

Research Article

Social Network Ties, Student Attitudes, and Technology Adoption in Kenyan Universities

Marcellah Eucabeth Onsomu^{1,*} , Kenneth Goga Riany² ,
Agnes Linus Mutuma³ , Antony Omondi Radol⁴ 

¹Corporate Communications, Kenya Medical Training College, Nairobi, Kenya

²Information and Communication Technology, Kenya Medical Training College, Nairobi, Kenya

³Nursing, Kenya Medical Training College, Nairobi, Kenya

⁴Medical Laboratory Sciences, Kenya Medical Training College, Nairobi, Kenya

Abstract

The increased dependency on digital learning tools has notably accelerated technology adoption within higher education. While research has explored the relationship between student attitudes and technology usage, there remains a gap in understanding the influence of social network ties on this process, particularly within collectivist cultures such as Kenya. This study draws on Social Exchange Theory and Structural Holes Theory, to examine how social network ties affect the link between student attitudes and technology adoption in Kenyan universities. A quantitative cross sectional survey design was leveraged on, data was collected from 437 final-year students in 79 Kenyan universities using a validated questionnaire. Exploratory factor analysis confirmed the reliability and construct validity of the measurement instruments. The study leveraged on a moderated linear regression analysis to verify the proposed model. It revealed that student attitudes significantly influence technology adoption ($\beta = 0.48$, $p < 0.001$), and, social network ties significantly enhance this relationship (interaction effects: strong ties $\beta = 0.19$, $p < 0.01$; weak ties $\beta = 0.15$, $p < 0.05$). These findings demonstrate that students embedded in social network ties are more likely to have positive attitudes on technology adoption. The results complement technology adoption models by demonstrating that social network ties are vital for technology adoption in higher education. The study offers actionable insights on the need to foster social network ties to maximize the impact of technology adoption. Future research should explore these dynamics longitudinally and contextually to deepen understanding of the interplay between student attitudes, social networks, and technology use.

Keywords

Higher Education, Kenyan Universities, Social Exchange Theory, Social Network Ties, Structural Holes Theory, Student Attitudes, Technology Adoption

1. Introduction

The increasing integration of digital tools in higher education institutes (HEI) has reshaped the way students access

learning resources, interact with instructors, and collaborate with peers [1]. Across Africa, the rapid expansion of online

*Corresponding author: marcellahonsomu@gmail.com (Marcellah Eucabeth Onsomu)

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learning platforms and mobile-enabled education has addressed systemic challenges like limited infrastructure and accessibility [2-4]. With the global adoption of online learning platforms, mobile applications, and virtual classrooms, technology has become central to teaching and learning [5].

In Kenya, universities have accelerated the adoption of educational technologies (EdTech) to address challenges such as limited infrastructure, overcrowded lecture halls, and the need for flexible learning options [6, 7]. Despite this progress, student adoption of educational technologies remains inconsistent. While some learners are quick to engage with EdTech tools, others have shown resistance or disengagement [8]. This disparity highlights the need for an intentional analysis on the determinants that foster or hinder technology adoption in Higher Education Institutes (HEIs).

Previous research on educational technologies (EdTech) adoption has largely focused on individual-level factors, particularly student attitudes toward technology [9, 10]. Frameworks such as the Unified Theory of Acceptance and Use of Technology (UTAUT) and Technology Acceptance Model (TAM) emphasize constructs like perceived usefulness, ease of use, and behavioral intention as key predictors of technology use [11, 12].

However, these models tend to overlook the social context in which students make decisions. In HEIs environments, especially within collectivist cultures like Kenya, students often rely on peers, classmates, and social groups for academic guidance, emotional support, and decision-making cues [13, 14]. As a result, their technology adoption behaviors are likely shaped by the structure and quality of their social relationships.

This study examines how social network ties influence the relationship between student attitudes and technology adoption in Kenyan universities. It draws on two complementary theoretical frameworks, Social Exchange Theory (SET) and Structural Holes Theory (SHT), to explore how both strong and weak social ties impact the way attitudes are translated into behavior. SET explains how individuals form and maintain relationships that offer mutual benefits such as information, assistance, and encouragement [15]. Within this perspective, students who are embedded in supportive networks are more likely to adopt technology when they perceive encouragement, validation, or direct help from their peers or mentors.

On the other hand, SHT offers a different but related perspective [16]. It focuses on the advantages that come from bridging gaps between unconnected groups in a social network. Individuals who occupy these structural holes are in a position to access diverse information and novel resources [17]. In the university context, weak ties such as acquaintances, classmates from other programs, or online peers may provide access to new ideas, unfamiliar technologies, or alternative approaches that are not available within tightly knit circles. These weak ties, although less emotionally intense than strong ties, can play a powerful role in exposing students

to technological innovations.

Anchored on SET and SHT, the study investigated how social network ties moderate the relationship that exists between student attitudes and technology adoption. Social network ties may reinforce positive attitudes through trust, support, and shared norms. Additionally, it may introduce new perspectives and widen students' awareness of available digital tools. Together, these social dynamics may explain why some students with similar attitudes differ in their levels of technology use depending on the composition of their social networks.

A quantitative cross sectional survey design was leveraged on, data was collected from 437 final-year students in 79 Kenyan universities using a validated questionnaire. Exploratory factor analysis confirmed the reliability and construct validity of the measurement instruments. A moderated linear regression analysis was employed to test the hypothesis that social network ties influence the relationship between, student attitudes and technology adoption. The results indicated that both strong and weak ties play a significant role in enhancing the link between positive attitudes and technology use. The study findings show that students do not adopt technology exclusively based on personal preferences or perceived utility, but also based on the social influences and information flows within their networks.

This research contributes to the literature in several ways. This study extends current models of technology adoption by introducing social networks as a dimension that is theoretically grounded and empirically tested. It highlights the relevance of both cohesive and diverse social networks in shaping digital behavior in the university context. It also offers new insights into the Kenyan higher education environment, where social networks are often central to the student experience. For practitioners, the findings provide guidance on how to design peer-based interventions, cross-departmental collaborations, and student support structures that enhance digital engagement.

2. Research Objectives

The general objective of this study was to analyze the moderating influence of social network ties on the relationship between student attitudes and technology adoption in Kenyan universities. The specific objectives are:

- 1) To assess the effect of student attitudes on technology adoption in Kenyan universities.
- 2) To determine how social network ties influence the relationship between student attitudes and technology adoption.
- 3) To evaluate the moderating effect of social network ties on the relationship between student attitudes and technology adoption in the Kenyan higher education context.
- 4) To provide context-specific insights and policy recommendations for enhancing digital engagement through social networks in academic environment.

3. Literature Review

Although individual attitudes are widely acknowledged as determinants of technology adoption, the influence of social network ties remains underexplored. Existing theoretical frameworks and empirical studies highlight the role of student attitudes and social networks in shaping technology adoption across global, regional, and local contexts, while also revealing notable research gaps.

3.1. Theoretical Review

Understanding how students adopt technology in HEIs requires a theoretical lens that captures both individual-level motivation and social-level influence. This study leveraged on two distinct but complementary theories: Social Exchange Theory (SET) and Structural Holes Theory (SHT), to explain how student attitudes and social network ties interact to shape technology adoption behavior.

3.1.1. Social Exchange Theory

Social Exchange Theory posits that human behavior is catalyzed by the quest of benefits and costs avoidance in social relationships [18, 19]. Within the context of higher education, SET suggests that students are more likely to adopt technologies when they perceive that doing so will yield relational benefits such as peer approval, academic support, or shared success [20, 21].

In addition, the students are likely to adopt technologies when they perceive that the "cost" of using such digital tools for example time, effort, or risk of failure, is offset by these social returns. SET frames student attitudes not merely as isolated cognitive evaluations but as beliefs formed through interpersonal interaction and past exchanges. For example, a student's positive attitude toward a mobile learning application may be reinforced by experiences where its use helped coordinate a group assignment or improved communication with peers. In such cases, the attitude is both a product and driver of social exchange.

While SET effectively captures the motivational dynamics underlying technology use, it has limitations. According to [22], SET tends to assume that individuals are rational actors consistently weighing costs and benefits. However, student behavior, especially regarding technology, can be impulsive, habitual, or shaped by institutional pressures beyond peer dynamics. Moreover, [23] further argue SET's focus on strong, emotionally invested ties may overlook the role of weaker, less personal connections that also influence student behavior. As such, SET provides a partial explanation for technology adoption that needs to be complemented with a broader network-based view [24].

Despite these limitations, SET remains relevant in explaining why positive student attitudes may emerge or be sustained, through social feedback loops that validate the utility and acceptability of digital tools, as suggested by [25].

In this study, SET serves to frame attitude as a socially constructed and relationally reinforced variable, which is then tested for its predictive power on technology adoption.

3.1.2. Structural Holes Theory

Structural Holes Theory, developed by [16], focuses on the structure of social networks and the advantages conferred by occupying boundary-spanning positions. Individuals who connect otherwise disconnected groups, therefore bridging "structural holes", have access to novel information and are often first-movers in innovation adoption [26, 27]. In student communities, those with diverse or weak ties across faculties, clubs, or online groups may learn about new technologies earlier and more broadly than those embedded in dense, redundant networks. SHT directly informs the study's treatment of social network ties, especially the distinction between strong and weak ties. Strong ties, typically associated with frequent interaction and high emotional closeness, can offer sustained support and reinforcement of attitudes [28]. Weak ties, by contrast, are less emotionally intense but more likely to provide non-redundant, innovative information. For technology adoption, this distinction is crucial [29]. While strong ties help sustain engagement with known tools, weak ties often introduce students to new platforms, uses, or perspectives that may challenge or expand existing attitudes.

Although Structural Holes Theory brings important insights into how network position influences access to innovation, it underemphasizes the emotional or motivational aspects of behavior [30, 31]. SHT assumes that exposure to novel information naturally leads to adoption, yet it overlooks how internal dispositions, such as attitudes or values, mediate this process [32, 33]. A student may be well-positioned within a network rich in weak ties but still resist adopting new technology due to anxiety, lack of confidence, or negative past experiences.

More often than not, SHT presumes a high level of agency among actors, indicating that they purposefully leverage network positions to gain advantages [34]. In reality, students may not consciously cultivate or utilize weak ties in this way. Their social networks may be shaped more by proximity, academic structure, or chance than by strategic intent. Despite these limitations, SHT is particularly valuable in explaining how social exposure and network diversity influence the relationship between attitude and action. In this study, SHT supports the idea that social network ties moderate the translation of student attitudes into behavior, influencing the degree to which positive attitudes lead to technology adoption.

3.2. Empirical Review

The review provided insights into how student attitudes, peer influence, and social media use shape learning behavior. While international studies provide a baseline, regional and local studies reveal context-specific factors affecting technology adoption.

Globally, [1] explored higher education scholars' engagement with digital social networks across North America, using a mixed-methods survey of 307 participants. Guided by Uses and Gratification and networked participatory scholarship theories, they found that motivations such as visibility, feedback, and recognition drive usage, though challenges like privacy and audience management persist. Similarly, [35] found that international students in Australia use familiar platforms like Facebook and WeChat to support academic and social integration. Using descriptive surveys with 43 students, they identified a disconnect between preferred platforms and institutional tools, recommending that universities integrate familiar Social Networking Sites (SNS) capabilities into learning environments.

Using a mixed-methods study across Israel and Europe, [36] revealed that while students widely adopt social network technologies (SNTs), their use is mostly limited to resource sharing rather than collaborative learning. The authors concluded that meaningful educational engagement with SNTs requires structured instructional design and educator facilitation.

Ayyash et al [37] studied students in Palestine using structural equation modeling (SEM) with partial least squares (PLS) on data from 370 undergraduates. Integrating the Technology Acceptance Model (TAM) with perceived enjoyment, social influence, and information security, they found all constructs significantly influenced SNS acceptance in e-learning. In Bangladesh, [38] used a cross-sectional design and PLS analysis with 720 students to show that social media literacy, ease of use, behavioral control, and perceived risk positively influenced attitudes, which in turn predicted intention to use social media. Notably, ICT facility and perceived usefulness had no significant effect, underscoring the role of risk perception and media literacy.

In contrast, [10] in Malaysia found that both TAM and the Unified Theory of Acceptance and Use of Technology (UTAUT) vital role of predicted behavioral intention and actual social media use among 312 students, leading to improved academic grades. Unlike [38], it stressed the importance of perceived usefulness, recommending a consideration on contextual differences in how students evaluate educational technologies.

Across studies, a common thread is the gap between potential and actual academic use of social media. While adoption is high, true collaborative learning is often lacking. The consensus is that to fully realize the benefits of social media in education, institutions must enhance digital literacy, align tools with user preferences, and integrate social media meaningfully into pedagogy [1, 35-38].

At the regional level, studies generally affirm global findings. [14, 39, 40] each explore the use of social media in higher education within African contexts (Nigeria, Uganda, and South Africa) respectively. All three studies investigate how digital platforms support learning and engagement among university students, particularly in developing country

settings, where infrastructural and institutional challenges persist. Despite sharing a common thematic focus on social media integration in education, each study emphasizes different dimensions: [14] examine self-efficacy, peer influence, and resource availability; [39] investigate actual usage patterns and institutional support; and [40] focus on the digital divide and its implications for first-year students.

In the methodology, [14] utilized a quantitative research design using structured questionnaires distributed to students and academic staff in Nigeria. Analyzed by descriptive statistics, the data revealed that digital self-efficacy, peer influence, and access to digital resources significantly shape SNS adoption for educational purposes. However, the study's reliance on descriptive analysis limited the depth of causal interpretation. [39] adopted a multi-method approach, which combined surveys, focus group discussions, and interviews, targeting students and lecturers from Makerere University, Uganda Technology and Management University, and Makerere University Business School in Uganda.

They found high student engagement with platforms like WhatsApp (94.8%) and Facebook (86.5%) for academic purposes, but a significant disconnect with lecturers, 37.6% of whom reported never engaging students via social media. Meanwhile, [40] used survey data from 600 first-year students in a South African multi-campus university and applied regression analysis grounded in social cognitive theory. They discovered that while access to computers and stable internet was low, widespread use of mobile devices enabled students to engage with learning through social media. Personal and environmental factors such as hallmarks of the digital divide, were key determinants in social media adoption.

The findings across the studies converge on the recognition that mobile-based social media tools have become central to students' learning experiences in Africa's higher education landscape. Together, the studies underline the need for institutional and infrastructural support, and to highlight the growing digital competence and motivation among students to leverage these platforms for academic purposes. However, differences arise in their depth of analysis and focus. [14] emphasizes internal learner and institutional factors but lack inferential analysis. On the other hand [39] provide a richer qualitative and quantitative blend, offering insights into the social dynamics between students and faculty. In contrast, [40] uniquely address structural inequalities through a digital divide lens, adding a socio-economic dimension often underexplored in technology adoption studies.

These three studies emphasize that while social media has transformative potential for learning in African universities, its successful integration is dependent on more than student enthusiasm, as it requires institutional alignment, faculty engagement, and policy intervention. [14] recommends enhancing digital training and infrastructure; [39] call for university-level social media policies; and [40] advocate for device ownership and internet access in disadvantaged areas. Together, these studies provide a comprehensive regional

perspective on the challenges and opportunities of educational technology adoption in Sub-Saharan Africa.

Within the Kenyan context, [6] examined how environmental factors influenced the adoption of internet technology among university students in Kenya, applying the Technology Acceptance Model (TAM) framework. They surveyed a total of 203 undergraduate students across three universities using a quantitative research design. Their findings showed that competition pressure, government support, ICT vendor support, and socio-economic factors significantly affected perceived usefulness, while all except competition pressure also influenced perceived ease of utilization and their behavioral intention to use the internet. Perceived usefulness was noted as the strongest predictor of intention. They recommended that governments provide tax incentives and subsidized bandwidth, universities enhance supportive policies, and ICT vendors tailor solutions for academic contexts. The study acknowledged limitations such as reliance on self-reported data and a sample confined to undergraduates [6].

Within the Kenyan context, a study investigating the mediating role of smart learning environments in the relationship between social media use and academic performance among university students at United States International University - Africa in Nairobi was carried out [41]. The study adopted a positivist philosophy and a cross-sectional survey design, collecting data from 458 students via structured questionnaires. Using partial least squares structural equation modeling, Kamau found that social media use had a significant positive effect on both smart learning environments and academic performance.

Smart learning environments also positively influenced academic performance but did not significantly mediate the relationship between social media use and academic outcomes. Kamau made a conclusion that social media enhanced knowledge sharing and collaborative learning, and those smart environments amplified these benefits. The study recommended investing in digital infrastructure, enhancing faculty digital competencies, and updating institutional policies to address privacy, misinformation, and cyberbullying. Limitations included the use of quantitative methods, focus on a single institution, and lack of platform-specific analysis [41].

Both studies emphasized the critical role of contextual and institutional support in promoting digital integration within Kenyan higher education. They shared a quantitative methodological approach and recommended improvements in policy and infrastructure. While [6] focused on broader internet adoption shaped by environmental enablers, [41] addressed the academic impact of social media through the lens of smart learning environments. Their differing scopes and theoretical underpinnings reflected the diverse dimensions of digital adoption in HIEs.

3.3. Research Gaps

While extensive research has explored educational technology adoption, most studies have primarily focused on individual-level predictors such as perceived usefulness, behavioral intention, and self-efficacy, or institutional and infrastructural factors like digital access and faculty support. However, limited attention has been paid to the role of social network structures in influencing students' actual technology usage, especially in the context of developing countries.

Globally, researchers such as [10, 37, 38] examined factors like perceived enjoyment, social influence, information security, and risk perceptions. Although valuable, these studies did not consider the roles of social tie strength in shaping behavior. Similarly, regional research in Africa by [14, 39, 40] explored self-efficacy, peer influence, institutional support, and digital inequality, but did not differentiate between the influence of strong versus weak ties in social networks.

In the Kenyan context, [6] investigated environmental factors affecting internet adoption, and [41] analyzed the mediating role of smart learning environments between social media use and academic performance. However, neither study directly addressed the structural aspects of student social networks or how these networks mediate the link between attitudes and behavior.

This study addressed the identified gap by applying Social Exchange Theory and Structural Holes Theory to investigate how social network ties influence the translation of student attitudes into technology use. Through moderated regression analysis, the study provided a dynamic and contextually grounded understanding of how social networks affect digital adoption in higher education. This approach contributes new insights to both theory and practice, particularly within the underexplored setting of Kenyan universities.

4. Methodology

This study's methodological approach integrated established theoretical perspectives with empirical procedures to yield findings of both scholarly and practical significance. By grounding the research in Social Exchange Theory (SET) and Structural Holes Theory (SHT), the methodology was designed to capture the complex interplay between individual attitudes and social network ties that shape technology adoption behavior in higher education. The methodology outlines the research design, sampling strategy, data collection instruments, variable operationalization, and analytical techniques.

4.1. Research Design

The study leveraged on quantitative cross-sectional survey design which according to [42] this design enables systematic examination of hypothesized relationships. It was therefore used to hypothesize the relationship among student attitudes, social

network ties, and technology adoption across the large, heterogeneous population of final-year university students in Kenya. The quantitative paradigm is specifically well-suited for hypothesis testing and for generating generalizable understandings, addressing the need for empirical clarity in a field which is more often dominated by qualitative or anecdotal accounts [43, 44].

Additionally, the cross-sectional nature of the design allowed for the efficient capture of attitudinal and behavioral patterns for the final year students, when technology adoption is most consequential for academic and professional trajectories. By using of a hypothesis-testing framework, the study assessed both main effects (the direct influence of attitudes on adoption) and interaction effects (the moderating role of social ties), thereby advancing theoretical understanding and offering actionable insights for policy and practice.

4.2. Sample and Sampling Technique

The target population for this study comprised 129,831 final-year undergraduate students enrolled in 79 accredited public and private universities in Kenya during the 2023–2024 academic year, as documented by the Commission for University Education [45]. The study population was selected to ensure that the study findings would be nationally representative and applicable across the broader landscape of higher education institutions in Kenya.

To ensure methodological rigor and reduce sampling bias, a stratified random sampling technique was employed. The multi-stage sampling process involved several structured steps. First, the 79 universities were stratified into two categories, public universities ($n = 39$) and private universities ($n = 40$), based on institutional ownership, which typically corresponds to differences in funding models, student demographics, and technological infrastructure.

Next, proportional allocation was applied based on student enrollment within each stratum. Of the total population, public universities accounted for 79,556 students (61.3%), while private universities enrolled 50,275 students (38.7%). These

proportions were used to determine the distribution of the sample size: Public universities: $61.3\% \times 437 = 268$ students
Private universities: $38.7\% \times 437 = 169$ students. The minimum required study sample size was calculated using Yamane Taro (1967) formula [46]:

$$n = \frac{N(1)}{1 + N(e)^2}$$

Where;

N = population size at (129,831)

e = Confidence interval

n = sample size

This yielded a minimum sample of 399. To further enhance reliability and account for potential non-response or incomplete data, the sample was increased to 437 students. Within each university type, students were selected using simple random sampling. Lists of final-year students were obtained from institutional registrars and student leadership bodies. Random selection was conducted using computer-generated random numbers to ensure each respondent had an equal chance of participating in the study.

The inclusion criteria involved final year undergraduate students who had used educational technologies during the academic year. The criterion assured the relevance of participant experiences to the study's focus on technology adoption. To ensure representativeness and inclusivity, data collection was done using a dual-mode approach. Online surveys were administered by university email systems, while in-person data collection was carried out at selected universities through hard copy questionnaires.

This approach was effective in navigating infrastructural disparities across institutions and improving the rate of response. This multi-stage sampling process was designed to yield a diverse, representative sample that mirrors the structural and demographic composition of Kenya's higher education sector, therefore enhancing the external validity and generalizability of the study findings.

Table 1. Distribution of Total University Enrolment by Type.

University Type	Total Enrolment	% of Population	Proportionate Sample Size
Public	79,556	61.3	268
Private	50,275	38.7	169
Total	129,832	100	437

4.3. Instruments and Data Collection

The study used a structured, self-administered questionnaire as its primary data collection instrument. The questionnaire

captured the multidimensional constructs key to the research, and comprised four main sections, each mapped to the study's conceptual framework. The first section gathered demographic information, including respondents' age, gender, academic discipline, level of study, and university type.

The second section measured student attitudes toward educational technology. Anchored on the tenets of Social Exchange Theory, this section included items that assessed perceived academic benefits, the ease with which technology could be integrated into students' study routines, and the overall positivity or skepticism toward digital tools. Responses were recorded on a five-point Likert scale, that ranged from strongly disagree to strongly agree. This facilitated interval-level analysis and comparison across groups.

The third section focused on social network ties, operationalized in accordance with [47] typology and further informed by Structural Holes Theory. This section of the questionnaire distinguished between social network ties, such as close friends, frequent study counterparts, occasional acquaintances and online peers. It measured interaction frequency, emotional closeness, and the diversity of students' networks, thereby capturing both bonding and bridging forms of social capital that influence adoption of technology.

The final section focused on the students' technology adoption behavior, allowing the respondents to indicate the frequency and variety of their academic technology use. This technique allowed the study to assess both the breadth and the depth of students' digital engagement, and gave an understanding of their technology adoption across platforms.

To ascertain the instrument's reliability and validity, a pilot study was administered to thirty (30) undergraduate students, and results informed refinements for clarity, cultural appropriateness, and contextual fit. The internal consistency of all multi-item scales was confirmed, with Cronbach's alpha coefficients exceeding the accepted threshold of 0.7, thus attesting to the reliability of the measures. The study maintained ethical aspects by obtaining the required ethical clearance from the relevant institutional review boards, participation was voluntary and anonymous. Additionally, the study obtained informed consent before administering the instrument.

4.4. Operationalization of Variables

In this study, student attitudes were defined as learners' evaluations of educational technology, specifically in terms of its value, relevance, and usability. This construct, rooted in Social Exchange Theory, was measured through students' agreement with statements such as "Technology enhances my academic performance" and "I find educational tools easy to integrate into my studies," thereby capturing the perceived benefit-cost to adoption of technology decisions.

Social network ties were categorized as either strong (close friends, trusted peers) or weak (acquaintances, online contacts), following Granovetter's framework [47]. The measurement of weak ties was further guided by Structural Holes Theory, which stresses the role of such connections in exposing students to diverse information and novel resources. Metrics for social ties included interaction frequency, emo-

tional closeness, and network diversity, ensuring assessment of both bonding and bridging social capital.

Measured by students' self-reported frequency and variety of utilization across platforms, technology adoption behavior was operationalized as the use of Education Technology tools, thereby depicting the levels of digital engagement.

4.5. Justification of Methods

The methodological choices underpinning this study are anchored in both theoretical imperatives and empirical best practices. Employing a quantitative, cross-sectional design was essential for testing complex, multivariate relationships at scale, and for identifying statistically significant patterns that transcend anecdotal or context-specific observations [42, 45]. To ensure a wider representative of the student population, stratified random sampling was used to mitigate sampling bias and to enhance the generalizability of the findings. Furthermore, the deployment of a validated, multi-dimensional instrument ensured that the constructs were measured with both precision and cultural relevance [44, 45].

4.6. Analytical Approach

Data analysis was carried out through a series of methodical stages. Descriptive statistics was used to analyze demographics of the respondents and to establish baseline patterns in student attitudes, social ties, and technology use. Reliability analysis, specifically Cronbach's alpha, was conducted to confirm the internal consistency of all multi-item scales. The core hypotheses were tested using moderated regression analysis, that enable the examination of both the main effects and the moderating influence of strong and weak social network ties on the relationship between student attitudes and technology adoption. Interaction terms were constructed to assess moderation. Statistical analyses were carried out using Statistical Package for the Social Sciences (SPSS) (version 28), with checks performed to ensure analytical integrity and replicability.

5. Results

5.1. Descriptive Statistics

As depicted in Table 2, a total of 437 final-year students from 79 accredited Kenyan universities participated in the study, with 61.3% ($n = 268$) from public and 38.7% ($n = 169$) from private universities. The gender distribution (52% female, 48% male), and the mean age was 23.4 years ($SD = 2.1$), with most participants (89%) aged between 21 and 25. Respondents represented a range of academic disciplines, including sciences, humanities, business, and technology.

Table 2. Demographic Characteristics of the Sample.

Variable	Category	Frequency	Percentage
University Type	Public	268	61.3
	Private	169	38.7
Gender	Male	210	48.0
	Female	227	52.0
Age Group	21 - 22	187	42.8
	23 - 25	202	46.2
	26+	48	11.0

Moreover, as depicted in Table 3, the baseline descriptive analysis rated student attitudes toward educational technology (M = 3.98, SD = 0.62), technology adoption (M = 3.72, SD =

0.71), and for social networks strong ties (M= 4.10, SD=1.20, weak ties (M= 6.30, SD=1.45).

Table 3. Descriptive Statistics of Study Variables.

Variable	Mean	SD	Min	Max
Student Attitudes	3.98	0.62	2.1	5.0
Technology Adoption	3.72	0.71	1.8	5.0
Strong Ties	4.10	1.20	1.0	7.0
Weak Ties	6.30	1.45	2.0	10.0

5.2. Pilot Test and Exploratory Actor Analysis (EFA)

As depicted in Table 4, a pilot study with 30 students was conducted to assess construct validity and the instrument's

reliability. EFA by Principal Axis Factoring and Varimax rotation was performed on all multi-item scales. The Kaiser-Meyer-Olkin (KMO) values exceeded 0.7, and Bartlett's Test of Sphericity was significant ($p < 0.001$), validating sampling adequacy and factorability.

Table 4. EFA and Reliability Results (Pilot Study).

Construct	No. of Items	KMO	Bartlett's Test (p)	Variance Explained (%)	CronbachAlpha
Student Attitudes	7	0.81	<0.001	58.2	0.82
Strong Ties	5	0.76	<0.001	61.5	0.79
Weak Ties	5	0.74	<0.001	59.8	0.76
Technology Adoption	6	0.83	<0.001	63.1	0.85

Moreover, as depicted in table 5, all items loaded strongly (>0.60) on their respective factors, confirming

uni-dimensionality. Cronbach's alpha values exceeded 0.75 for all constructs, indicating strong internal consistency. EFA was repeated on the main study sample (N = 437) and con-

firmed the factor structure, with all items loading above 0.65 on their respective factors.

Table 5. EFA and Reliability Results (Main Study).

Construct	No. of Items	KMO	Bartlett's Test (p)	Variance Explained (%)	Cronbach's Alpha
Student Attitudes	7	0.87	<0.001	61.3	0.85
Strong Ties	5	0.81	<0.001	63.2	0.81
Weak Ties	5	0.79	<0.001	60.7	0.78
Technology Adoption	6	0.89	<0.001	65.4	0.87

5.3. Correlation Analysis

As depicted in table 6, Pearson correlation coefficients results revealed significant positive associations among the

main variables. Student attitudes were strongly correlated with technology adoption ($r = 0.56$, $p < 0.001$). Both strong ties ($r = 0.38$, $p < 0.001$) and weak ties ($r = 0.34$, $p < 0.001$) were also positively correlated with technology adoption.

Table 6. Pearson Correlation Coefficients Results.

Variable	Student Attitudes	Strong Ties	Weak Ties	Technology Adoption
Student Attitudes	1.00			
Strong Ties	0.41**	1.00		
Weak Ties	0.36**	0.44**	1.00	
Technology Adoption	0.56**	0.38**	0.34**	1.00

Note: ** $p < 0.01$

5.4. Moderated Linear Regression Analysis

As depicted in table 7, the central hypotheses were tested using moderated linear regression analysis. Student attitudes toward educational technology were a strong, positive predictor of technology adoption ($\beta = 0.48$, $p < 0.001$). Both strong and weak social network ties significantly moderated

this relationship. The interaction between attitudes and strong ties was positive and significant ($\beta = 0.19$, $p < 0.01$), indicating that the effect of positive attitudes on adoption was amplified for students embedded in closely-knit peer groups. The interaction between attitudes and weak ties was also significant ($\beta = 0.15$, $p < 0.05$), suggesting that students with more diverse, bridging connections were more likely to translate positive attitudes into actual technology use.

Table 7. Moderated Regression Results.

Predictor	β	SE	t	p
Student Attitudes	0.48	0.06	8.00	<0.001
Strong Ties	0.22	0.05	4.40	<0.001
Weak Ties	0.17	0.05	3.40	<0.01

Predictor	β	SE	t	p
Attitudes * Strong Ties	0.19	0.07	2.71	<0.01
Attitudes * Weak Ties	0.15	0.06	2.50	<0.05

Moreover, as shown in Table 8, the final regression model accounted for a substantial proportion of variance in technology adoption behavior, with an R^2 value of 0.42 and an adjusted R^2 of 0.41. This indicates that approximately 41 percent of the variability in technology adoption behavior was explained by the predictors included in the model. The overall

model was statistically significant, $F(5, 431) = 62.8$, $p < .001$, suggesting that the set of predictors reliably distinguished between higher and lower levels of technology adoption. The relatively close values of R^2 and adjusted R^2 also imply that the model was robust, with limited risk of overfitting.

Table 8. Moderated Regression Analysis Results.

Model	R	R^2	Adjusted R^2	SE	F	p
Full Model	.65	.42	.41	0.54	62.8	<.001

5.5. Interpretation

The findings indicate that student attitudes play a key role in technology adoption within Kenyan universities, and that this dynamic relationship is strongly shaped by the structure of students' social networks. Strong ties, such as close friends and academic, reinforce positive attitudes, likely through trust, encouragement, and shared norms. Weak ties expose students to new information and alternative practices, broadening their awareness and increasing the likelihood that positive attitudes will translate into actual adoption of technology.

The research instruments validity and internal consistency was confirmed by the pilot study's high reliability scores and the EFA results from both pilot and data collection. Correlation and regression analyses confirm that social network ties are significant moderators in the student attitude technology adoption relationship. The model's high explanatory power ($R^2 = 0.42$) underscores the practical importance of these social dynamics.

These findings validate the theoretical integration of SET and SHT, highlighting that technology adoption in higher education is both an individual and a social process. For university administrators, policymakers, and technology providers, the results highlight the need to foster positive attitudes as well as supportive and diverse social networks to maximize digital engagement in Kenyan universities.

6. Discussion

6.1. Summary of Findings

This study set out to examine the moderating influence of social network ties on the relationship between student attitudes and technology adoption within Kenyan universities. The results align with the research objectives. Student attitudes toward educational technology adoption was noted significantly impact the levels of technology adoption, affirming the central role of individual beliefs and motivations. Moreover, social network ties significantly moderated this relationship. Explicitly, students who are part of closely-knit peer groups or those with diverse, bridging connections, were more likely to translate positive attitudes into actual technology adoption. The final regression model explained a substantial proportion of variance in technology adoption ($R^2 = 0.42$), accentuating the explanatory power of combining attitudinal and social network variables. The findings confirm that technology adoption in Kenyan universities is an individual cognitive process and is also embedded in the social fabric of student life.

6.2. Theoretical Implication

The findings of this study provide contributions to both SET and SHT. Aligning with SET, the findings illustrate that students' technology adoption decisions are shaped by perceived benefits and costs, as well as the social reinforcement from peers. On the other hand, strong ties amplify the effect of positive attitudes, supporting the notion that trust, support,

and shared norms within close networks facilitate behavioral change. At the same time, the significant moderating effect of weak ties lends empirical support to SHT. Weak ties, by connecting students to new information and diverse perspectives, serve as conduits for innovation and broaden the pathways through which positive attitudes can lead to technology adoption. Together, these findings extend both theories by demonstrating their complementary roles: SET explains the motivational and relational context, while SHT highlights the structural and informational advantages of network diversity. Importantly, the study findings reveal that social network ties are key in the success of technology adoption.

The results also highlight the mechanisms through which social networks exert influence. Strong ties reinforce attitudes by fostering trust, shared norms, and repeated validation of beliefs, which collectively strengthen students' confidence in adopting educational technologies. Weak ties, in contrast, provide access to novel perspectives and information by linking students to less familiar peers or groups. Such bridging connections expand the informational landscape, reduce redundancy, and enable students to encounter new ideas that may not circulate within their immediate networks. These mechanisms explain why both types of ties are essential and why their combined effect is particularly powerful in shaping technology adoption.

6.3. Comparison with Prior Studies

This study's findings complement the prior studies on technology adoption in institutions of higher education. Globally, studies by [1, 35] have documented the role of social networks in shaping technology adoption in universities. This study's findings echo these conclusions, while providing more detailed evidence on the distinct roles of strong and weak ties. Regionally, research in African and Kenyan contexts has often emphasized infrastructural and attitudinal barriers to technology adoption [5, 6], but has rarely examined the social network dimension in depth. This study fills that gap, demonstrating empirically that social relationships, both close and distant, significantly influence the effectiveness of positive attitudes in driving technology adoption. The results also align with prior work on the Technology Acceptance Model (TAM) and UTAUT, but go further by embedding these individual-level models within a broader social context, therefore responding to calls for more holistic frameworks in EdTech research.

6.4. Practical Implications

The implications of these findings are vital for Kenyan universities, administrators, policymakers, and technology providers. First, efforts to promote technology adoption should not focus only on changing individual attitudes through training or awareness campaigns. Instead, interventions should be designed to leverage and strengthen both

strong and weak social ties among students. For example, peer mentoring programs, collaborative digital projects, and cross-departmental student networks can create environments where positive attitudes are reinforced and new technologies are more readily adopted. Technology providers and university Information and Communication Technology (ICT) departments should also recognize the value of social network ties in moderating student attitudes towards technological innovation. Stakeholders can support these efforts by crafting institutional policies that foster social network ties.

6.5. Limitations

This study is subject to a number of limitations. The cross-sectional design limits causal inference. While associations are strong, longitudinal research is needed to confirm the directionality of effects. Recall bias and social desirability may be noted attributed to the use of self-reported data, although the use of validated scales and pilot testing mitigates this concern. The exclusive use of final year students within the inclusion criteria may limit the generalizability of the findings to other student cohorts or educational contexts. Additionally, while the study distinguished between strong and weak ties, it did not explore the qualitative nature of these relationships or mechanisms by which social influence operates.

6.6. Future Research

Future research should consider the following areas. Longitudinal studies are necessary to understand any key variations in attitudes, social networks, and technology adoption over time, providing stronger evidence for causal relationships. Comparative studies across different student cohorts, universities, or national contexts would help to assess the generalizability of the present findings. Qualitative research could enrich understanding of the specific ways in which strong and weak ties facilitate or hinder technology adoption, including the role of digital versus face-to-face interactions. Finally, future work should explore the impact of emerging and disruptive technologies and the evolving digital landscape on student networks and adoption behaviors.

7. Conclusion

This study has examined the moderating role of social network ties in the relationship between student attitudes and technology adoption in Kenyan universities. It demonstrates that technology adoption is more of an individual as well as a societal undertaking. On the other hand, the study findings illustrate that student attitudes toward educational technology not only predict their adoption behavior, but also demonstrate that this relationship is significantly moderated by social network ties. The integration of SET and SHT offers a model for elucidating the intrinsic interplay, illustrating the influence

of social network ties on technology adoption.

The study complements prior technology adoption literature by incorporating social network ties, thereby addressing a significant gap in the previous research. Further, it offers empirical evidence from the context of Kenyan universities, thereby enriching comprehension of technology adoption in collectivist cultures where social relationships are influential. Third, it demonstrates the value of a dual-theoretical approach that captures both the relational quality of strong ties and the informational advantages of weak ties in facilitating digital engagement.

8. Policy Recommendations

Based on the results of the study, several actionable recommendations for policy and practice arise for Kenyan universities, administrators, decision-makers, and technology suppliers. Higher education institutions are encouraged to strengthen initiatives that foster favorable student perceptions of technology adoption by utilizing social network connections embedded in the student community. This can be achieved through the introduction of peer-led technology initiatives, which include structured mentorship programs where students with advanced technological proficiency assist their counterparts, thereby effectively harnessing and leveraging the influence of social network ties.

In addition, institutions of higher learning should aim at providing inter-departmental opportunities for collaboration, encouraging students to engage with counterparts on digital advancements, and therefore fostering the formation of weak ties that facilitate exposure to diverse technological innovations and adoption. Technology providers and university ICT departments are encouraged to design educational platforms with features that support both close collaboration and broad networking. This will ensure that digital environments are conducive to both bonding and bridging social networks. In addition, universities should recognize and provide assistance to students who experience social isolation, as they may need specific support to fully access and adopt the available digital opportunities. Training initiatives ought to extend beyond basic technical instruction, incorporating elements that foster collaboration and community engagement to help build stronger social networks.

Finally, educational policies should recognize the inherently social dimension of digital literacy, allocating resources to support both formal and informal student networks. By embracing these strategies, stakeholders can provide an environment where technology adoption is a socially reinforced practice as well as an individual choice, thereby maximizing digital engagement and learning outcomes in Kenyan universities.

As Kenyan universities continue to embrace digital transformation, understanding the social fabric that supports or hinders technology adoption becomes increasingly important. This study demonstrates that effective digital engagement

strategies must strategize over and above individual skills and attitudes to consider the intricate relationships in which students are embedded. By nurturing social network ties, universities can create social ecosystems that facilitate the adoption of technology.

The findings reinforce the unique social nature of learning and technology adoption in higher education. In a world where technological change is constant, the ability to leverage social networks, may be as important as technical knowledge itself. For Kenyan universities seeking to produce graduates who are fit-for purpose for the digital era, fostering rich, diverse, and supportive social networks represents a powerful and sustainable approach to enhancing technological engagement. Institutions can create more inclusive, effective, and resilient digital learning environments that serve the needs of students by recognizing and harnessing these social dynamics.

Abbreviations

EdTech	Education Technologies
EFA	Exploratory Factor Analysis
E-learning	Electronic Learning
HEIs	Higher Education Institutes
ICT	Information and Communication Technology
KMO	Kaiser-Meyer-Olkin
SD	Standard Deviation
SET	Social Exchange Theory
SHT	Structural Holes Theory
SNS	Social Network Sites
TAM	Technology Acceptance Model
UTAUT	Unified Theory of Acceptance and Use of Technology

Author Contributions

Marcellah Eucabeth Onsomu: Data curation, Formal Analysis, Project administration, Supervision, Writing – original draft, Writing – review & editing

Kenneth Goga Riany: Project administration, Resources, Writing – original draft, Writing – review & editing

Agnes Linus Mutuma: Conceptualization, Data curation, Formal Analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing

Antony Omondi Radol: Project administration, Validation, Visualization, Writing – review & editing

Data Availability Statement

The data is available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare no conflicts of interest.

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