# Bridging the Digital Divide in Nigeria: Examining the Role of Digital Inclusion in Enhancing Well-Being Among University Students

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**Abstract**

With digital technologies becoming increasingly integral to daily life and pivotal in shaping the future, their influence on individual well-being has attracted growing attention from researchers. Yet, despite decades of investigation, there remains limited clear evidence on whether digital technology positively or negatively affects well-being. This study explores a framework aimed at promoting digital inclusion to address the digital divide, ensuring fair access to technology and supporting a digitally empowered society that enhances overall well-being, including happiness and life satisfaction. Using a convenience sampling approach, data were collected from 238 university students in Nigeria, providing a solid basis for evaluating 12 hypotheses. The proposed model was analyzed through partial least squares structural equation modeling (PLS-SEM) using SmartPLS 4. Results indicate that digital inclusion is essential for understanding individuals' engagement with technology and how such interactions offer critical resources that contribute to well-being. Most hypothesized relationships were supported, except for the link between digital inclusion and life satisfaction, and the mediating role of resources between digital inclusion and life happiness. The study's findings carry significant implications for educational institutions, government agencies, and organizations seeking to enhance well-being through equitable access to digital technologies.

**Keywords:** Digital inclusion, well-being, happiness, life satisfaction, digital divide, Nigeria

## INTRODUCTION

In the contemporary digital era, information and communication technologies (ICTs) have become fundamentally embedded in global socioeconomic systems, transforming how societies function, communicate, and develop (Li et al., 2022; World Benchmarking Alliance, 2023). The education sector has experienced particularly significant transformations through digital technologies, with innovations reshaping pedagogical approaches and learning outcomes worldwide (Shadiev et al., 2024; Adam & Alhassan, 2020). In Nigeria, Africa's largest economy and most populous nation, this digital revolution presents both opportunities and challenges as the country navigates its technological integration within educational frameworks (NBS, 2023). Globally, internet penetration has reached 67.1% of the population (5.44 billion users), with social media platforms engaging 63.7% of connected individuals (Petrosyan, 2024). However, this technological progress has simultaneously exacerbated the digital divide, creating disparities in access and digital literacy between developed and developing nations (Sieck et al., 2021). Nigeria exemplifies this paradox: while urban centres show relatively high connectivity rates, rural areas and low-income populations face persistent barriers including inadequate infrastructure, high data costs, and limited digital skills. The COVID-19 pandemic starkly revealed these inequalities when educational institutions transitioned to online learning, disproportionately affecting students without reliable digital access (Jamil & Muschert, 2024).

Digital inclusion - defined as equitable access to and meaningful use of digital technologies (Wrapson & Gasteiger, 2024) - has consequently emerged as a critical development priority. For Nigerian university students, this concept takes on particular significance as they represent a demographic where digital competency intersects with educational attainment, career prospects, and psychosocial well-being (Büchi, 2024). However, research examining these intersections within Nigeria's unique socioeconomic context remains limited, creating a knowledge gap this study seeks to address. Access to digital technology has become increasingly critical for university students, particularly in Nigeria, where disparities in digital access can significantly influence educational outcomes. The concept of the digital divide, which refers to the inequalities in access to and the usage of digital technologies, remains a pressing issue globally, especially in developing countries like Nigeria. This research paper aims to examine the role of digital inclusion in enhancing well-being among university students in Nigeria against the backdrop of the broader digital divide. The digital divide manifests prominently within educational environments. Especially during critical phases such as the COVID-19 pandemic, disparities in digital access became apparent. Iftikhar et al. discussed how urban students in Pakistan faced fewer barriers compared to their rural counterparts when engaging with online learning opportunities, highlighting a similar trend likely present in Nigeria, where variations in access to technology influence educational experiences and outcomes among students from different socioeconomic backgrounds (Iftikhar et al., 2023). Moreover, Mathrani et al. noted that many students in developing nations struggle with limited digital capabilities, which can adversely affect their education and overall confidence in leveraging digital media (Mathrani et al., 2021). This underscores the necessity for effective digital inclusion strategies to enhance the educational experiences of underserved student populations in Nigeria.

Examining the specific case of Nigerian university students, a study that assessed e-assessment practices and found significant disparities in access to digital assessments, which directly impact students' academic performance. This suggests that students without adequate access to digital resources face long-term educational disadvantages, perpetuating the cycle of inequity. Additionally, Ibrahim et al. explored the concept of digital accessibility and its critical role in facilitating better exam performances among students, indicating a clear link between enhanced digital access and improved academic outcomes. Moreover, the implications of digital well-being are particularly relevant in the Nigerian context, as increased digital engagement can contribute to better mental health and productivity. Other findings illustrate a belief

among students that digital well-being features could help mitigate screen time and enhance productivity. Furthermore, Büchi's studies have drawn connections between digital practices and well-being, indicating that intentional usage of digital resources can lead to heightened well-being and productivity (Büchi, 2020).

In terms of policy implications, enhancing digital inclusion necessitates a multi-faceted approach, addressing infrastructural barriers and promoting digital literacy among students. The literature highlights how empowering students through access to digital technologies can foster greater agency and autonomy, which is crucial for enhancing well-being. The overarching theme is that without intentional interventions to bridge the digital divide, many Nigerian students will continue to face significant challenges in both their academic and personal lives. Thus, bridging the digital divide in Nigeria is imperative for the well-being of university students. As digital technologies increasingly permeate academic settings, ensuring that all students have equitable access and the necessary skills to utilize these technologies is essential to promote educational equity and overall well-being.

The digital divide in Nigeria continues to pose a formidable barrier to equitable access to education, particularly for university students navigating the demands of a rapidly digitized academic environment. This divide, defined by gaps in access to digital technologies, internet connectivity, and digital literacy skills, undermines educational inclusion and amplifies socio-economic disparities across geographic regions. In particular, students from rural or low-income backgrounds are disproportionately affected due to infrastructural limitations and socio-cultural constraints, which hinder their ability to fully engage in digital learning environments (Guobadia & Ekuobase, 2024; Bello et al., 2016). As the integration of technology becomes increasingly central to teaching and learning, these inequalities have grown more pronounced, especially in the wake of the COVID-19 pandemic which necessitated an abrupt transition to online learning (Mathrani et al., 2021; Azubuike et al., 2021; Müller et al., 2023). Existing literature emphasizes that the digital divide is not simply a matter of access to devices or internet services; it extends to the effective use of technology, often influenced by students' digital competence, institutional support, and socio-cultural alignment between learners' backgrounds and educational expectations (Phillips et al., 2020). Studies show that students who lack digital literacy skills are less able to engage meaningfully with academic content delivered through online platforms, leading to reduced academic performance, limited job readiness, and heightened psychological stress (Oztosun et al., 2023; Dienlin & Johannes, 2020). The challenges are particularly acute for first-generation university students and those from underserved communities who face additional pressures to succeed despite limited digital resources (Deng & Yang, 2021; Soriano et al., 2024).

Furthermore, the psychological ramifications of digital exclusion are increasingly evident. The lack of access to digital tools and skills contributes not only to academic disengagement but also to feelings of isolation, anxiety, and reduced life satisfaction. Research by Igoki and Langat (2023) has highlighted a clear linkage between digital inequity and mental health challenges among university students, noting that inadequate digital competence exacerbates stress and impairs well-being. Similarly, Panesi et al. (2020) and Dienlin and Johannes (2020) argue that the inability to participate in digital learning environments effectively can lower students' confidence and emotional resilience, further compounding the adverse effects on their educational outcomes. Digital inclusion, understood as the equitable provision of access, digital literacy training, and culturally relevant technological integration, is increasingly recognized as a cornerstone of student success and well-being. Scholars like Igbinovia & Aiyebelehin (2023) and Irele (2021) emphasize that libraries and academic institutions play a critical role in promoting digital inclusion by offering supportive infrastructure, digital tools, and training programs. These resources are not only vital for enhancing academic performance but are also positively associated with improved

psychological health and job search self-efficacy (Huang et al., 2020). In this regard, interventions aimed at increasing digital fluency can serve as powerful enablers of educational equity and holistic development.

Despite these insights, there is a noticeable gap in the literature concerning the holistic impact of digital inclusion on university students' well-being in the Nigerian context. Most studies focus on access and usage metrics, with insufficient attention given to the psychosocial dimensions of digital deprivation. Moreover, while some research has considered the effects of the digital divide on academic performance, far fewer have examined how inclusive digital environments can foster psychological resilience, satisfaction, and emotional stability. The intersectionality of factors such as gender, socio-economic background, and prior educational exposure remains underexplored in relation to digital inclusion and well-being (Hossain et al., 2023).

In light of these considerations, it becomes imperative to investigate how digital inclusion can serve as a mediating mechanism for promoting well-being among university students in Nigeria. This includes examining not only access to technological resources but also the quality and cultural relevance of digital engagement facilitated through institutional policies, pedagogical approaches, and student support services. Understanding these dynamics is critical for developing targeted interventions that bridge digital disparities, enhance academic outcomes, and foster a supportive, resilient, and inclusive learning environment for all students, regardless of their socio-economic or geographic backgrounds.

Hence, while prior research has made progress in identifying the structural and technological dimensions of the digital divide in Nigerian higher education, the complex interrelationship between digital inclusion and student well-being remains insufficiently explored. A comprehensive, context-specific investigation is needed to understand how digital equity efforts can be effectively implemented to support students' academic and emotional needs. Such insights are essential for shaping inclusive digital education policies that not only provide access to technology but also cultivate the digital fluency and psychological resilience necessary for students to thrive in an increasingly digital world.

**Objective(s) of the Study:**

1. To assess the level of digital inclusion among university students in terms of access to and interaction with digital technologies.

2. To evaluate the direct relationship between digital inclusion and components of well-being, specifically life satisfaction and happiness.

3. To investigate the mediating role of digital resource access in the relationship between digital inclusion and well-being outcomes.

4. To test a conceptual model explaining the mechanisms through which digital inclusion influences subjective well-being using PLS-SEM.

## LITERATURE REVIEW

### Digital Wellbeing

Smartphones interact via taps, clicks, and swipes approximately 2,600 times daily (Nelson, 2016). The average user interacts with devices for 145 minutes, but more active users dedicate 225 minutes daily to their smartphones, a figure that could exceed five hours for those who use extensively (Deng et al., 2018; Sewall et al., 2020). Consequently, digital technologies help people be "constantly online and perpetually connected" (Vorderer et al., 2016). People are faced with a new problem as a result, which raises the question of how individuals might achieve well-being in the digital age by striking an equilibrium across detachment and connectedness (Vanden Abeele, 2021).

Recent discoveries have prompted scholars to investigate the influence of psychological well-being on modern humans (Vanden Abeele, 2021). Well-being, in its broadest sense, is the condition attained when we engage in lifestyles that are advantageous to us (Klenk, 2020). Well-being encompasses both positive emotional states and

effective functioning. Experiencing well-being encompasses positive feelings of happiness, satisfaction, interest, engagement, confidence, and affection; effective functioning entails the realization of one's potential, exercising control over one's life, possessing a sense of purpose, and fostering meaningful connections. Digital technology expands the prospects for enhancing well-being, especially for young individuals for whom technology is often an essential companion (Taylor, 2018). Adolescents with inadequate well-being are more prone to low educational achievement and career opportunities, challenges in social relationships, physical health issues, drug abuse, and engagement in criminal activities (Taylor, 2018)

"Well-being" is a term that generally seeks to include a broad spectrum of favorable life outcomes. Therefore, it may be seen as both objective and subjective: the latter denotes measurable indices of quality of life, such as income and educational achievement. It includes tangible resources, external living conditions, or materials that improve quality of life. Subjective well-being, often referred to as happiness or life fulfilment (Neville et al., 2024; Voukelatou et al., 2021), is defined as "an individual's evaluation or declaration of their quality of life" (Diener, Diener, et al., 2018; Helliwell & Aknin, 2018). This encompasses aspects such as fostering healthy relationships, finding a sense of purpose, and participating in social interactions (Büchi, 2024). It reflects individuals' self-assessed quality of life (Diener, Seligman, et al., 2018; Helliwell & Aknin, 2018; Jebb et al., 2020). Psychosocial research suggests that perception of circumstances often outweighs objective reality in shaping individual experiences (Vezzoli et al., 2023). Accordingly, this study focuses on the subjective well-being of university students.

**Digital Wellbeing Framework**

Focused theoretical development and empirical study can be built upon the overall digital welfare model (Büchi, 2024). It links three types of variables: (1) digital activities; (2) immediate results, including both positive and negative effects; and (3) markers of satisfaction as long-term consequences. The concept distinguishes digital actions from their immediate results, acknowledging these outputs as often cooccurring with tangible harm and advantages. Digital media have no intrinsic negative or helpful qualities; however, the digitalization of society and daily life may significantly influence well-being (Suárez Álvarez & Vicente, 2024). The influence has been challenging to evaluate experimentally owing to insufficient trustworthy and valid measurements, formal models, and robust theory (Büchi, 2024; Filep et al., 2024).

The framework for digital well-being depicted in Figure 1 outlines the process of identifying and characterizing reliable connections between people's digital behaviors and outcomes connected to wellbeing. Researchers are encouraged to find moderators and mediators that outline the crucial conditions and intermediary processes relevant to the digital activity, loss or gain, and satisfaction metric under investigation because of its universality and breadth. The framework outlines a number of broad ideas that require specific manifestations and connections to be formalized in order to yield insightful findings regarding the effects of digital media (Büchi, 2024). Socially relevant outcomes have been the subject of numerous digital media studies (Boulianne, 2020; Williams, 2019). This perspective is obviously expanded by the digital well-being paradigm, which makes subjective well-being the main variable (Büchi, 2024).

**Digital Inclusion and Wellbeing**

Digital technologies have been in place for several years, and we have depended on them for an extended period to sustain our well-being (Burr & Floridi, 2020). They are a commonplace aspect of existence for several young individuals (Taylor, 2018). As stated by Allen & Gluckman, 2018, p. 10), "comprehending wellbeing in the 21st century necessitates an understanding of transformative digital technologies as catalysts for change, influencing not only human material conditions but also human values and the organizational frameworks that underpin wellbeing." Digital inclusion refers to equitable access to and use of information and

communication technology (ICT), including the internet and digital devices, for all societal members (Islam et al., 2022; Sieck et al., 2021b). Increasing evidence indicates that digital inclusion enhances well-being by enhancing access to information, resources, social relationships, economic possibilities, and overall quality of life. Enabling universal access to the digital domain promotes a more inclusive and equitable society for everyone.

The significance of digital technology in enhancing wellbeing is garnering heightened focus (Kang et al., 2024; Taylor, 2018; Virós-Martín et al., 2024). Consequently, digital inclusion and personal well-being have gained prominence in research, as individuals increasingly depend on digital technology across several domains, including education, health, and personal development (Alhassan & Adam, 2021). In education, it significantly influences the lives of university students. The increasing focus on online education suggests that university students with access to reliable internet, laptops, and cellphones are more likely to obtain advantages from online learning platforms, educational materials, and social networks. These technologies may improve academic achievement, facilitate social relationships, and provide access to entertainment, hence contributing to overall happiness and life satisfaction (Li et al., 2022; Shadiev et al., 2024). The accessibility of these digital tools may help students manage academic expectations, alleviate stress, maintain connections with classmates and family, and acquire exposure to global viewpoints, all of which may increase their happiness and life satisfaction (Pizzul et al., 2024). Moreover, digital skills, or the capacity to access and employ digital resources properly, may play a crucial role in how digital inclusion influences life satisfaction. Students who are proficient in the use of digital platforms for learning, communication, and entertainment are likely to derive greater advantages from their online activities (Carabregu-Vokshi et al., 2024). They are more inclined to fully utilize the opportunities afforded by technology, such as employing applications that assist in time management, accessing mental health resources, or participating in recreational activities such as streaming or gaming. This improves their capacity to equilibrate their academic and personal lives, resulting in increased satisfaction (Suárez & Colmenero, 2024). In contrast, students experiencing digital disparities, such as inadequate internet connectivity or restricted access to digital devices, may see themselves as marginalized from these chances, resulting in dissatisfaction and diminished satisfaction with their academic and social experiences (Castelli & Sarvary, 2021). Individuals residing in regions with elevated digital inclusion levels tend to have more happiness and enjoy supplementary social and economic benefits (Marshall et al., 2023). Consequently, it is reasonable to assert that increased access to and proficient utilization of diverse digital devices for resources, information, communication, or enjoyment positively influence individuals' wellbeing (Büchi, 2024). Hence, the study hypothesizes the following:

H1: Digital inclusion has a positive influence on student happiness.

H2: Digital inclusion has a positive influence on students' life satisfaction.

Information and resources as dual mediators

To offer students the greatest possibility of becoming effective lifelong learners and future employers, students need to become information rich and literate (Graves et al., 2021). Research has increasingly acknowledged that the loss of data is a major contributor to many negative outcomes, making it an economic resource (Weeramuni et al., 2023). Success requires the cultivation of outstanding insights or possession of unique knowledge that enables individuals to identify and pursue possibilities. Information is sanitized, structured, and arranged facts that are helpful, meaningful, and best explain events and settings (Potnis, 2015; Yang et al., 2021; Yeganegi et al., 2021). It is "knowledge that leads to immediate progress on a current assignment" (Irvine & Anderson, 2008). This notion has garnered significant attention in the literature, with several studies demonstrating the critical role of information (Avram & Priescu, 2012). Additionally, information acts as a regulatory

tool, enhances satisfaction, reduces uncertainty by clarifying methods, priorities, and options, and drives innovation; its absence can negatively affect positive outcomes (Carr et al., 2023; Wong et al., 2022). Moreover, acquiring accurate information is crucial for preventing and managing stress (Oldham, 2020). Therefore, several studies have explicitly shown the value of knowledge for well-being (Doherty et al., 2020; Losecaat Vermeer et al., 2022).

Conversely, resources are defined as "available, accessible, and usable means perceived by an individual as beneficial for the accomplishment of his/her activity" (Arab, 2015). Within the framework of this research, resources are defined as any elements seen by the student as beneficial for achieving their objectives (Halbesleben et al., 2014). This encompasses an array of tools, services, materials and support systems available to improve their learning experience and academic achievement. These resources may be categorized as physical, digital, financial, or human. Restricted access to resources may impede students, particularly those from underprivileged backgrounds, possibly affecting their academic performance, emotional well-being, and overall university experience. Conversely, sufficient access to resources cultivates an atmosphere in which students may excel, cooperate, and realize their full potential (Christensen et al., 2021).

Consequently, the potentially valuable resources and information acquired from internet usage have served as motivating elements for digital engagement, which is impacted by many factors (Kruk & Pawlak, 2023). This study is influenced by digital inclusion. Digital inclusion markedly enhances access to diverse resources and information, equipping people with the information and resources necessary for informed decision-making and active participation in multiple life domains (Adam & Alhassan, 2020; Alhassan & Adam, 2021). Digital inclusion guarantees that a larger portion of the population can access the extensive information and resources accessible online in a huzzle-free manner (Fitzpatrick & Trninic, 2023). The democratization of information and resources facilitates the bridging of information disparities across various socioeconomic groups (Xie, Charness, Fingerman, Kaye, et al., 2021). Hence, digital inclusion significantly transforms access to information and resources, impacting several facets of human lives and communities. Therefore, as technology progresses, promoting digital inclusion is vital for establishing a more equal, resource-abundant, information-rich and educated society, which subsequently impacts well-being. Therefore, the study posited the following:

H3: Digital inclusion has a positive influence on resources.

H4: The positive influence of digital inclusion on information

H5: Resources have a positive influence on student happiness.

H6: Resources have a positive influence on students' life satisfaction.

H7: Information has a positive influence on student happiness.

H8: Information has a positive influence on students' life satisfaction.

While many studies have related digital inclusion to well-being (Büchi, 2024; Burr & Floridi, 2020; Li et al., 2022; Pizzul et al., 2024; Shadiev et al., 2024; Taylor, 2018), the underlying mechanism through which digital inclusion leads to well-being is not known. This study argues that digital inclusion does not necessarily lead to well-being. The information individuals seek when using digital devices and the internet, whether good or bad, together with the resources they choose to access, may indicate their mental state and mood (Sharot & Sunstein, 2020). The quantity, nature, or significance of the information and resources that students obtain from using these digital tools determine their well-being. Hence, it is only when students obtain what they want from using technology that their well-being improves, not by merely having all the necessary digital gadgets and tools. Hence, the following is hypothesized:

H9: Resources positively mediate the relationship between digital inclusion and student happiness.

H10: Resources positively mediate the relationship between digital inclusion and students' life satisfaction.

H11: Information positively mediates the relationship between digital inclusion and student happiness.

H12: Information positively mediates the relationship between digital inclusion and students' life satisfaction.

**Conceptual Framework**

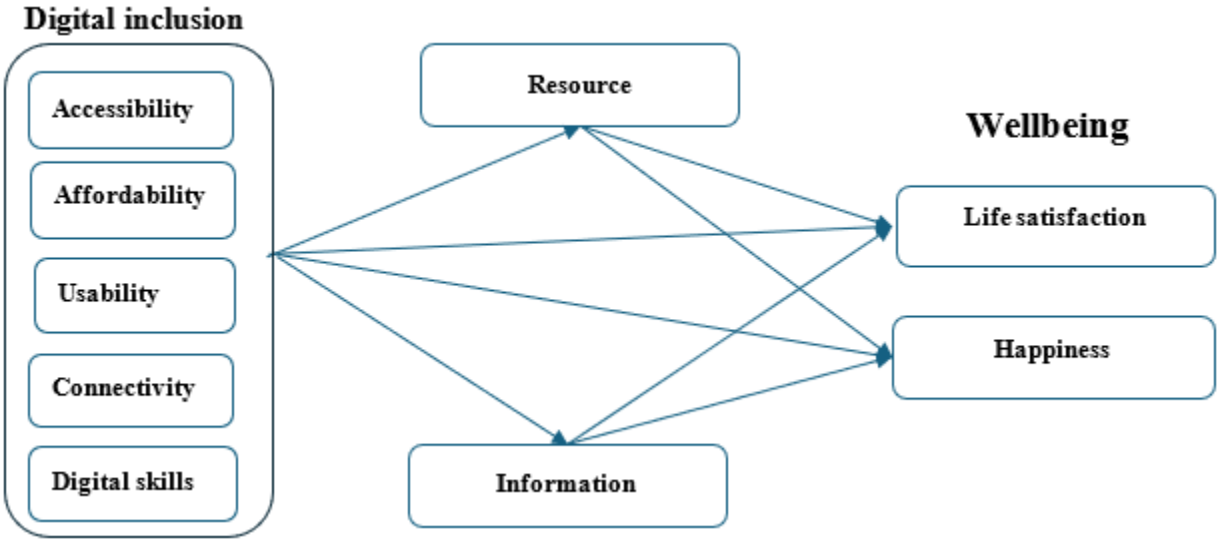


Figure 1. Conceptual framework

## RESEARCH DESIGN

This study adopts a quantitative research design to investigate the influence of digital inclusion on students' well-being in Nigerian universities, using a dual-mediation model involving access to digital information and resources. A survey-based design was selected due to its suitability for examining structural relationships among constructs through standardized questionnaires. This approach enables the collection of quantifiable data that can be statistically analyzed to test hypotheses and validate theoretical models (Creswell, 2014).

### Survey Instrument Development

To ensure the validity and reliability of the study, pre-validated instruments from prior research were adapted. All measurement items were originally in English and were reviewed for contextual and cultural relevance by experts in the Nigerian education sector. Digital inclusion, the main independent variable, is conceptualized as a second-order reflective-formative construct comprising five dimensions: accessibility (Miranda et al., 2018), affordability (Dwivedi et al., 2006; Venkatesh et al., 2001), usability (Brooke, 1996), connectivity (Ahmad, 2020), and digital skills (Qin et al., 2024). Each dimension was measured using multiple items to capture its multidimensional nature.

Students' well-being, the dependent variable, was measured using two validated scales. Happiness was assessed using the 4-item Subjective Happiness Scale (Lyubomirsky & Lepper, 1999), while life satisfaction was measured with five items adapted from Huebner's (1991) Student Life Satisfaction Scale. The two mediating variables; access to digital information and access to digital resources, were measured using items adapted from Spreitzer (1996) and Yuan et al. (2007). All constructs were assessed using a 7-

point Likert scale ranging from "1 – strongly disagree" to "7 – strongly agree."

**Sampling and Data Collection**

Due to the lack of a comprehensive sampling frame, a non-probability convenience sampling technique will be employed to collect data from university students across various public and private institutions in Nigeria. A total of 238 questionnaires will be issued, with the sample size determined using G*Power software to ensure sufficient statistical power for structural equation modeling (Krieger et al., 2023; Mitra, 2024). Data collection will be conducted online, using platforms such as email and WhatsApp to distribute the survey. A cover letter will be included on the first page of the questionnaire to assure participants of the voluntary nature of the study, the confidentiality of their responses, and their anonymity, an approach that helps reduce common method bias (Podsakoff et al., 2012).

**Methods of Data Analysis**

Data analysis was conducted in two stages. First, SPSS was used for preliminary analysis, including data entry, screening, and descriptive statistics. Internal consistency of the constructs will be assessed using Cronbach's alpha. Next, the main analysis will be conducted using SmartPLS version 4, which is well-suited for complex models involving reflective-formative constructs, small to medium sample sizes, and non-normal data (Hair et al., 2017; Benitez et al., 2020). The measurement model was first evaluated for reliability, convergent validity, and discriminant validity. Followed by the structural model assessed to test the hypothesized relationships, including direct and indirect effects, using bootstrapping procedures. To ensure robustness against multicollinearity and common method variance, the study will apply full collinearity tests based on variance inflation factor (VIF) thresholds recommended by Kock & Lynn (2012) and Kock (2015). This methodological approach provides a rigorous framework for examining how digital inclusion affects university students' well-being in Nigeria, particularly through access to technology-enabled resources and information.

**Measurement Model Assessment**: Cronbach's alpha (CA), rho-A, and composite reliability (CR) were utilized to assess the reliability of the constructs within the measurement model. As shown in Table 1, these key metrics exceed the standard threshold of 0.50 (Hair et al., 2017; Hair Jr & Sarstedt, 2019), affirming the reliability of the measures.

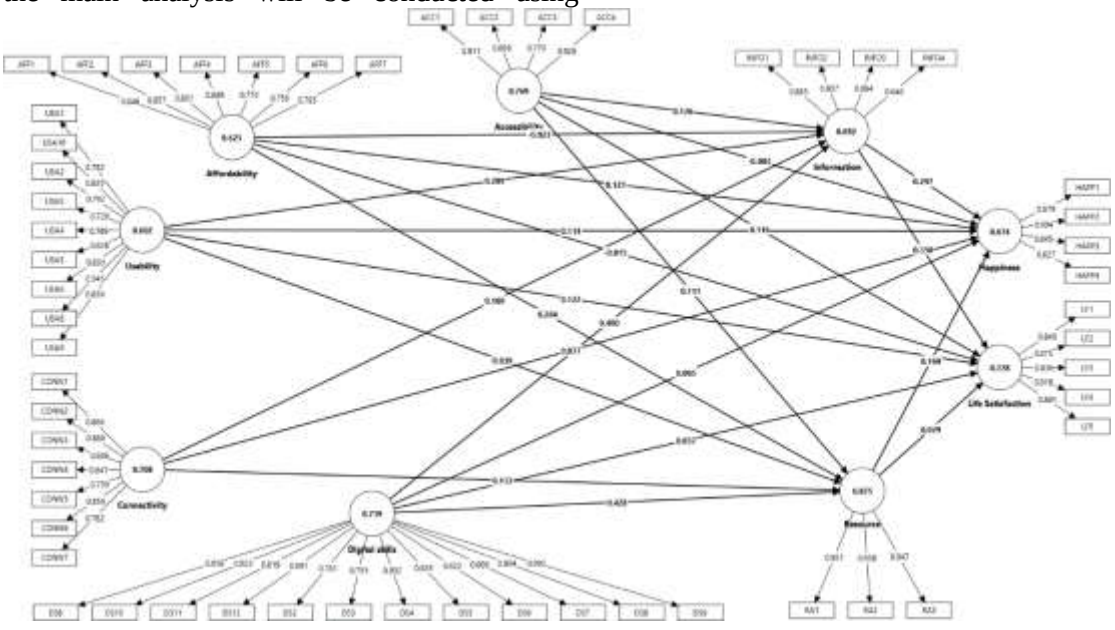

Figure 2: Measurement Model

Convergent validity was assessed using CR, AVE, and item loadings. Validity was established when item loadings exceeded 0.50, CR values were above 0.70, and AVE values were greater than 0.50 (Hair et al., 2017; Vishnoi et al., 2024), as presented in Table 1.

Table 1. Internal consistency reliability and convergent

| Constructs | Items | Loadings | Cronbach's alpha | Composite reliability (rho_a) | Composite reliability (rho_c) | Average variance extracted (AVE) |
|---|---|---|---|---|---|---|
| Accessibility | ACC1 | 0.911 | 0.898 | 0.900 | 0.930 | 0.769 |
| | ACC2 | 0.889 | | | | |
| | ACC3 | 0.770 | | | | |
| | ACC4 | 0.929 | | | | |
| Affordability | AFF1 | 0.846 | 0.898 | 0.902 | 0.920 | 0.623 |
| | AFF2 | 0.857 | | | | |
| | AFF3 | 0.801 | | | | |
| | AFF4 | 0.689 | | | | |
| | AFF5 | 0.770 | | | | |
| | AFF6 | 0.756 | | | | |
| | AFF7 | 0.795 | | | | |
| Connectivity | CONN1 | 0.866 | 0.930 | 0.932 | 0.944 | 0.708 |
| | CONN2 | 0.889 | | | | |
| | CONN3 | 0.886 | | | | |
| | CONN4 | 0.847 | | | | |
| | CONN5 | 0.750 | | | | |
| | CONN6 | 0.859 | | | | |
| | CONN7 | 0.782 | | | | |
| Usability | USA1 | 0.782 | 0.915 | 0.922 | 0.931 | 0.602 |
| | USA10 | 0.835 | | | | |
| | USA2 | 0.792 | | | | |
| | USA3 | 0.720 | | | | |
| | USA4 | 0.769 | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | USA5 | 0.828 | | | | |
| | USA6 | 0.830 | | | | |
| | USA8 | 0.545 | | | | |
| | USA9 | 0.839 | | | | |
| Digital skills | DS10 | 0.823 | 0.964 | 0.965 | 0.968 | 0.719 |
| | DS11 | 0.819 | | | | |
| | DS12 | 0.891 | | | | |
| | DS2 | 0.781 | | | | |
| | DS3 | 0.755 | | | | |
| | DS4 | 0.892 | | | | |
| | DS5 | 0.835 | | | | |
| | DS6 | 0.822 | | | | |
| | DS7 | 0.906 | | | | |
| | DS8 | 0.858 | | | | |
| | DS8 | 0.884 | | | | |
| | DS9 | 0.893 | | | | |
| Happiness | HAPP1 | 0.879 | 0.830 | 0.837 | 0.890 | 0.674 |
| | HAPP2 | 0.904 | | | | |
| | HAPP3 | 0.845 | | | | |
| | HAPP4 | 0.627 | | | | |
| Information | INFO1 | 0.885 | 0.845 | 0.855 | 0.899 | 0.692 |
| | INFO2 | 0.907 | | | | |
| | INFO3 | 0.864 | | | | |
| | INFO4 | 0.646 | | | | |
| Life Satisfaction | LF1 | 0.846 | 0.907 | 0.907 | 0.931 | 0.728 |
| | LF2 | 0.875 | | | | |
| | LF3 | 0.836 | | | | |
| | LF4 | 0.819 | | | | |
| | LF5 | 0.891 | | | | |
| Resource | RA1 | 0.921 | 0.928 | 0.929 | 0.954 | 0.875 |

| | |
|---|---|
| RA2 | 0.938 |
| RA3 | 0.947 |

The "Fornell and Larcker criterion" and "heterotrait–monotrait (HTMT) ratio" were assessed for discriminant validity (Cheung et al., 2024; Franke & Sarstedt, 2019; Rasoolimanesh, 2022). Table 2 indicates that oblique values exceed non-oblique values, and the correlations among all the components are less than 0.90. Both criteria were satisfied, demonstrating excellent discriminant validity. Additionally, Table 4 shows that all variables had a VIF < 5 (Kalnins & Kendall, 2024; Rasoolimanesh, 2022), confirming the absence of multicollinearity concerns in this study.

Table 2. Discriminant Validity

*HTMT*

| **Constructs** | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Accessibility | | | | | | | | | |
| 2 | Affordability | 0.708 | | | | | | | | |
| 3 | Connectivity | 0.675 | 0.767 | | | | | | | |
| 4 | Digital skills | 0.648 | 0.750 | 0.735 | | | | | | |
| 5 | Happiness | 0.611 | 0.729 | 0.697 | 0.730 | | | | | |
| 6 | Information | 0.727 | 0.761 | 0.794 | 0.865 | 0.840 | | | | |
| 7 | Life Satisfaction | 0.491 | 0.472 | 0.527 | 0.512 | 0.629 | 0.638 | | | |
| 8 | Resource | 0.707 | 0.831 | 0.760 | 0.846 | 0.768 | 0.861 | 0.515 | | |
| 9 | Usability | 0.666 | 0.812 | 0.734 | 0.762 | 0.738 | 0.847 | 0.534 | 0.760 | |

*Fornell & Larcker criterion*

| **Constructs** | | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
|---|---|---|---|---|---|---|---|---|
| 1 | **Accessibility** | 0.877 | | | | | | |
| 2 | Affordability | 0.640 | 0.789 | | | | | |
| 3 | Connectivity | 0.616 | 0.705 | 0.841 | | | | |
| 4 | Digital skills | 0.606 | 0.697 | 0.696 | 0.848 | | | |
| 5 | Happiness | 0.528 | 0.629 | 0.611 | 0.652 | 0.821 | | |
| 6 | Information | 0.634 | 0.668 | 0.705 | 0.786 | 0.696 | 0.832 | |
| 7 | Life Satisfaction | 0.444 | 0.431 | 0.485 | 0.483 | 0.549 | 0.557 | 0.853 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 8 | Resource | 0.646 | 0.762 | 0.706 | 0.800 | 0.672 | 0.762 | 0.475 | 0.935 | |
| 9 | Usability | 0.609 | 0.734 | 0.679 | 0.720 | 0.642 | 0.752 | 0.492 | 0.700 | 0.776 |

Prior to evaluating the structural model and testing the hypotheses, the study analyzed the higher-order constructs. As illustrated in Table 3, all five dimensions showed significant associations with the digital inclusion constructs. Furthermore, a VIF of less than 5 (Hair et al., 2017; Kalnins & Kendall, 2024; Rasoolimanesh, 2022) indicates that they are distinctively capturing the aspects of digital inclusion.

Table 3: Assessment of Formative Higher order construct

| Relationships | **Std. Beta** | **Std. Dev.** | **t values** | **p values** | **LL BCI** | **UL BCI** | **VIF** |
|---|---|---|---|---|---|---|---|
| Accessibility -> Digital Inclusion | 0.141 | 0.059 | 2.379 | 0.009 | 0.043 | 0.238 | 1.969 |
| Affordability -> Digital Inclusion | 0.139 | 0.078 | 1.781 | 0.037 | 0.013 | 0.269 | 2.895 |
| Connectivity -> Digital Inclusion | 0.199 | 0.062 | 3.201 | 0.001 | 0.092 | 0.296 | 2.554 |
| Digital skills -> Digital Inclusion | 0.432 | 0.057 | 7.566 | 0.000 | 0.340 | 0.527 | 2.677 |
| Usability -> Digital Inclusion | 0.238 | 0.077 | 3.098 | 0.001 | 0.107 | 0.357 | 2.807 |

**Structural Model Assessment**: The structural model was assessed in five stages: (1) lateral collinearity, (2) path coefficients, (3) in-sample predictive power ($R^2$), (4) effect sizes ($f^2$), and (5) out-of-sample predictive power (PLSpredict). To evaluate lateral collinearity, the variance inflation factor (VIF) was examined. As shown in Table 4, all VIF values were below the threshold of 5 (Hair et al., 2017; Kalnins & Kendall, 2024; Rasoolimanesh, 2022), indicating that multicollinearity did not significantly affect the model.

Second, the structural model's assumptions were evaluated using the bootstrapping resampling method with 10,000 iterations (Becker et al., 2023) to determine the significance of the path coefficients. Table 4 and Figure 4 present the outcomes of the hypothesized relationships. The findings reveal that digital inclusion significantly influences all endogenous variables: happiness (H1: $\beta = 0.328$, $p = 0.005$), life satisfaction (H2: $\beta = 0.275$, $p = 0.037$), resources (H3: $\beta = 0.850$, $p = 0.000$), and information (H4: $\beta = 0.841$, $p = 0.000$). Thus, H1–H4 are supported.

The relationships between the mediating variables (resources and information) and well-being were also analyzed. The results show that resources influence happiness (H5: $\beta = 0.127$, $p = 0.027$) but not life satisfaction (H6: $\beta = -0.017$, $p = 0.438$). Therefore, H5 is supported, while H6 is not. Additionally, information significantly influences both happiness (H7: $\beta = 0.288$, $p = 0.003$) and life satisfaction (H8: $\beta = 0.339$, $p = 0.001$), supporting H7 and H8. The study also tested the mediating roles of resources and information. Resources were found to mediate the relationship between digital inclusion and happiness (H9: $\beta = 0.147$, $p = 0.027$) but not between digital inclusion and life satisfaction (H10: $\beta = -0.014$, $p = 0.439$). Hence, H9 is supported, while H10 is not. Furthermore, information mediates the relationship between digital inclusion and happiness (H11: $\beta = 0.242$, $p = 0.003$) and between digital inclusion and life

satisfaction (H12: β = 0.285, p = 0.001), providing strong support for H11 and H12.

The study employed Cohen's $f^2$ to evaluate the magnitude of the constructs' impacts (Cohen, 1998). According to Cohen's guidelines, an $f^2$ value of 0.02 or greater indicates a small effect, 0.15 represents a medium effect, and 0.35 signifies a large effect. The $f^2$ values presented in Table 4 reveal that all supported hypotheses have $f^2$ values exceeding 0.02, confirming that these variables effectively predict the criterion variable. Additionally, as recommended, model fit criteria were assessed using the standardized root mean square residual (SRMR), which should be less than 0.08 (Guenther et al., 2023). In this study, the SRMR value is 0.064, which is well below the threshold. This result confirms that the model achieves an adequate fit.

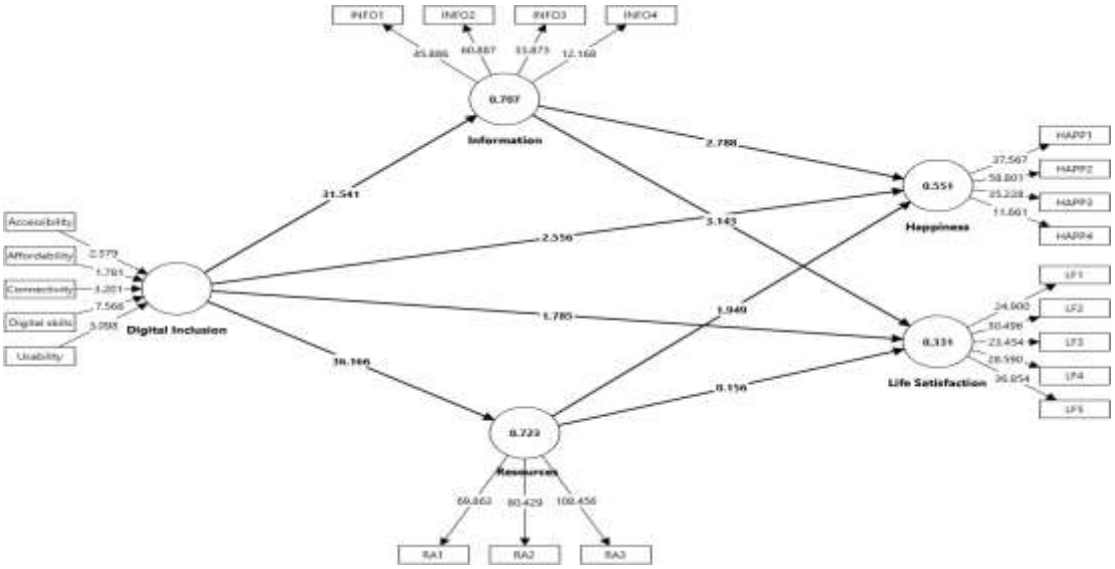


Figure 4. Structural model.

Table 4. Results of the Hypothesis Testing

| Relationships | Std. Beta | Std. Dev. | t values | p values | Confidence Intervals | | VIF | $R^2$ | $F^2$ | Model Fit | Decision |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | LL BCI | UL BCI | | | | | |
| Digital Inclusion -> Happiness | 0.328 | 0.128 | 2.556 | 0.005 | 0.104 | 0.523 | 1.972 | 0.551 | 0.045 | | Supported |
| Digital Inclusion -> Life Satisfaction | 0.275 | 0.154 | 1.785 | 0.037 | 0.789 | 0.878 | 2.908 | 0.331 | 0.021 | | Supported |
| Digital Inclusion -> Resources | 0.850 | 0.024 | 36.166 | 0.000 | 0.003 | 0.505 | 2.809 | 0.723 | 2.606 | | Supported |
| Digital Inclusion -> Information | 0.841 | 0.027 | 31.541 | 0.000 | 0.805 | 0.883 | 2.551 | 0.707 | 2.412 | | Supported |
| Resources -> Happiness | 0.172 | 0.088 | 1.949 | 0.026 | 0.124 | 0.462 | 2.672 | | 0.018 | | Supported |
| Resources -> Life Satisfaction | -0.017 | 0.107 | 0.156 | 0.438 | -0.031 | 0.321 | 2.908 | | 0.000 | | Not Supported |
| Information -> Happiness | 0.288 | 0.103 | 2.788 | 0.003 | 0.169 | 0.525 | 1.972 | | 0.053 | 0.064 | Supported |
| Information -> Life Satisfaction | 0.339 | 0.108 | 3.143 | 0.001 | 0.169 | 0.186 | 2.809 | | 0.049 | | Supported |
| Digital Inclusion -> Resources -> Happiness | 0.147 | 0.076 | 1.930 | 0.027 | 0.028 | 0.278 | 2.551 | | 0.022 | | Supported |
| Digital Inclusion -> Resources -> Life Satisfaction | -0.014 | 0.091 | 0.155 | 0.439 | -0.144 | 0.160 | 2.672 | | 0.000 | | Not Supported |
| Digital Inclusion -> Information -> Happiness | 0.242 | 0.088 | 2.741 | 0.003 | 0.104 | 0.394 | 2.308 | | 0.059 | | Supported |
| Digital Inclusion -> Information -> Life Satisfaction | 0.285 | 0.093 | 3.079 | 0.001 | 0.142 | 0.448 | 2.107 | | 0.081 | | Supported |

**Model Quality Checks**

To ensure the reliability of the model and its results, the research rigorously assessed model quality using in-sample ($R^2$) and out-of-sample (PLSpredict) predictive capabilities (Chin et al., 2020; Shmueli et al., 2019), along with CVPAT (Becker et al., 2023; Ringle et al., 2023) and effect size ($f^2$). The in-sample predictive power was evaluated using the $R^2$ values for the endogenous variables, which were as follows: happiness ($R^2$ = 0.551), life satisfaction ($R^2$ = 0.331), resources ($R^2$ = 0.723), and information ($R^2$ = 0.707). These values were considered entirely satisfactory based on the study context (Becker et al., 2023). For out-of-sample indicators, the PLSpredict procedure was executed using 10-fold cross-validation with 10 repetitions, and the findings were interpreted in accordance with Shmueli et al. (2016, 2019). The results first confirmed that all PLS-SEM $Q^2$ values for the happiness and life satisfaction indices were positive, affirming predictive relevance for these constructs. Furthermore, as the prediction errors exhibited a symmetrical distribution, the research applied the criterion PLS-SEM_RMSE < LM_RMSE (refer to Table 5). This condition was met for all metrics, verifying that the model possesses substantial predictive power.

Table 5. PLSpredict

| Focal Constructs | | PLS | | LM | | PLS-LM | |
|---|---|---|---|---|---|---|---|
| | $Q^2$predict | RMSE | MAE | RMSE | MAE | RMSE | MAE |
| HAPP1 | 0.286 | 0.863 | 0.669 | 0.871 | 0.658 | -0.008 | 0.011 |
| HAPP2 | 0.331 | 0.857 | 0.625 | 0.869 | 0.639 | -0.012 | -0.014 |
| HAPP3 | 0.374 | 0.836 | 0.615 | 0.844 | 0.615 | -0.008 | 0.000 |
| HAPP4 | 0.307 | 1.096 | 0.835 | 1.079 | 0.808 | 0.017 | 0.027 |
| LF1 | 0.217 | 0.873 | 0.671 | 0.884 | 0.668 | -0.011 | 0.003 |
| LF2 | 0.166 | 0.946 | 0.732 | 0.958 | 0.744 | -0.012 | -0.012 |
| LF3 | 0.156 | 0.961 | 0.721 | 0.966 | 0.725 | -0.005 | -0.004 |
| LF4 | 0.243 | 0.969 | 0.775 | 0.984 | 0.763 | -0.015 | 0.012 |
| LF5 | 0.190 | 0.939 | 0.719 | 0.946 | 0.723 | -0.007 | -0.004 |

**Discussion**

In this contemporary advanced technological era, bridging the digital divide, equality in digital technological access is essential (Vassilakopoulou & Hustad, 2023). Digital inclusion, which refers to people's access to technology for information and resources, has an indispensable role in enhancing various aspects of individuals' well-being worldwide (Alhassan & Adam, 2021). The access to and use of digital technologies are fully encouraged and incorporated worldwide; therefore, it is expected that they will promote individual and societal wellbeing (Mohieldin & Ramadan, 2024). This study examined digital inclusion and how it influences individual well-being (happiness and life satisfaction) through resources and information. The robust framework presented here was validated via data from university students in the Nigeria. The results indicated that all the hypothesized direct relationships were positive and significant except for the relationship between resources and life

satisfaction. Furthermore, the study tested resources and information as underlying mechanisms through which digital inclusion influences well-being. The findings show that three mediating relationships were significant, whereas one was not.

Specifically, the study revealed that digital inclusion is significantly related to two dimensions of well-being (happiness and life satisfaction). These significant results are in line with the literature that digital inclusion is vital for an individual's well-being (Alhassan & Adam, 2021; Büchi, 2024; Dev et al., 2024; Gann, 2019; Lei et al., 2023; Wrapson & Gasteiger, 2024). It is also in line with the digital well-being framework (Büchi, 2024), which argues that access to and use of digital technologies influence well-being. This suggests that a digitalized world enables people to easily interact and converse with people all over the world. This increases their pleasure and life satisfaction and gives them the freedom to make life choices, therefore boosting their well-being (Alhassan & Adam, 2021).

Individual-level attempts to control the abundance and continuous availability of information and resources have increased in frequency as digital communication has permeated every aspect of life (Nguyen et al., 2024). Hence, the study further revealed that digital inclusion influences the resources and information one obtains from digital interaction. These resources and information are regarded as benefits in the Büchi, (2024) digital wellbeing framework. This finding is also in line with prior studies (Imran et al., 2019; Rostami et al., 2022; Salisu et al., 2022; Wollmann et al., 2021), which have argued that the potentially valuable resources and information one obtains from the internet are motivating factors for digital engagement. Furthermore, (Szymkowiak et al., 2021) noted that the internet and digital devices are considered information- and resource-finding tools. The findings indicate that when students are digitally included, they will have the needed information and resources. This information and resources may include full-text documents, research reports, training materials, books, dictionaries, encyclopaedias, newspapers, games and many more (Khatri, 2021)

The study used knowledge and resources as mediators in the relationship between well-being and digital inclusion. The findings showed that both forms of information completely moderated the relationships between digital inclusion and well-being (happiness and life satisfaction). Resources did not, however, moderate the relationship between digital inclusion and life satisfaction; rather, they only mediated the relationship between digital inclusion and happiness. These noteworthy results are consistent with the concept for digital well-being (Büchi, 2024), which posits that a person's digital habits frequently produce concomitant benefits that in turn affect subjective well-being.

**Implications**

The study offers valuable implications for educational institutions, policymakers, and technology providers. It emphasizes the need to not only ensure access to digital devices and internet services but also to provide user-friendly technology platforms and resources that enhance digital skills. Educational institutions should focus on both granting access to digital tools and fostering digital competencies, ensuring these tools are usable and accessible (Pizzul et al., 2024). Institutions should invest in training programs that improve digital literacy, enabling students to make the most of available resources for both academic and personal growth. Digital inclusion can be promoted through initiatives that provide devices, internet access, and digital mentoring, helping individuals build knowledge and confidence in using technology (Petrou et al., 2023). Incorporating digital literacy into the curriculum will support students in maximizing their use of digital tools for learning and personal development (Pan et al., 2024). Additionally, institutions should invest in reliable internet infrastructure and offer affordable technology solutions to alleviate financial burdens on students.

For policymakers, digital inclusion extends beyond access to technology; it involves affordability, usability, and digital skills. The results underscore the need for comprehensive digital inclusion policies that address affordability issues (Zaballos et al., 2024) without overlooking other critical factors, such as connectivity, usability, and digital skills. Efforts should be made to subsidize the cost of technology and internet services for students while also ensuring the availability of training programs to enhance digital literacy. Simply providing access to technology will not be sufficient to improve well-being; policies should also ensure that technology is affordable, easy to use, and reliable. Policies should also focus on improving connectivity infrastructure to ensure consistent access to high-quality internet services (Sathyanath, 2024; Zaballos et al., 2024). For vendors and other technology providers, a recent study shows that the majority of tech companies still are not taking responsibility for ensuring that people can use technology in a way that benefits them (World Benchmarking Alliance, 2023). Hence, the results emphasize the need for more user-friendly digital tools that cater to the needs of students with varying levels of digital proficiency (Osorio et al., 2024). Companies should invest in creating intuitive platforms and devices that increase productivity and reduce frustration. Additionally, the lack of affordable and adequate sources of "technical support" is a factor influencing technology literacy and its use (Sen et al., 2022). Additionally, technology is expensive for those living on fixed incomes and are cash-strapped to be able to afford to purchase or use new technologies (Sen et al., 2022). Hence, providing affordable technological solutions for students will contribute to their overall well-being (Pizzul et al., 2024).

**Limitations and Recommendations for Future Study**

While this study provides valuable insights into the relationship between digital inclusion and well-being, it has several limitations. One key limitation is that the study focused solely on university students in Nigeria, a relatively homogeneous group, which may limit the generalizability of the findings to broader populations. As such, the findings may not be generalizable to other populations, particularly those outside the academic environment or in different cultural contexts. Expanding the sample to include diverse populations, such as individuals from various age groups, socioeconomic backgrounds, and geographic locations, would improve the generalizability of the findings. Future research could explore how digital inclusion impacts specific vulnerable groups, such as individuals with disabilities, women, or those living in rural areas (Raihan et al., 2024). The study used a cross-sectional design, capturing data at a single point in time, which limits the ability to assess the long-term effects of digital inclusion on well-being (Elabd et al., 2024). A longitudinal approach could provide deeper insights into how changes in digital inclusion influence well-being over time and offer a clearer understanding of the causal relationships between the two. Additionally, the study relied on self-reported data, which may be subject to biases such as social desirability bias or inaccurate self-assessment. Future research should consider using objective measures of digital inclusion and well-being to enhance the validity of the findings. The study primarily focused on life satisfaction and happiness as indicators of well-being. However, well-being is a multidimensional construct that includes aspects such as mental health, stress levels, social connectedness, and emotional resilience (Ruggeri et al., 2020). Future studies should explore how digital inclusion influences these broader dimensions of well-being to provide a more comprehensive understanding of its effects.

Future research could also investigate the influence of cultural attitudes toward technology and digital engagement on the relationship between digital inclusion and well-being (Fanea-Ivanovici & Pană, 2020). Comparative studies across different cultural contexts may offer valuable insights into how cultural factors moderate the effects of digital inclusion on well-being. Additionally, examining the effectiveness of interventions aimed at enhancing digital

inclusion, such as digital literacy programs or affordability initiatives, would be beneficial in assessing their impact on well-being (Moshe et al., 2021; Xie, Charness, Fingerman, et al., 2021). This could provide actionable insights for educational institutions and policymakers. Moreover, future studies could consider other variables, such as the quality of digital content, online social interactions, and the role of digital inclusion in mental health. Finally, exploring other potential mediators and moderators in the relationship between digital inclusion and well-being, such as personality traits, social support, or digital consumption patterns, could deepen our understanding of the mechanisms through which digital inclusion influences well-being (Sieck et al., 2021a).

## CONCLUSION

In summary, human communication is essential to wellbeing and is greatly influenced by digital inclusion; its impacts are neither permanent nor insignificant. This study provides insightful information about how digital inclusion affects Nigerian university students' wellbeing. The results show that digital inclusion significantly affects happiness and life satisfaction, underscoring its complexity and wide range of impacts on different aspects of wellbeing. Furthermore, the study highlights that information and resources are important mediators in the relationship between well-being and digital inclusion, acting as the links that make this beneficial association possible. To foster well-being in an increasingly digitalized academic environment, efforts must go beyond providing access to technology. Institutions, policymakers, and technology providers must ensure that technology is affordable, user-friendly, and supported by reliable connectivity and strong digital skills. By addressing these factors, stakeholders can help students maximize the benefits of digital inclusion, ultimately enhancing both their academic success and overall well-being. Further research is needed to explore the long-term effects of digital inclusion, focusing on the five elements examined in this study, assessing its impact on broader populations, and examine other dimensions of well-being. Such studies will provide a more nuanced understanding of how digital inclusion can contribute to improved well-being in different contexts.

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