning should continue expanding flexible learning opportunities that enhance learner autonomy and accessibility.

Similarly, feedback and improvement mechanisms demonstrate a positive and statistically significant effect on hybrid learning sustainability across all models. The finding indicates that institutions that systematically gather, analyze, and utilize feedback are better able to sustain and improve their hybrid learning systems. This result supports Activity Theory (Engeström, 1987), which views learning environments as dynamic systems requiring continuous interaction, adaptation, and improvement among stakeholders. The finding also aligns with Bozkurt and Sharma (2020), who argued that successful digital learning environments depend on continuous monitoring and iterative improvement processes. Effective feedback systems enable institutions to identify challenges early, make evidence-based decisions, and refine instructional and technological practices to support long-term sustainability.

Technical support effectiveness also exhibits a statistically significant positive effect on hybrid learning sustainability at the 5% significance level across all estimation models. This finding highlights the importance of providing timely technical assistance and troubleshooting services for instructors and students. The result supports the Technology Acceptance Model's emphasis on facilitating conditions as important determinants of technology usage (Venkatesh & Bala, 2008). Likewise, the finding is consistent with Mtebe and Raisamo (2014), who

reported that the availability of effective technical support enhances users' confidence and willingness to engage with digital learning technologies. Therefore, universities must invest in responsive technical support services to minimize technological disruptions and ensure continued participation in hybrid learning environments.

In contrast, digital resource sustainability, user training and development, management commitment, and long-term reliability of digital learning tools did not demonstrate statistically significant effects across the models. Although digital resource sustainability showed marginal significance in the ordered logit model ($\beta = 0.159$, $p < 0.10$), its effect was not consistently supported by the ordered probit and multiple regression results. Similarly, user training and development and management commitment exhibited positive coefficients but failed to achieve statistical significance. These findings partially contradict previous studies that identified institutional leadership and professional development as essential determinants of successful digital learning implementation (Oye et al., 2012; Mengistu & Tadesse, 2024). A possible explanation is that respondents perceive these variables as indirect enabling factors whose effects operate through instructional quality and technical capacity rather than exerting a direct influence on sustainability. In other words, management support and training programs may only contribute to sustainability when they successfully translate into improved teaching practices and stronger institutional technological readiness.

Finally, long-term reliability of digital learning tools exhibited a negative but statistically insignificant relationship with hybrid learning sustainability. Although this finding contrasts with the expectations of the Technology Acceptance Model and Diffusion of Innovation Theory, which emphasize the importance of reliable technological systems, it may indicate that respondents place greater value on pedagogical and human factors than on the technical characteristics of digital tools themselves. This interpretation is supported by Owston et al. (2013), who argued that learning outcomes and sustainability depend more on how technology is integrated into teaching and learning processes than on the technology itself. Overall, the findings demonstrate that the sustainability of hybrid learning in Ethiopian public universities is primarily driven by pedagogical quality, institutional technical capacity, learning flexibility, effective feedback systems, and responsive technical support services.

5. Conclusion and Recommendation

5.1. Conclusion

This study reveals that the adoption of hybrid teaching modalities in Ethiopia's higher education institutions reflects ongoing progress in the country's digital transformation agenda. National initiatives such as the e-Learning for

Strengthening Higher Education (e-SHE) program and the development of the national e-learning policy demonstrate growing governmental and institutional commitment to modernizing higher education through technology-enhanced learning environments. However, the implementation and operationalization of hybrid teaching remain uneven across universities due to inadequate digital infrastructure, limited

pedagogical support, institutional constraints, and socioeconomic challenges.

The study further concludes that the hybrid teaching approach is gradually transforming course delivery practices in Ethiopian public universities by promoting the use of learning management systems, digital learning resources, and technology-enabled communication. Nevertheless, this transformation remains largely superficial in many cases, as instructors continue to rely predominantly on traditional teaching methods, with limited instructional redesign. In most instances, learning management systems are used primarily as repositories for learning materials rather than as interactive, student-centered platforms.

The findings also indicate generally positive student experiences with hybrid learning, particularly in relation to flexibility, accessibility, and opportunities for independent learning. Students benefit from improved access to digital resources, asynchronous learning opportunities, and increased engagement beyond traditional classroom settings. However, these advantages are constrained by poor internet connectivity, limited access to digital devices, inadequate digital literacy, and insufficient institutional support. As a result, students from rural and economically disadvantaged

5.2. Recommendation

Based on the findings of the study, several recommendations are proposed for the Ministry of Education, universities, instructors, and ICT support units to strengthen the implementation of hybrid learning in Ethiopian public universities. At the policy level, the Ministry of Education should prioritize investment in digital infrastructure, including reliable internet connectivity, expanded broadband access, and well-functioning learning management systems and multimedia centers. It is also important to strengthen the monitoring and evaluation of e-learning policies, expand national digital capacity-building programs for instructors, and implement inclusive strategies that address digital inequality among students from rural and low-income backgrounds. A sustainable financing mechanism is also needed to ensure the long-term operation of hybrid learning systems, including maintenance and content development.

At the institutional level, universities should strengthen their digital readiness by establishing dedicated learning support centers staffed with qualified technical and instructional design personnel. Continuous professional development programs should be provided to academic staff

backgrounds are disproportionately affected, exacerbating existing educational inequalities.

The study highlights institutional readiness as a critical determinant of effective hybrid learning implementation. Successful operationalization requires not only technological infrastructure but also continuous staff development, strong leadership commitment, policy alignment, dedicated student support systems, and ongoing monitoring and feedback mechanisms. Although all public universities have adopted the Open edX learning management system and established multimedia centers, significant gaps remain in staff training, instructional design capacity, and institutional coordination.

Furthermore, the study demonstrates that hybrid learning in Ethiopia extends beyond technological innovation and involves broader pedagogical and institutional transformation. Its successful implementation depends on the ability of universities to bridge the gap between policy intentions and practical realities while ensuring inclusiveness, sustainability, and educational quality. Without addressing the structural and contextual challenges identified, the large-scale expansion of hybrid education may fail to achieve its intended objectives.

to enhance skills in hybrid teaching, online assessment, and student-centered learning. Universities are also encouraged to promote innovation through incentives and recognition for staff engaged in digital teaching, while formally integrating hybrid learning into strategic planning, quality assurance, and academic evaluation systems. In addition, universities should improve student support through orientation, technical assistance, and regular assessment of student engagement and satisfaction.

For instructors, it is essential to move beyond basic content uploading and adopt more interactive and learner-centered approaches that utilize digital tools such as discussion forums, group activities, and continuous feedback. Instructors should also engage in ongoing professional development and design inclusive hybrid courses that consider students with limited access to technology. Finally, ICT units and technical staff should provide continuous support, regularly upgrade learning systems, and collaborate closely with academic departments to ensure effective integration of educational technologies and smooth implementation of hybrid learning.

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