

Establishing the relationship between online and HyFlex teaching modalities and students' learning engagement at University X

Navin Imbova Mackatiani^{1*}

Eunice Majanga²

Benard Amwayi³

^{1*}mackatianinavin@gmail.com

²ekanaga@mmust.ac.ke

³amwayibernard@yahoo.com

^{1,2,3}Masinde Muliro University of Science and Technology, Kenya

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ABSTRACT

The COVID-19 pandemic has significantly affected the education sector, and many Universities around the world have been forced to implement online and HyFlex instructional approaches to keep education continuing. Although these are ubiquitous, there is a dearth of studies on their impact on student engagement in Kenya's universities, which have different ICT infrastructures. This study seeks to examine the effect of online teaching and HyFlex teaching modalities on the learning engagement of students in a leading public university in Kenya. The research uses a correlational research design, based on the Technology Acceptance Model (TAM), to examine the effect of online and HyFlex teaching methods on students' behavioral, cognitive, emotional, and social involvement. The study was conducted on undergraduate students, lecturers, and academic administrators of University X with a sample size of 312 students, 31 lecturers, and 10 academic administrators. The methods of selecting participants were purposive sampling and Slovin's formula. Questionnaires, semi-structured interviews, and focus group discussions were used to gather data, which were analyzed using descriptive statistics for quantitative data and thematic analysis for qualitative data. The results show that HyFlex teaching (a combination of in-person and online delivery) and online teaching are both associated with higher levels of engagement in students, but that HyFlex teaching is associated with higher levels of engagement in all four domains. Technical infrastructure, devices, internet access, and training were identified as having a significant impact on the effectiveness of both teaching modalities. HyFlex teaching, with proper support from ICT equipment and training of the lecturers, is more effective in improving student engagement than online-only teaching, the study findings show. It calls for continued investment in ICT infrastructure and ongoing professional development for lecturers to maximize the effectiveness of online and HyFlex teaching approaches on student engagement and learning outcomes.

Keywords: COVID-19, HyFlex, ICT, Kenya, Online Teaching, Technology Adoption, Teaching Modalities, Technology Acceptance Model (TAM).

I. INTRODUCTION

The COVID-19 pandemic has changed the education landscape in so many ways, giving rise to a completely new paradigm of online learning on an unprecedented scale. United Nations Educational, Scientific, and Cultural Organization (Watermeyer et al., 2021) highlighted the implementation of hybrid-flexible (HyFlex) models as one of the critical strategies adopted by educational institutions to provide continuity of learning as they scrambled to adapt to the situation. While this transformation has brought numerous advantages, it has also introduced new challenges, including the need to develop digital literacy skills, ensure equitable access to technology, and keep students engaged in digital settings (Watermeyer et al., 2021). University X is known for its cutting-edge ICT use, and this has influenced the teaching method used in their universities, which now incorporates both online and "HyFlex" teaching to suit a wide range of learners.

Online learning, which became more popular during the pandemic, is the process of delivering content via virtual platforms, with students learning asynchronously or synchronously, without being physically present (Dhawan, 2020). The opposite side of the coin is the HyFlex model, which combines face-to-face and virtual learning options, allowing students to attend class both in person and virtually (Beatty, 2014). This is a combination of both so as to optimize the advantages of both and minimize some of the drawbacks, like the digital divide and the physical attendance (Mtebe & Raisamo, 2014).

It is important to understand the effects that any of these teaching models will have on student engagement as engagement is directly connected to academic success, motivation, and overall learning outcomes (Bowers & Kumar, 2022). Engagement has four components: behavior, emotion, social, and cognition, and each of these can be influenced by a different teaching method (Kahu & Nelson, 2018). The previous research has pointed out that online education has been shown to be effective in promoting cognitive learning but lacks emotional and social connections, as there is no physical presence (Li & Chen, 2022). On the other hand, HyFlex models that combine in-person learning with the facilitation of digital access have been found to enhance students' participation, collaboration, and attention (Johnson et al., 2021). These teaching strategies are not equally effective in all education environments, however, and in higher education, it is important to understand the factors that influence engagement within each modality, so as to maximize their application to each context (Czerniewicz et al., 2022).

This work is based on one of the oldest and well-established Universities in Kenya, University X, which has made tremendous progress in the use of teaching modalities through ICTs. University X introduces new HyFlex and online learning to meet the needs of students who have different needs and must be able to attend classes in both the virtual and physical space. This study aims to investigate the relationship between these teaching modalities and student engagement, to understand students' perceptions of these teaching modalities, and to determine factors like access to technology and training that affect the effectiveness of these teaching modalities. The research is inspired by the Technology Acceptance Model (TAM) (Davis, 1989) in order to investigate the student and faculty response to and acceptance of these teaching innovations. The study aims to bring light to the advantages and difficulties of the implementation of HyFlex and online pedagogies at University X, to inform educational policymakers, administrators, and teachers seeking to improve student engagement and learning in the new digital world.

1.1 Statement of the Problem

The Covid-19 pandemic has challenged traditional education systems, and the need for University X to continue with teaching and learning outcomes has led to the need to adapt quickly to online and hybrid-flexible (HyFlex) teaching. Although these digital modalities of teaching have played a key role in enhancing flexibility, especially in remote or difficult settings, the potential impact on student engagement, a key variable for academic achievement, is not well understood. While online learning can be accessed asynchronously or synchronously, students may not have the emotional and social interaction they need to build relationships in person, which can be vital for emotional and social development (Dhawan, 2020). HyFlex teaching, however, has the potential to act upon some of these shortcomings, as it combines in-person and online learning while affording greater freedom and choice for students in their learning interactions with the course content (Beatty, 2014).

However, the effectiveness of the teaching modalities online and HyFlex in fostering student engagement at University X has not been extensively explored. The university has incorporated these technologies, but there is no clarity about these technologies and the behavioral, emotional, cognitive, and social engagement of the student. Furthermore, the various factors affecting the success of these learning methods have not been thoroughly investigated as they relate to the success of the teaching methods (Watermeyer et al., 2021). This study aims to fill this gap by comparing the influence of the two teaching methods on student engagement and exploring students' perceptions and what factors make online and HyFlex teaching modalities effective or ineffective in this context at University X. Understanding these dynamics is crucial in order to bestow the most suitable implementation of these teaching modalities to maximize the impact on learning outcomes.

1.2 Research Objective

To establish the relationship between online and hyflex teaching modalities on learning engagement at University X

II. LITERATURE REVIEW

2.1 Theoretical Review

The Technology Acceptance Model (TAM) is a theoretical model that is used to understand the use and adoption of online and HyFlex teaching modalities by students and instructors. The Theory of Adoption of Technology (Davis, 1989) focuses on the two major factors that influence the adoption and success of the technology: perceived usefulness (PU) and perceived ease of use (PEOU). In a higher education setting, students are more likely to use the technology in HyFlex or online courses (such as learning management systems and video conferencing systems) when they perceive the technology as effective and easy to use (Davis, 1989).

This framework is applicable in discussing the relationship between teachers' ICT skills and students' engagement, especially. Technology that is intuitive and useful for lecturers will lead to a more effective use of it, which will create a more engaging learning environment, as seen in TAM. In addition, the model indicates that sufficient training, good ICT infrastructure, and institutional support (e.g., good internet connectivity and updated

hardware equipment) are important factors in increasing both PU and PEOU, thereby enabling both students and lecturers to maximize teaching and learning (Davis, 1989).

These factors have a significant effect on learning engagement in the Hyflex teaching model, where learners can attend class in person or online. When a learning environment is well supported and flexible, Kahu & Nelson (2018) identify two areas of student engagement – active participation and emotional engagement – that are enhanced. Targeted training and infrastructure development can help increase the acceptance of technology, benefiting the learning process in various learning modalities through the use of TAM.

2.2 Empirical Review

A comprehensive body of research on online and HyFlex teaching has consistently identified ICT infrastructure as an important condition shaping the quality of teaching and learning experiences. Lim et al. (2015) showed that access to appropriate digital tools and the development of ICT competence influence technology-supported teaching and learning. Adequate ICT resources improve access to course content and interaction through tools such as video conferencing, digital learning materials, and online platforms (Lim et al., 2015).

Furthermore, Sahni (2019) and Beatty (2014) suggest that the flexibility of blended and HyFlex learning can enhance engagement because students can adjust participation to their schedules and learning preferences. At the same time, limitations in internet access remain a major challenge to online and HyFlex education in low-resource settings. Simeon et al. (2022) found that inadequate internet access was an important barrier to e-learning among university students in Sub-Saharan Africa, limiting participation in synchronous learning activities.

Training and professional development are also important in optimizing the use of these modalities. Barr and Luo (2024) and Kohnke and Moorhouse (2021) highlight the need for lecturer preparation and institutional support when teaching students across in-person and online modes. Faculty members who are adequately supported in the use of ICT tools are better positioned to design clear, interactive, and engaging learning experiences (Lim et al., 2015).

In addition, OECD (2023) and Means et al. (2014) indicate that well-designed blended learning environments can improve learning and engagement by combining the affordances of online and face-to-face teaching. However, access to technology remains uneven across contexts, particularly for students in lower-resource settings (Czerniewicz et al., 2022; Simeon et al., 2022). The potential of HyFlex courses to enhance engagement and flexibility therefore depends on reliable digital infrastructure and appropriate teaching practices (OECD, 2023).

III. METHODOLOGY

3.1 Research Design

The study is of a correlational research design, which enables the examination of the relationship between the online teaching modality and the HyFlex teaching modality with student engagement. The design is based on understanding the impact of different teaching modalities (online vs. HyFlex) on the four dimensions of student engagement – behavioral, emotional, cognitive, and social (Kahu & Nelson, 2018). This study is grounded in the Technology Acceptance Model (TAM) (Davis, 1989), which helps to understand the acceptance and use of technology in blended learning. This design allows the researcher to see a pattern and correlation between the teaching modalities and the level of student engagement.

3.2 Study Area

The study was carried out in University X, a well-established public university in Kenya, which has been utilizing online and HyFlex instructional methods. The study was conducted in University X, a prominent public university with good infrastructure for ICTs in Kenya and its experience with online and HyFlex teaching methods. The study is best conducted at University X, which has a large number of students and widely uses digital Learning Platforms across the various faculties. The university's continued action plan for integrating flexible learning modalities after the COVID-19 pandemic is a crucial case that should be explored to understand the impact of flexible learning modalities on student engagement.

3.3 Target Population

The target population included undergraduate students, lecturers, and academic administrators at University X, as it is the undergraduate students who are the most direct target of the online and HyFlex teaching modalities. These courses were conducted with lecturers who had participated in teaching the courses to gain insight into the effectiveness of the teaching methods. Academic managers and supporters were also chosen to take part in academic governance and support in the implementation of these modalities.

3.4 Sampling and Sample Size

A purposive sampling technique was used to select participants who had direct experience with online and HyFlex teaching. Participants were 312 undergraduate students, 31 lecturers, and 10 academic administrators. Students were selected by Slovin's formula to achieve a representative sample from the different faculties, and lecturers were selected based on their activities in the different teaching modalities, and administrators were selected based on their participation in the activities of the teaching modalities. This sampling strategy enabled a broad spectrum of experiences and perspectives that were relevant to the study's objectives to be captured.

3.5 Data Collection Methods

The methods of this study are a mix of quantitative and qualitative approaches, so that the data obtained is more complete and provides a full picture of the influence of teaching modalities on student engagement. In the quantitative part of the study, 312 students from different categories of undergraduate students will be interviewed using a structured questionnaire. Questions on the questionnaire will ask students about their engagement in the four domains - behavioral, emotional, cognitive, and social - in online and HyFlex learning environments using a Likert scale. Further, the survey will collect data about students' demographic characteristics (e.g., gender, year in study, faculty, and course types). This data will be used to investigate possible relationships between engagement and students' personal attributes.

Semi-structured interviews will be carried out with 31 lecturers and 10 academic administrators, and the interview questions will be qualitative. The interviews will give insights into their perceptions of the effectiveness of online and HyFlex teaching methods. In addition, a few focus group discussions will be conducted with a small subset of students to learn more about their experience in taking both online and HyFlex courses. Challenges encountered by students and factors that affect their engagement in each modality were discussed. This mixed methods approach helped to identify statistical trends, personal stories, and barriers to engagement that can be discovered by using both qualitative and quantitative methods.

3.6 Data Analysis

The quantitative data were analyzed by using descriptive statistics (mean and standard deviation) in order to summarize the level of engagement of students with the different teaching modalities in the survey. Hypotheses were then tested to see how student engagement or involvement relates to the teaching modalities using inferential statistics. In particular, Pearson correlation will be employed to analyze the correlation between the variables, and multiple regression analysis will be used to analyze how the variables (teaching modalities) affect the dependent variable (student engagement).

Thematic analysis of the transcripts from the interviews and focus group discussions will be used to address the qualitative data. Thematic coding will be used to understand the patterns and themes across aspects related to the effectiveness of online/hyflex teaching, student engagement, and challenges for students and instructors. Data triangulation, that is, comparison and contrast of students, lecturers, and academic administrators' data, will be used in order to ensure the reliability and validity of the data.

3.7 Validity and Reliability

To assure validity and reliability in the study: Pilot Testing: The questionnaire will be pre-tested with a selected sample of students to check the clarity and relevance of the questions in the questionnaire. Triangulation: Data will be cross-validated by gathering information from a variety of sources (students, lecturers, academic administrators) and through various data collection techniques (surveys, interviews, and focus groups). This will strengthen the validity of the study's results. Reliability will be measured in terms of internal consistency of the survey instrument with the help of Cronbach's alpha level.

3.8 Ethical Considerations

The study adhered to ethical guidelines to ensure the protection of participants' rights and maintain the integrity of the research process. Informed consent was obtained from all participants, and they were fully informed of the purpose, procedures, and the fact that they could withdraw without any repercussions. Each participant gave written informed consent. In addition, the study was conducted in confidence, personal information of participants was kept private, and data was anonymized to ensure their identities were protected. All data from the research was kept in a secure manner to give further protection to participants' privacy. Finally, there was no compulsion or pressure on any participants to take part in the study.

IV. FINDINGS & DISCUSSION

4.1 Students' Engagement during Online Sessions

The data in Table 1 indicate that 38.5 percent of respondents agree that students are actively engaged during online sessions. 34.6 percent remain neutral, 15.4 percent disagree, and 11.5 percent strongly agree. Given that 38.5 percent of the respondents agree that students are actively engaged in online sessions, it indicates that online tools, such as Google Meet and Zoom, facilitate meaningful interaction in online teaching modalities. The results suggest that online teaching fosters active participation and attention, two key aspects of learning engagement that align with Beatty's (2019) findings

Table 1

Students' Engagement during Online Sessions

Students appeared engaged, attentive, and participative during Online sessions.					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	4	12.9	15.4	15.4
	Neutral	9	29.0	34.6	50.0
	Agree	10	32.3	38.5	88.5
	Strongly Agree	3	9.7	11.5	100.0
	Total	26	83.9	100.0	
Missing	System	5	16.1		
Total		31	100.0		

. The study sought lecturers' opinions on engagement during Hyflex teaching sessions. Students' opinions were recorded in Table 2.

Table 2

Students' Engagement during Hyflex Sessions

Students appeared engaged, attentive, and participative during Hyflex sessions.					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	1	3.2	3.8	3.8
	Disagree	2	6.5	7.7	11.5
	Neutral	1	3.2	3.8	15.4
	Agree	5	16.1	19.2	34.6
	Strongly Agree	17	54.8	65.4	100.0
	Total	26	83.9	100.0	
Missing	System	5	16.1		
Total		31	100.0		

The data in Table 2 showed that 65.4% of students indicated very high levels of engagement in HyFlex classes, 19.2% agreed they were engaged, 7.7% perceived low engagement, and 3.8% were undecided. This data suggests that a combined agreement and strong agreement showed that students were engaged. The findings indicate that the hyflex teaching modality facilitates learning engagement. It enables learners to connect with the instructor via different modalities, ranging from face-to-face to online, using various technologies. This pattern is consistent with Beatty (2019), who described HyFlex as enabling learners to participate through different but equivalent modes.

From a comparative perspective, the data in Tables 1 and 2 shows that HyFlex recorded a 34.6 percentage point higher positive engagement score than online-only delivery. Neutral perceptions dropped (34.6%→3.8%), implying that HyFlex provided consistent experiences for lecturers to evaluate student participation. HyFlex permits learners to attend classes physically or online, which can reduce participation barriers when connectivity or other circumstances limit one mode of attendance (Beatty, 2019). The findings are consistent with Beatty (2019) and OECD (2023), which emphasize the value of flexible participation and well-supported digital learning environments for sustaining engagement. Overall, the results indicate the positive impact of HyFlex Learning in asynchronous coursework, providing students with flexibility and understanding of course material. The study sought lecturers' views on students' motivation to complete assignments in online and hyflex modalities. The lecturers' views were recorded in Table 3 below.

Table 3*Student Motivation in Assignment Completion*

Students were motivated to complete Online and Hyflex assignments.					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	5	16.1	19.2	19.2
	Neutral	3	9.7	11.5	30.8
	Agree	4	12.9	15.4	46.2
	Strongly Agree	14	45.2	53.8	100.0
	Total	26	83.9	100.0	
Missing	System	5	16.1		
Total		31	100.0		

The data in Table 3 show that 69.2% of the lecturers, including 53.8% who strongly agreed and 15.4% who agreed, felt students were motivated to complete assignments in both online and HyFlex formats. This indicates a positive perception of learner motivation in these formats. In contrast, 11.5% of the respondents remained neutral, reflecting uncertainty about students' motivation levels, which could depend on individual conditions, teaching style, or subject matter. Meanwhile, 19.2% disagreed; suggesting that in some cases, online or HyFlex environments may not have been sufficiently motivating, possibly due to challenges like digital fatigue. The strong agreement shows that flexibility (choosing between online and in-person participation) supports motivation, aligning with OECD (2023) findings that learner autonomy is essential in assignment completion.

The findings mirror Beatty's (2019) hyflex model perspective. In the study, 69.2% of respondents agreed or strongly agreed that students were motivated to complete assignments in hyflex modality because of learners' ability to choose which modality to use to complete assignments as well as join the class. The finding relates to Beatty's principle of learner choice. By allowing learners to choose between in-person and online attendance, HyFlex reduces obstacles such as commuting time, which sustains motivation. Besides, the increased motivation in both online and hyflex modalities aligns with Beatty's argument that choice enhances independence, and autonomy drives engagement. Similarly, OECD (2023) indicates that digital access, institutional support, and flexible learning arrangements are important for participation and engagement. This means in both online and HyFlex formats, flexibility and accessibility boost motivation, allowing students to complete assignments. In turn, student motivation creates an engaging learning experience, resulting in better academic persistence. However, the dissenting and neutral opinions from the respondents may reveal known obstacles such as limited access to devices, inadequate training, and unreliable internet in Sub-Saharan Africa that impede online or hyflex teaching.

The study gathered information from lecturers to understand if online and hyflex teaching modalities support peer-to-peer and student-instructor interaction, essential variables in learning engagement. The lecturers' responses were recorded in Table 4

Table Error! No text of specified style in document.*Peer-to-peer and student-instructor interaction*

The Online and Hyflex modality supported peer-to-peer and student-instructor interaction.					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	2	6.5	7.7	7.7
	Disagree	3	9.7	11.5	19.2
	Neutral	2	6.5	7.7	26.9
	Agree	8	25.8	30.8	57.7
	Strongly Agree	11	35.5	42.3	100.0
	Total	26	83.9	100.0	
Missing	System	5	16.1		
Total		31	100.0		

The data in Table 4 indicate a combined 73.1% of respondents (30.8% agree and 42.3% strongly agree) felt that online and HyFlex teaching supported peer-to-peer and student-instructor interaction. On the contrary, 19.2% expressed disagreement (7.7% strongly disagree and 11.5% disagree), while 7.7% remained neutral. This data distribution reveals that for the majority (73.1%) of lecturers, these modalities facilitate meaningful communication channels in teaching and learning processes. This means that online and hyflex teaching allows students to get into small groups, with the in-person groups and online students moving to breakout rooms on a video conferencing tool like Zoom. This provides students with time to discuss the provided questions or prompts in their small groups and report their responses using a shared Google Document. These findings corroborate Lim, Yan and Xiong (2015 study,

which established that hybrid teaching modalities increase transactional engagement, where regular interactions with peers and instructors are essential predictors of student persistence. Similarly, the findings align with Ananga and Biney (2017) study, which found that online and hyflex teaching encourage peer-to-peer and student-to-instructor interaction, thereby facilitating learner engagement. Furthermore, Ananga and Biney (2017) showed that effective peer-to-peer interaction in HyFlex modalities compensates for infrastructural constraints by ensuring that even students attending remotely participate in collaborative learning.

4.2 Hypothesis Testing

The Wilcoxon signed-rank test was used to test the hypothesis. The hypothesis stated that there is no statistically significant relationship between online and hyflex teaching modalities on learning engagement. The Wilcoxon Signed Rank Test is a non-parametric test used when comparing two related samples. In this context, the same group of lecturers rated HyFlex and Online teaching on learning engagement indicators

Table 5

Wilcoxon Signed Rank Test Results based on Lecturers' Ratings

Test Statistics					
	Students appeared actively engaged during Hyflex sessions. - Students appeared actively engaged during Online sessions.	Students participated effectively in class Hyflex discussions. Students participated effectively in class Online discussions.	Students seemed attentive and focused throughout Hyflex class time. - Students seemed attentive and focused throughout Online class time.	Students were motivated to complete Hyflex assignments and follow through. - Students were motivated to complete Online assignments and follow through.	The Hyflex modality supported peer-to-peer and student-instructor interaction. - Online modality supported peer-to-peer and student-instructor interaction.
Z	-2.926 ^b	-2.909 ^b	-3.067 ^b	-3.191 ^b	-3.231 ^b
Asymp. Sig. (2-tailed)	.003	.004	.002	.001	.001

a. Wilcoxon Signed Ranks Test

b. Based on negative ranks.

Table 5 presents the Wilcoxon signed-rank test results. A Wilcoxon Signed Rank Test was conducted to compare learning engagement between online and HyFlex teaching modalities. The null hypothesis stated that there is no statistically significant relationship between the two modalities and learning engagement. Results revealed statistically significant differences across all measured engagement indicators. Students reported higher engagement during HyFlex sessions compared to online sessions for active engagement ($Z = -2.926$, $p = .003$, $r = .57$), participation in class discussions ($Z = -2.909$, $p = .004$, $r = .57$), attentiveness ($Z = -3.067$, $p = .002$, $r = .60$), motivation to complete assignments ($Z = -3.191$, $p = .001$, $r = .63$), and peer-to-peer/student-instructor interaction ($Z = -3.231$, $p = .001$, $r = .64$). All p -values were below the .05 threshold, leading to rejection of the null hypothesis. These outcomes indicate that the HyFlex modality fosters greater student engagement than online-only delivery, corroborating Beatty's (2019) argument that HyFlex designs offer enhanced flexibility and interactivity. Besides, the findings are consistent with OECD (2023) and Sahni (2019), which established that hybrid models combining synchronous and asynchronous features result in higher engagement compared to fully online formats.

Additionally, these findings align with earlier results in this study that indicated high levels of motivation (53.8% strongly agreed) and strong interaction (42.3% strongly agreed) in HyFlex contexts. The integration of synchronous in-person and online participation facilitates cognitive engagement as well as social and collaborative dimensions of learning. This is consistent with Beatty's (2019) HyFlex model, which emphasizes learner choice, equivalency, reusability, and accessibility. Besides, it reflects patterns reported in OECD (2023) and Sahni (2019), where hybrid models were found to outperform fully online formats in sustaining motivation and fostering interactive learning communities, particularly in post-pandemic higher education environments.

From a comparative viewpoint, University X's results are consistent with broader evidence that the success of technology-mediated learning depends on equitable access, institutional support, and flexible design. Czerniewicz et al. (2022) documented persistent inequalities in emergency remote teaching and learning, while OECD (2023) emphasized the importance of digital infrastructure, connectivity, and teaching capacity in effective digital education systems. These parallels indicate that when HyFlex is implemented according to principles of flexibility, equivalency, and accessibility, it can help reduce participation barriers and support more active learning communities.

Overall, the findings illustrate that Hyflex and Online teaching support the management of specific accessibility considerations. Nevertheless, Hyflex teaching permitted learners to engage in a fluid way that matched their personality. If students find physical learning exhausting, unlike online learning, they choose the modality that suits their learning needs. Additionally, if students find socialization with others in class to be a good thing to do, they choose to attend half the classes online and half face-to-face. The result justifies components of Hyflex teaching, such as flexibility, which facilitates engagement across different learning needs. The study gathered information from students through questionnaires and focus group discussions to determine the relationship between online and hybrid teaching on undergraduate students' learning engagement. The study first sought students' views on online teaching modality on learner engagement. The students' opinions from questionnaires were recorded in Table 6 below.

Table 6*Online Teaching Modality Encourages interaction, Collaboration, attention, and Motivation*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	30	12.6	12.6	12.6
	Disagree	30	12.6	12.6	25.1
	Neutral	27	11.3	11.3	36.4
	Agree	107	44.8	44.8	81.2
	Strongly Agree	45	18.8	18.8	100.0
	Total	239	100.0	100.0	

The data in Table 6 show that 44.8 percent of the respondents agreed and 18.8 percent strongly agreed that online teaching modalities support interaction and collaboration. Neutral responses accounted for 11.3 percent, while negative views were equally divided between "strongly disagree" (12.6%) and "disagree" (12.6%). This indicates that while 44.8 percent and 18.8 percent of the respondents recognize the collaborative potential of online teaching modalities, one-quarter of participants remain unsure about its effectiveness in fostering interaction. These findings are consistent with Means et al.'s (2014) study, which established that online modalities, when integrated with collaborative tools like Zoom, Google Meet, and Microsoft Teams, enhance peer-to-peer and student-instructor interactions. The results suggest that structured online environments with active learning features lead to higher levels of collaboration, attention, and motivation. The study collected students' views on the influence of the Hyflex teaching modality on learner engagement. The students' responses were captured in Table 7

Table 7*Hyflex Interaction, Collaboration, Attention, and Motivation*

Hyflex Teaching Modality encourages interaction, collaboration, attention, and motivation					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	19	7.9	7.9	7.9
	Disagree	28	11.7	11.7	19.7
	Neutral	35	14.6	14.6	34.3
	Agree	50	20.9	20.9	55.2
	Strongly Agree	107	44.8	44.8	100.0
	Total	239	100.0	100.0	

The data in Table 7 show that 44.8% of participants strongly agreed and 20.9% agreed that the Hyflex teaching modality promotes interaction, collaboration, attention, and motivation. This results in a combined positive perception rate of 65.7%. Neutral responses made up 14.6%, indicating that a minority of respondents remained unsure. Additionally, 11.7% disagreed, and 7.9% strongly disagreed, suggesting some reservations. These results show that Hyflex approaches promote active engagement and collaborative learning. This matches with Beatty (2019) Hyflex model, which focuses on student choice, flexibility, and equivalent learning experiences across modalities. According to the OECD (2023) study, universities in Croatia and the Netherlands adopted Hyflex teaching modality because it enhanced student interaction and motivation, especially when supported by reliable technology and clear instructional design.

The comparative analysis of Tables 6 and 7 indicates that both online and Hyflex modalities contribute to learner engagement, though the magnitude of perceived effectiveness varies. For online modalities, 44.8% of respondents agreed, and 18.8% strongly agreed that these environments encourage interaction, collaboration, attention, and motivation, leading to a 63.6% positive perception rate. In contrast, Hyflex teaching received stronger support, with 44.8% strongly agreeing and 20.9% agreeing, resulting in a 65.7% positive perception rate. Although both modalities garnered similar levels of agreement, the proportion of "strongly agree" responses was higher in the Hyflex

context, indicating a higher engagement level. The findings indicated that Hyflex teaching generated higher satisfaction scores, leading to a noticeably higher overall course satisfaction, and students showed a clear preference for Hyflex teaching as they valued the opportunity to receive face-to-face instruction.

These findings align with Beatty (2019), whose HyFlex framework combines in-person and online participation to preserve learner choice and equivalent learning opportunities. Kohnke and Moorhouse (2021) similarly found that students valued the flexibility of HyFlex while also noting the need to manage interaction carefully across participation modes. Means et al. (2014) further showed that outcomes in online and blended learning depend strongly on instructional design and implementation. Taken together, these studies support the present finding that HyFlex can strengthen interaction, active engagement, attention, collaboration, and motivation when the online and face-to-face components are intentionally integrated. Using focus group discussions, the study sought students' views on the influence of online and HyFlex teaching modalities on learner engagement. Group 11 (Health Sciences) stated that:

"In our experience, both online and Hyflex classes promote engagement, motivation, and collaboration, but in different ways. Online tools like Zoom make it easier to connect with classmates beyond the classroom, especially through breakout rooms and discussion boards. However, Hyflex feels more interactive because we can choose to attend in person or join online, depending on our situation. Being able to see classmates face-to-face while also engaging with remote peers keeps our attention higher. Hyflex sessions also feel more personal, which motivates us to participate more actively compared to purely online sessions." 12th April 2026

On the same note, group 15 (Education faculty) asserted that:

"Hyflex lets us practice teaching strategies in real classrooms while still engaging with peers online. It feels more authentic than purely online learning. Group activities work better because we can split tasks between in-person and remote students, keeping everyone motivated and focused on collaborative goals." 12th April 2026

Similarly, group 7 (science and technology) noted that:

"Lab-based courses are more effective in Hyflex since we can do experiments on-site and discuss results online. Online-only classes sometimes reduce focus, but Hyflex keeps attention high by mixing hands-on activities with digital collaboration tools". 13th April 2026

From these findings, both online and hyflex teaching modalities promote motivation, participation, and attention. However, students' choice of modality depends on their needs. According to Peimani and Kamalipour (2021), students choose the modality of engagement that best suits their needs and learning styles. HyFlex requires planning and technical infrastructure to support multiple modalities of delivery simultaneously. It requires instructors to be highly skilled in facilitating learning in different environments, but promotes higher learning engagement than online learning. The implications of these findings are significant for educational institutions and lecturers. By recognizing the value of real-time communication, social-emotional exchanges, and collaborative learning, instructors can create an inclusive and engaging learning environment that supports students' engagement. Incorporating the HyFlex Learning approach is crucial since it can enhance student engagement, promote deeper understanding of the subject matter, and ultimately improve overall learning outcomes.

4.3 Hypothesis Testing

The hypothesis stated that there is no statistically significant relationship between online and hyflex teaching modalities on learning engagement. The Wilcoxon Signed Rank Test is a non-parametric test used when comparing two related samples.

Table 8
Wilcoxon Signed Rank Test Results based on Students' Ratings

Test Statistics					
	I felt actively engaged during the Hyflex class - I felt actively engaged during the online class.	I was able to participate in Hyflex discussions effectively - I was able to participate effectively in Online discussions.	I could concentrate throughout the Hyflex class - I could concentrate throughout the online class.	I felt motivated to attend and complete Hyflex class tasks - I felt motivated to attend and complete Online class tasks.	The learning environment encouraged Hyflex interaction and collaboration. The learning environment encouraged Online interaction and collaboration.
Z	-3.053 ^b	-3.297 ^b	-1.367 ^b	-4.000 ^b	-3.110 ^b
Asymp. Sig. (2-tailed)	.002	.001	.171	.000	.002

a. Wilcoxon Signed Ranks Test

b. Based on negative ranks.

Table 8 shows the results from a Wilcoxon signed-rank test. A Wilcoxon Signed Ranks Test was conducted to compare students' perceptions of engagement, participation, concentration, motivation, and interaction between Hyflex and online teaching modalities. The results showed statistically significant differences in most variables, favoring the Hyflex modality. Students reported significantly higher engagement during Hyflex classes compared to online classes, $Z = -3.053$, $p = .002$, and greater participation in Hyflex discussions, $Z = -3.297$, $p = .001$. Motivation to attend and complete tasks was significantly higher in Hyflex, $Z = -4.000$, $p < .001$. The learning environment was perceived to encourage more interaction and collaboration in Hyflex, $Z = -3.110$, $p = .002$. However, no significant difference was found in concentration levels between the two modalities, $Z = -1.367$, $p = .171$.

In conclusion, lecturer and student responses show that learner engagement was higher in the Hyflex teaching modality compared to the fully online modality. Lecturers stated that Hyflex sessions facilitated higher interaction, both peer-to-peer and student-to-instructor, because of the integration of in-person and online participation. This means the integration enabled instant feedback, lively discussions, and collaborative problem-solving, which contribute to sustained student attention. Additionally, the flexibility in Hyflex allowed students to select their preferred modality of attendance, enhancing motivation. Similarly, students' opinions closely mirrored those of the lecturers, who felt motivated, attentive, and engaged in Hyflex sessions. Students attributed this to the dual access to classroom dynamics and digital interaction, which offered diverse avenues for participation. Although over 60 percent of the students acknowledged that online teaching modalities enabled meaningful interaction and collaboration, 40 percent cited challenges in sustaining concentration and active participation in purely virtual environments. Therefore, the findings indicate that both online and Hyflex modalities foster learner engagement as evidenced by the higher response rate of agree and strongly agree.

V. CONCLUSION & RECOMMENDATIONS

5.1 Conclusion

This study examined the effect of Online teaching modality and the HyFlex teaching modality on learning engagement of undergraduate students at University X in Kenya. The results show that there was a significant contribution to continuity of learning between both the conventional and online teaching modalities during the COVID-19 pandemic. HyFlex teaching, a blended delivery approach, did not just benefit students' academic achievement in all areas of learning (behavioral, emotional, social, and cognitive), but it was also more effective. Specifically, HyFlex teaching enhanced student motivation, involvement, and attention span. The technical infrastructure, the internet, and digital devices were identified as key factors for the successful implementation of these teaching methods. These findings were confirmed by the Technology Acceptance Model (TAM), which revealed that the perceived usefulness and perceived ease of use of the e-learning tools affected the level of involvement of the students. The findings showed that training and sufficient technical support for both students and instructors, as well as better infrastructure of ICT tools, are needed in order to effectively make the most of the use of online and HyFlex teaching methods in improving student learning outcomes.

5.2 Recommendations

Based on the findings of this study, several recommendations are proposed to improve the effectiveness of online and HyFlex teaching modalities at University X and other similar institutions. The technical infrastructure for universities needs to be improved, first of all. Upgrade of ICT infrastructure should be provided to ensure reliable internet connectivity, adequate bandwidth, and access to modern digital devices. This is crucial to remove accessibility obstacles that hinder students' ability to access online learning platforms and engage in HyFlex courses.

In addition, continued faculty training and development are important. Teachers should be offered continuous professional development in the use and implementation of technology, as well as in pedagogical strategies in relation to blended learning environments. Training will be provided to faculty members to be able to carry out online and in-person sessions effectively, to make effective learning experiences, and to use the learning management system (LMS) to engage students effectively. Student support is also a key component in meeting digital literacy challenges and needs, and universities ought to invest heavily in this aspect. Providing examples and tips for time management, SRL, and troubleshooting technical problems will enable students to maximize their opportunities to participate in online and HyFlex settings. Providing these supports can enable students to navigate digital platforms and engage in their learning processes confidently.

Furthermore, universities should further develop flexible learning arrangements to accentuate flexibility and inclusion in teaching and learning. Offering an option for in-person or online learning based on students' preferences, schedules, and technology availability will provide a more personalized learning environment. Such flexibility would enable students to handle their studies better and get an education in a way that matches their personal requirements.

Declaration of Interest

The authors declare that they do not have any known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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