Evaluating Integrated Telecommunications Strategies for Digital Inclusion in HBCU and Anchor Community

Adeyemi Jerry Ibiyemi, Morgan State University

I am a civil engineer with expertise in pavement construction, materials testing, and safety management. From 2016 to 2020, I managed engineering projects for Aniyikaye General Contractor with Nigeria Breweries, ensuring timely delivery and strict safety compliance. From 2021 to 2025, I worked in quality assurance and engineering roles at Craneburg Construction. Currently, I am pursuing advanced civil engineering studies at Morgan State University with a focus on transportation and structures. I hold safety certifications and am a member of ASCE and ASEE.

Olayinka Olawale Olaniyan, Morgan State University

Olayinka Olawale Olaniyan is a distinguished civil engineer with over 12 years of professional experience in construction and the oil and gas sectors. He has successfully delivered numerous building, road, and infrastructure projects across Nigeria. He is currently pursuing an M.Sc. in Civil Engineering at Morgan State University, where he serves as a Research Assistant in Sustainable and Resilient Infrastructure Engineering under Dr Oludare Owolabi. He is a COREN-registered engineer and a proud member of the Nigerian Society of Engineers.

Feyisayo Sarah Akinbobola, Towson University

Feyisayo Akinbobola is a doctoral student in Instructional Technology at Towson University and a Graduate Research Assistant at the Faculty Academic Center of Excellence (FACET). With a background in Science Education, her work bridges STEM education, instructional design, and digital accessibility. Her research focuses on the integration of emerging technologies, including artificial intelligence, to support inclusive and equitable learning in engineering and higher education contexts. She is particularly interested in Universal Design for Learning (UDL), assistive technologies, and faculty adoption of innovative teaching practices to enhance student engagement and access in STEM disciplines.

Julius Ogaga Etuke, Morgan State University

Julius Ogaga Etuke is a civil engineer with over 15 years of experience in consulting, academia, and project leadership, specializing in sustainable infrastructure, structural design, and transportation resilience. He is currently pursuing a Ph.D. in Civil Engineering at Morgan State University, where he serves as a Research Assistant in Sustainable and Resilient Infrastructure Engineering. His research integrates virtual and augmented reality, climate adaptation, and data-driven modeling to enhance disaster preparedness and risk mitigation in transportation systems. A COREN-registered engineer and member of the Nigerian Society of Engineers, Julius has led multidisciplinary teams, conducted impactful research, and delivered consultancy services that advance sustainable infrastructure development in Nigeria.

Dr. Olushola V. Emiola-Owolabi, Morgan State University

Olushola Emiola-Owolabi is an engineering pedagogy specialist, researching active learning in engineering classrooms and specializing in qualitative methods research on teaching and learning – particularly in remote synchronous learning environments.

Dr. Oludare Adegbola Owolabi P.E., Morgan State University

Dr. Oludare Owolabi, a professional engineer in Maryland, joined the Morgan State University faculty in 2010. He is the director of the Sustainable Infrastructure Development, Smart Innovation and Resilient Engineering Research Lab, Department of Civil Engineering at Morgan State University.

Dr. Uttam Gaulee

©American Society for Engineering Education, 2026

Evaluating Integrated Telecommunications Strategies for Digital Inclusion in HBCU and Anchor Community.

Abstract.

The world is a global society driven by digital connectivity, which is key to education, employment, healthcare, and civic engagement. Amid the post-pandemic era, hybrid learning and federal broadband investments, integrated telecom strategies are pivotal to converting technological access into sustained adoption. The digital divide, characterized by unequal access to broadband, digital devices, and digital skills, remains a barrier to opportunities in marginalized populations. This study examined the effects of targeted federal government investment programs on enhancing digital equity at a selected Historically Black College and University (HBCU), evaluating telecommunications integration strategies, digital inclusion outcomes, effectiveness, sustainability, and replicability. Data were obtained from Wi-Fi telemetry, device distribution records, broadband code redemption data, training assessments, and attendance records. Qualitative insights were gathered through focus groups and key informant interviews, while statistical analyses compared survey outcomes across demographic segments. Findings offered important insights into the effectiveness of digital inclusion at HBCUs. The mixed-method evaluation analyzed integrated broadband access, laptop distribution, and digital skills training implemented at a participating HBCU and its anchor community. Data were collected between November 2024 and January 2026, encompassing 94 survey respondents alongside administrative program records and network telemetry metrics. Beyond basic access, the study addressed engineering and STEM education relevance, recognized that student success depends on reliable connectivity, functional computing devices, and platform-based participation including LMS access, assignment submission, technical software use, and hybrid lab engagement. Results provided an equity-centered, scalable evaluation template that engineering educators at Minority-Serving Institutions (MSIs) can adapt to strengthen participation, persistence, and learning access in technology-intensive programs, particularly in the age of AI.

keywords: digital inclusion, integrated telecommunications, diffusion of innovations, mixed methods, HBCU anchor community

INTRODUCTION

Digital connectivity has become an institutional infrastructure for learning, employment, healthcare delivery, and civic engagement across the United States. Research shows that broadband access is associated with higher educational attainment, workforce readiness, and community resilience in the digital economy [1]. Yet connectivity alone is insufficient; the ability to use devices, networks, and digital services meaningfully shapes outcomes just as much as access [2]. Historically Black Colleges and Universities (HBCUs) and their adjacent anchor communities occupy a critical intersection of opportunity and challenge in the digital landscape. On one hand, HBCUs serve as educational pillars for underrepresented students and can function as anchor institutions to drive community digital inclusion [3]. On the other hand, many HBCU campuses and their surrounding neighborhoods remain in areas with underserved broadband infrastructure, high device cost burdens, and low digital-skills penetration [4]. For example, the National Telecommunications and Information Administration (NTIA) Office of Minority Broadband Initiatives (OMBI) report found that HBCUs, Tribal Colleges & Universities (TCUs), and MSIs face significant barriers to broadband availability, affordability, and adoption [5]. The federal landscape has responded with initiatives such as the Connecting Minority Communities (CMC) Pilot Program, which directs funding to HBCUs and anchor communities for infrastructure upgrades, device access, and digital skills training [5]. Still, persistent gaps remain between access and sustained meaningful adoption, especially when evaluating impacts on student learning and community empowerment [2-3]. This study treats an HBCU ecosystem as a "living lab" to examine how an integrated telecommunications strategy combining infrastructure enhancements, device deployment, and digital skills training can drive digital inclusion, academic success, and community empowerment. By applying the lenses of the Diffusion of Innovations (DOI) theory and the Technology Acceptance Model (TAM), the research investigates not only whether connectivity interventions reach the target population but also how and why they lead to meaningful use and replicable outcomes.

In engineering and other STEM programs, digital inclusion is not peripheral; it is a prerequisite for participation in core learning activities such as accessing the LMS, submitting computational assignments, running discipline-specific software, engaging in virtual labs, and collaborating on design projects. Therefore, this paper treats the telecommunications strategy as an engineering education infrastructure intervention and evaluates outcomes that directly influence students' ability to participate in technical coursework and persist through technology-intensive learning environments.

The digital divide remains a significant determinant of educational and economic opportunity in the United States. Although broadband infrastructure has expanded nationwide through federal investment. Disparities in digital adoption and meaningful technology use continue to affect underserved populations disproportionately. Digital inclusion is therefore defined not only by connectivity but by access to adequate devices, digital literacy, and institutional capacity to sustain technology-enhanced environments. These dimensions collectively influence students' engagement with academic resources, coursework, and digital learning ecosystems. Research highlights that meaningful use is now the principal barrier among marginalized groups, as many lack the skills or support required to leverage digital access effectively [5]. Growing evidence links digital access to positive academic outcomes. Students with reliable internet and appropriate devices demonstrate stronger engagement with online learning platforms, higher levels of assignment completion, and increased persistence in academic tasks [6]. Digital skills further support academic self-efficacy and independent learning. In STEM especially engineering disciplines, these relationships are more pronounced due to reliance on specialized software, virtual experiments, and computational tools. Studies indicate that insufficient digital access hinders student performance in engineering coursework and reduces their participation in remote or hybrid laboratory activities [7]. These findings underscore digital inclusion as a foundational requirement for academic success in modern higher education.

Historically Black Colleges and Universities (HBCUs) educate populations disproportionately

affected by systemic inequities in digital access. Students at HBCUs often encounter challenges such as limited broadband connectivity, device insecurity, and reduced digital readiness, all of which intersect with broader diversity, equity, and inclusion (DEI) priorities. Digital exclusion reinforces academic achievement gaps, affects students' sense of belonging, and diminishes long-terms career readiness [8]. As a result, digital inclusion is increasingly viewed as an equity-driven imperative rather than a solely technological intervention.

Higher education institutions increasingly serve as anchor organizations supporting digital capacity in surrounding communities. Research on community-based digital inclusion highlights the role of institutions in facilitating device distribution, shared access broadband hubs, and digital literacy programs targeting underserved populations. HBCUs hold unique potential to advance such initiatives due to their historical role as trusted community institutions. Community-engaged digital inclusion efforts have demonstrated improvements in digital skill acquisition, technology adoption, and socio-economic mobility among participants [9]. These findings emphasize the importance of analyzing digital ecosystems that extend beyond individual campuses and into the broader social context they serve.

Several federal telecommunications initiatives, including the Affordable Connectivity Program (ACP), Broadband Equity, Access, and Deployment (BEAD) Program, and Emergency Connectivity Fund (ECF) have sought to improve broadband affordability and availability. Despite these efforts, research indicates that adoption remains uneven. Barriers such as limited awareness of subsidy programs, low digital self-efficacy, and insufficient institutional support structures restrict full utilization among underserved communities [9]. In response, integrated telecommunications strategies that combine broadband access, device ecosystems, digital literacy training, and usage analytics have emerged as more comprehensive frameworks for promoting sustainable digital inclusion. However, empirical research examining such integrated models within HBCUs and other Minority-Serving Institutions (MSIs) remains limited, signaling a need for further investigation.

Although multiple digital equity programs have been launched to bridge the connectivity gaps, the impact of these investments on HBCU students' learning outcomes and their surrounding communities remains underexplored. These challenges also extend to involve unequal broadband penetration and affordability, limited access to digital devices for effective participation in hybrid learning, gaps in digital literacy and readiness among students and community members [10].

These persistent barriers prevent full participation in the digital economy and limit the academic potential of HBCU students. Furthermore, while the federal broadband program provides infrastructure and training support, evidence of long-term sustainability and replicability at other Minority-Serving Institutions (MSIs) remains sparse [11]. Such institutions must therefore develop sustained strategies that integrate digital infrastructure, academic support, and culturally responsive digital literacy initiatives. This study was thus designed to achieve the following objective: (i) evaluation of practical impact of NTIA-supported laptop distribution, broadband services, and infrastructure upgrades at HBCUs. (ii) assessment of the role of digital skills and technical training programs (NPower) in improving students' Engineering capabilities (iii) identification of barriers towards achieving a sustainable digital inclusion and, (iv) proposal of a framework for replicating successful strategies across other HBCUs.

In addition, this study also provided answers to the following research questions (i) how effectively broadband availability impacted recipients' livelihood especially Engineering students? (ii) to what extent were the distributed laptops perceived as effective for sustained use by students? (iii) How has the training impacted recipients' exposure to digital skills and academic performance?

METHODOLOGY

Conceptual Frameworks

The Diffusion of Innovations (DOI) Theory provides a foundational framework for understanding how new technologies are adopted in educational settings, especially engineering. DOI identifies several attributes of relative advantage, compatibility, complexity, trialability, and observability that influence adoption at both the individual and institutional levels [12]. This framework explains how new technologies and practices spread within a social system. Within an HBCU ecosystem, it helps interpret how broadband and digital training programs diffuse among students, faculty, and the surrounding community [13]. Complementing this framework, the Technology Acceptance Model (TAM) emphasizes perceived usefulness and perceived ease of use as primary determinants of technology acceptance [13]. TAM provides insight into behavioral factors influencing sustained technology adoption in both campus and community settings. Integrating DOI and TAM offers a comprehensive theoretical lens for analyzing the systemic and individual factors that shape the adoption of digital interventions in higher education. These frameworks clarify the conceptual grounding of the present study, which is positioned as a work in progress informed by theory-driven expectations and an evolving methodological design. Together, these frameworks establish a foundation for analyzing individual and institutional readiness, behavioral adoption patterns, and long-term inclusion impacts. Figure 1 illustrates the pictorial representation of the integration of these frameworks.

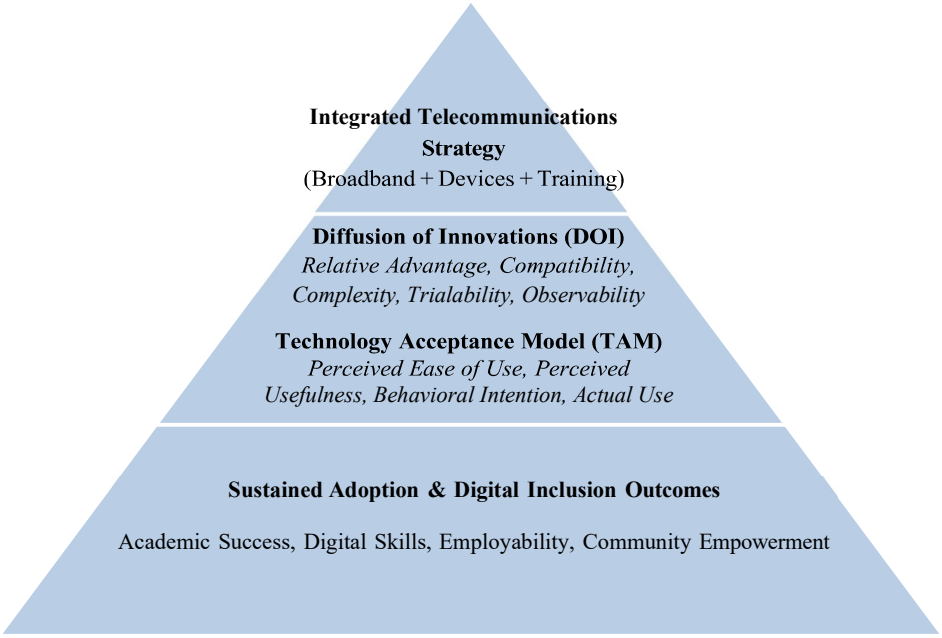

Fig 1: Integrated DOI–TAM Conceptual Framework

Research Design

This study employed a mixed-methods research design to evaluate an integrated telecommunications strategy (infrastructure enhancements, device deployment, and digital skills training) within an HBCU ecosystem and its surrounding anchor community. The design combined quantitative indicators (telemetry, program records, and digital skills assessments) with qualitative insights (focus groups and key-informant interviews) to examine adoption, sustained engagement, and participant outcomes. The study was framed by Diffusion of Innovations (DOI) and the Technology Acceptance Model (TAM) to explain both institutional-level diffusion processes and individual-level adoption behaviors.

Participants and Sampling

The study population (n=94) included students, faculty members and community beneficiaries of the NTIA initiative. Quantitative analyses data were drawn from the broad program coverage from administrative records and aggregated telemetry. Collected data included Wi-Fi telemetry, device distribution, broadband code-redemption records, and digital-skills assessments. Statistical analyses were conducted to identify factors influencing adoption, perceived usefulness, and sustained engagement. Qualitative data was collected from participants who were selected through purposeful sampling. This sampling ensured proper representation across key groups and adoption patterns.

Data Sources

The data used for this study includes Wi-Fi telemetry (aggregate metrics) from NTIA, Program and administrative records (Device distribution logs, broadband subsidy/code issuance and redemption records, training enrollment and completion scores), digital skills assessment, which is a performance-based assessment measuring practical skills (LMS navigation, file upload, email with attachments, cybersecurity.

Data Representation and Statistical Analysis

Quantitative analysis including descriptive statistics (adoption counts, redemption rates, training completion, telemetry trends) and chi-square were used as appropriate.

RESULTS

A total of 94 respondents completed the demographic items. Laptop distribution was largely cohort-based, with 90.43% of participants receiving their devices in Fall 2024, while 6.38% received laptops in Spring 2024 and 3.19% in Fall 2023. At the time of receipt, most participants were freshmen 78.72%, while 10.64% are juniors and 7.45% sophomores and 3.19%, seniors. These indicate that the intervention primarily targeted fresh students. Expected graduation dates further support long-term exposure, with 68.09% reporting May 2028.

The measure of asses of beneficiaries to technological devices, before the intervention revealed that 57.93% owned a smartphone, 22.07% owned a tablet, 6.90% owned printers, same 6.90% owned a desktop computer and 6.21% reported owning no other devices besides the distributed laptop. These results suggest that the program reached students positioned for sustained academic and digital engagement while addressing critical gaps in access to full computing resources.

The results also indicate that campus access to Wi-Fi on campus is the primary means of connectivity for many students, while home Wi-Fi, mobile hotspots, and public Wi-Fi provide additional connectivity options (Figure 2). This pattern reflects flexible and reliable access across different environments. These are indicators that many of the beneficiaries use about two different internet connection options, which is a useful resilience to sustainability indicator.

Figure 2 displays the distribution of internet connection modes among participants, with campus Wi-Fi being the most utilized at 45.83%, followed by home Wi-Fi (29.69%), mobile hotspots (13.02%), and public Wi-Fi (11.4%), suggesting that while institutional connectivity remains the primary access point, a substantial proportion of participants also rely on home-based and mobile alternatives.

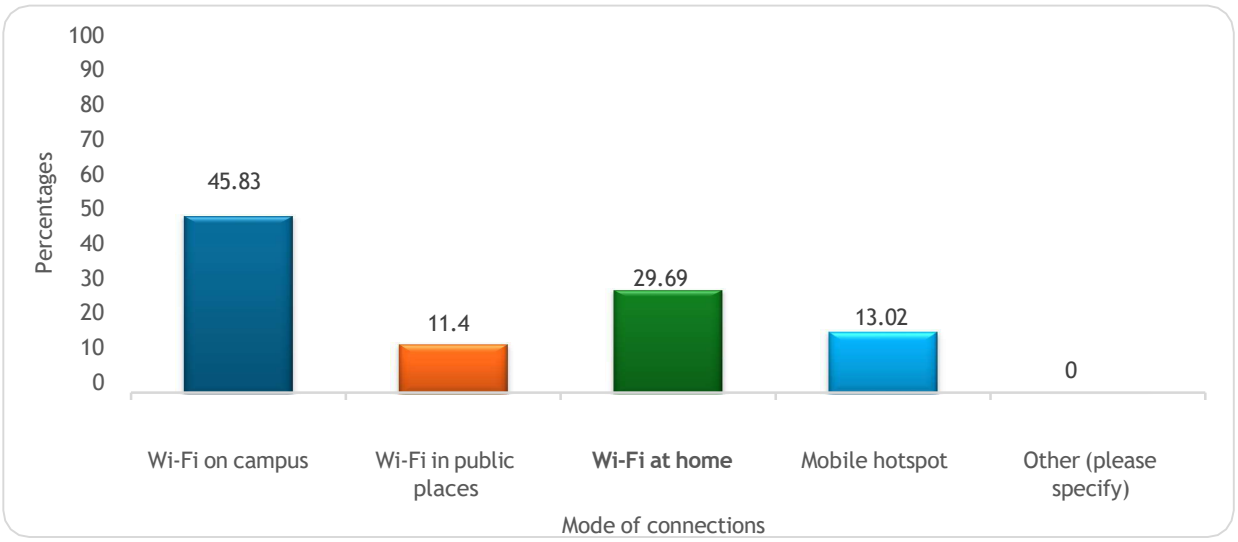

Fig. 2: Counts of each mode of internet connection

Figure 3 presents the proportion of participants with home internet access, revealing that an overwhelming 94.68% reported having internet services at home, while only 5.32% lacked access, reflecting the significant reach of the broadband connectivity intervention among the study cohort**.**

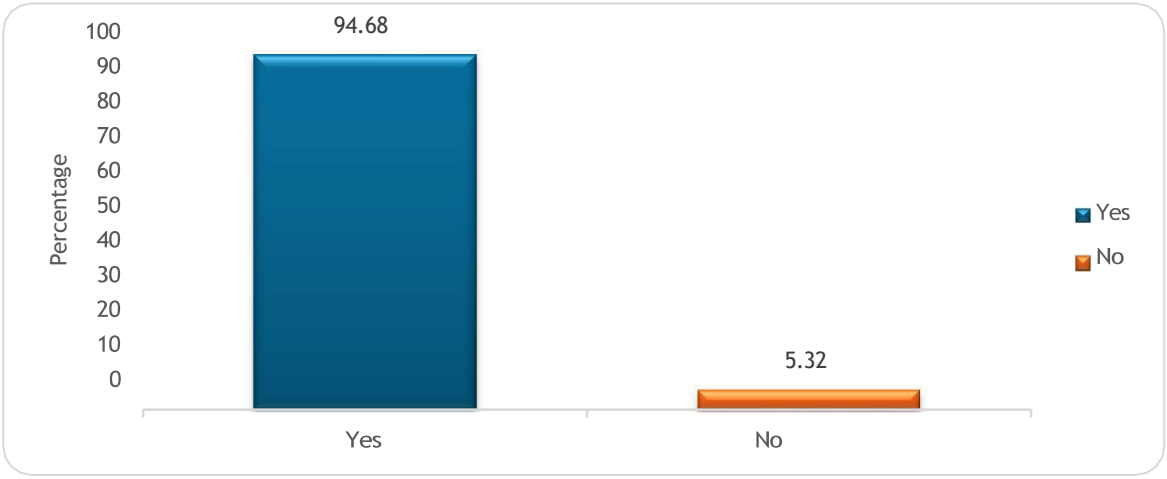

Fig 3: Participant with internet services at home.

Figure 4 depicts the frequency of laptop usage among recipients, showing that 80.22% use their devices every day and 14.29% use them often, collectively indicating that over 94% of participants engage with the distributed laptops on a regular basis, with only a negligible 1.1% reporting no use at all

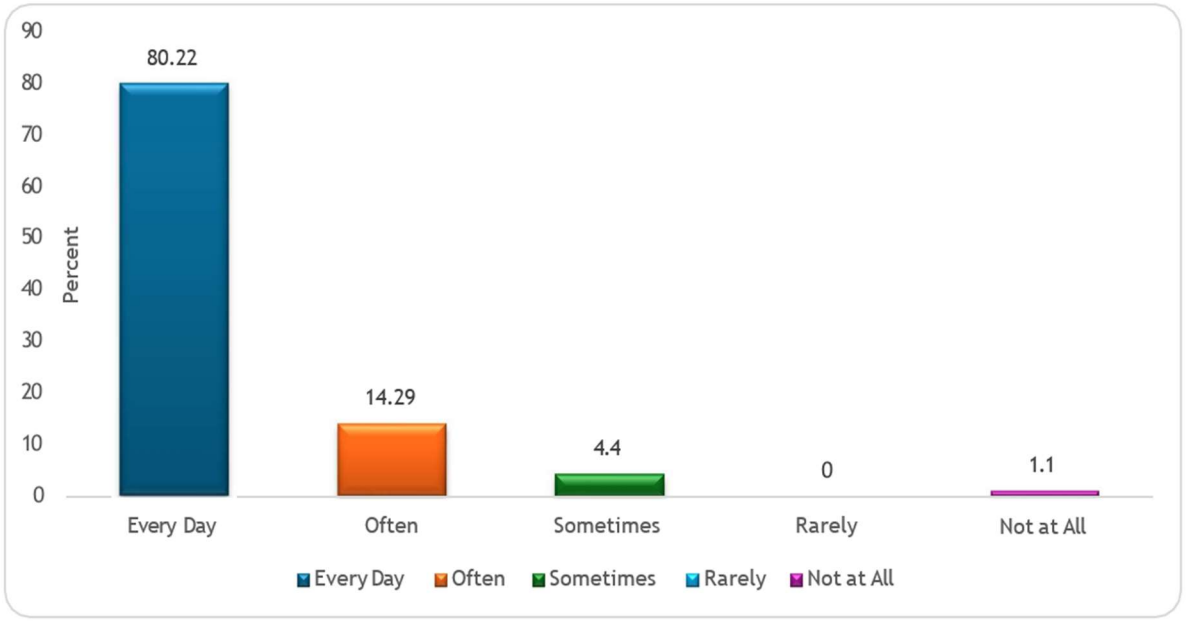

Fig. 4: Level of satisfaction of recipients with distributed laptops

Figure 5 illustrates participants' satisfaction levels with the distributed laptops, with an overwhelming majority reporting positive experience.

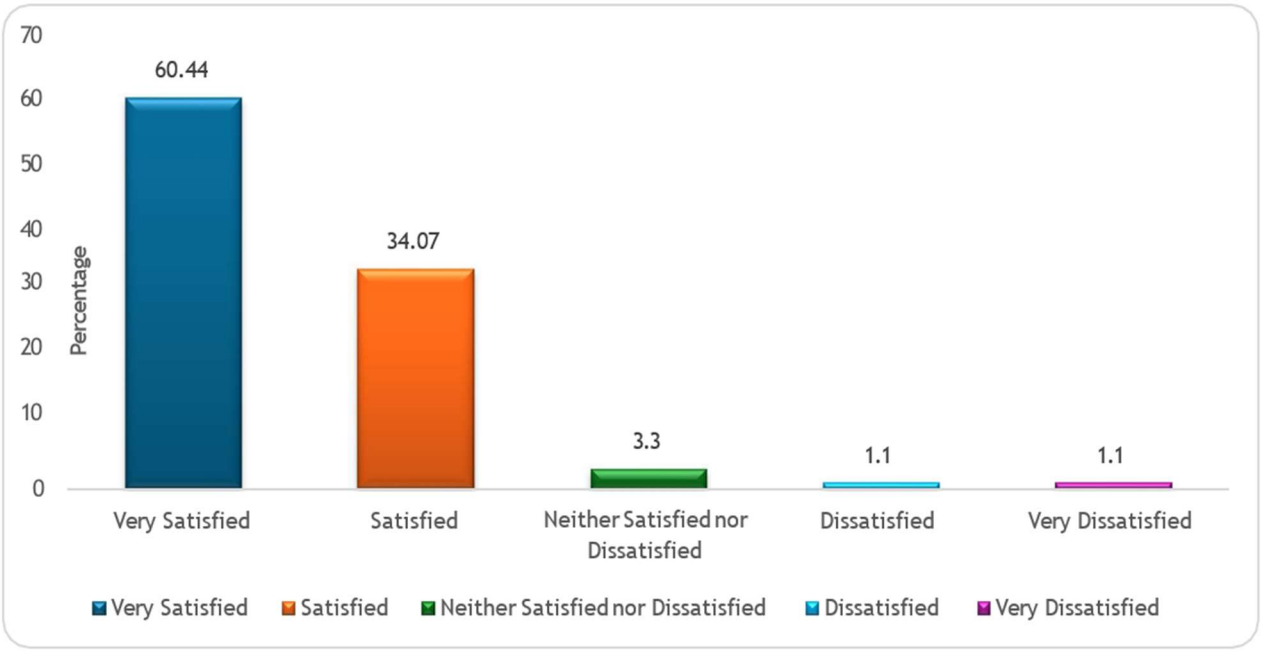

Fig. 5: Satisfaction level with the laptop

Figure 6 illustrates the percentage improvements across five key skill areas among program participants, with Digital Literacy and Typing Speed & Accuracy recording the highest gains , and Time Management, Course Grades, and Research Abilities

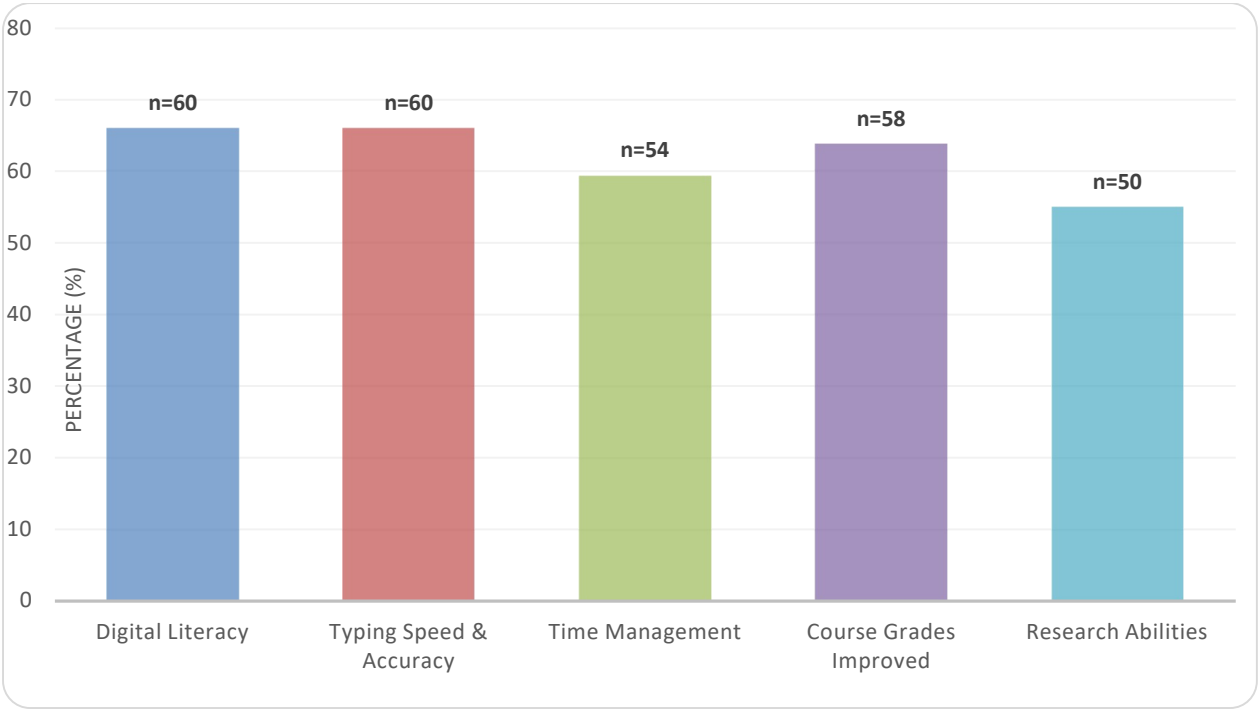

Fig. 6: Skills Improvement

Table 5 presents chi-square tests assessing responses for internet connectivity, home internet access, laptop usage frequency, and satisfaction with laptop performance evenly distributed. The extremely small p-values indicate statistically significant clusters toward frequent connectivity, widespread home access, daily laptop use, and high satisfaction. This confirms sustained adoption rather than random or uniform response patterns.

Table 5: Chi-Square Tests of Distribution for Internet Connectivity, Laptop Use, and Satisfaction

Items	Chi-square	P-Value
Means of internet connections	123.16	$2.2e\text{-}^{16}$
Presence of Internet Service in homes	75.065	$2.2e\text{-}^{16}$
Frequency of internet usage	212.02	$2.2e\text{-}^{16}$
Satisfaction with laptop performance	128.62	$2.2e\text{-}^{16}$
Skills improvement	53.69	$2.2e\text{-}^{16}$

Impact of Digital Proficiency

Based on the documented survey results and program administrative records, the program built digital capacity among participants to a substantial and demonstrable extent, moving beyond simple access to measurable skill development and applied technical competence.

At the foundational level, digital capacity was established through consistent device use. Among survey respondents, 80.22% (73 out of 91) reported using the provided laptop every day, while an additional 14.29% (13 out of 91) used it often, meaning 94.51% of respondents engaged with the device at a high frequency. This level of sustained use indicates that participants were repeatedly exposed to digital tools in their academic routines rather than interacting with them sporadically. Such routinized engagement is a key condition for building digital capacity, as it supports familiarity, confidence, and skill reinforcement over time.

This exposure translated into measurable improvements in digital and academic skills. When asked which skills had improved since using the laptop, 60 participants (65.93%) reported improved digital literacy, defined as understanding how to use software and digital tools. The same number, 60 participants (65.93%), reported gains in typing speed and accuracy, while 54 participants (59.34%) indicated improved time management.

Academic outcomes were also evidenced. Fifty-eight participants (63.74%) associated laptop use with improved course grades, and 50 participants (54.95%) reported stronger research abilities. These responses, drawn from 91 respondents and 284 total selections, show that improvements were multi-dimensional and often experienced concurrently, rather than being isolated to a single skill area.

Beyond self-reported outcomes, the program demonstrated digital capacity building through objective training and certification results. 35 participants enrolled in Tech Fundamentals training aligned with industry standards (Google IT Support, CompTIA ITF+, CompTIA A+, and related pathways). Of these, 23 participants completed the training and passed certification exams, while 12 participants remained enrolled at the time of reporting and were scheduled to graduate later. Certification outcomes among those who passed included 22 participants receiving Google IT Support, 12 receiving both Google IT Support and CompTIA ITF+, 5 receiving Google IT Support and CompTIA Tech+, and 1 receiving Google IT Support, CompTIA ITF+, and CompTIA A+. Progression into advanced training further demonstrates capacity building. Four participants enrolled in the Cybersecurity (CompTIA Security+) program, but 3 successful participants completed the training. This indicates advancement beyond foundational digital skills into specialized technical domains.

Taken together, the evidence shows that the program built digital capacity at multiple levels. Sustained digital engagement through daily laptop use, improved foundational and academic skills as reported by a majority of participants, and externally validated technical competencies were demonstrated through certification completion and progression into cybersecurity training. While the data do not yet capture long-term outcomes beyond the program period, they clearly document meaningful and structured digital capacity development among participants during the study window.

The program incorporated a substantial soft-skill development component designed to support the translation of technical and academic skills into professional and community contexts. Administrative records indicate that participants received a total of 180 hours of professional development training, complemented by 20 mentoring sessions and ongoing individualized support.

The soft-skill training explicitly covered mock interviewing and interview preparation, résumé writing, cover-letter development, elevator pitch development, professional attire guidance, formal email writing, LinkedIn profile creation, professional networking, time management skills, and stress-coping strategies. These activities were delivered alongside technical instruction rather than as stand-alone workshops. These reinforce their relevance to both academic performance and employment readiness.

In addition to structured training hours, relational support played a significant role. Among the 23 participants who completed training were documented as active alumni of the HBCU, with regular outreach from an Alumni Engagement Manager regarding job opportunities, job fairs, and programmatic events. A Social Support Manager met with each trainee three to four times during the program to address barriers to participation and persistence, resulting in 11 documented referrals for wrap-around support services. Although the data do not report participant counts for each individual soft-skill module or trainer-to-trainee ratios, they clearly show that soft-skill development was extensive, intentional, and embedded within a broader support system.

These soft-skill training complemented digital and technical instruction by strengthening communication, professionalism, self-management, and career readiness capabilities that are essential for sustaining digital inclusion and extending its benefits into academic success, employment, and broader community engagement.

Sustainability and Scalability Signals

Indicators of sustainability emerge from the timing and targeting of device distribution and training. 78.72% of recipients were freshmen at the time of laptop receipt, and 68.09% reported an expected graduation date of May 2028. There are indicators that devices were distributed early in students' academic trajectories. This timing supports multi-year use and reinforces sustainability at the individual level. Scalability is further supported by the integration of access and training. Administrative records show 35 participants enrolled in Tech Fundamentals training, with 23 completing and passing certifications, and 4 enrolling in cybersecurity training. These values demonstrate a tiered model in which device access supports progressed into structured training pathways, a design that can be replicated across cohorts and institutions.

DISCUSSION

This study evaluated how integrated telecommunications strategies consisting of broadband access, laptop distribution, and digital skills training supported digital inclusion at HBCU and environs. The results show that when access is combined with structured support, it leads to sustained adoption, skill development, and academic relevance.

Connectivity results indicate a strong access environment. Most respondents reported having home internet service, and nearly all relied on campus Wi-Fi, often using more than one connection method. This pattern reflects reliable and resilient access that supports continuous participation in academic and livelihood-related digital activities. Chi-square results confirm that these access patterns are highly concentrated rather than evenly distributed, indicating consistent broadband availability among participants [1-5].

Laptop adoption outcomes demonstrate sustained and meaningful use. Most respondents used their laptops daily or often and reported high satisfaction with device performance. The statistically significant chi-square results show that usage and satisfaction were strongly skewed toward positive outcomes, supporting continued engagement rather than short-term use. Within the Technology Acceptance Model, these findings correspond to actual use and ease of use.

Digital capacity outcomes further show that access translated into practical benefits. A majority of participants reported improvements in digital literacy, typing accuracy, time management, research ability, and course performance. These self-reported gains align with objective training outcomes, including enrollment in technology training, certification completion, and progression into cybersecurity pathways. Together, these results indicate movement from basic access to applied digital competence [6-7].

Demographic findings support sustainability. Most recipients were early career students with multiple years remaining before graduation, allowing long-term benefits from device access and training. When combined with professional development, mentoring, and alumni engagement, the program reflects a scalable institutional model. These findings align with Diffusion of Innovations theory, showing normalization of technology use within the HBCU ecosystem [3].

Limitations

This study is subject to limitations that should be considered when interpreting its findings. First, the study was carried out based on the data gotten from the NTIA. Secondly, as this study relies partly on self-reported data from participants, responses may be subject to social desirability bias, where respondents report more favorable outcomes than actual experience. Finally, the single-institution focus, while enabling an in-depth "living lab" analysis, may restrict the transferability of findings to HBCUs with different infrastructural, demographic, or geographic contexts.

CONCLUSION

The study shows that integrated telecommunications strategies can effectively advance digital inclusion when access is paired with training and institutional support. High broadband availability, sustained laptop use, strong satisfaction, and measurable skill development demonstrate meaningful adoption rather than symbolic access.

By applying Diffusion of Innovations and the Technology Acceptance Model, the study explains both institutional diffusion and individual acceptance of technology. The findings highlight the role of HBCUs as anchor institutions capable of delivering sustainable and scalable digital equity interventions that support academic success, workforce readiness, and community empowerment.

References:

[1] E. Ogbo-Gebhardt, “The impact of digital inclusion initiatives: A systematic literature review,” in Proceedings of the 58th Hawaii International Conference on System Sciences, 2025, doi: 10.24251/HICSS.2025.804.

[2] M. Salzmann-Erikson, “Digital inclusion: A mixed-method study of user behavior and content on Twitter,” Digital Health, vol. 9, 2023, doi: 10.1177/20552076231211277.

[3] Benton Institute for Broadband & Society, “Historically Black Colleges and Universities play a key role in states’ digital equity plans,” Aug. 2022. [Online]. Available: https://www.benton.org/blog/historically-black-colleges-and-universities-play-key-role-states-digital-equity-plans

[4] Robert F. Smith Foundation, “The digital divide at HBCUs,” Dec. 2022. [Online]. Available: https://robertfsmith.org/news/digital-divide-at-hbcus/

[5] U.S. National Telecommunications and Information Administration, Office of Minority Broadband Initiatives, Minority Broadband Initiatives Report. Washington, DC, USA: U.S. Department of Commerce, 2022. [Online]. Available: https://www.ntia.gov/

[6] J. B. Horrigan, Digital Readiness Gaps and Opportunities. Washington, DC, USA: Pew Research Center, 2021.

[7] B. Means, V. Peters, J. Neisler, K. Wiley, and R. Griffiths, Lessons From Remote Learning During COVID-19. San Mateo, CA, USA: Digital Promise, 2021, doi: 10.51388/20.500.12265/116.

[8] D. May, G. R. Alves, A. A. Kist, and S. M. Zvacek, “Online laboratories in engineering education research and practice,” in International Handbook of Engineering Education Research, A. Johri, Ed. New York, NY, USA: Routledge, 2023, pp. 525–552, doi: 10.4324/978100328748329.

[9] E. McGee, Black, Brown, Bruised: How Racialized STEM Education Stifles Innovation. Cambridge, MA, USA: Harvard Education Press, 2021.

[10] B. Reisdorf and C. Rhinesmith, “Digital inclusion as a core component of social inclusion,” Social Inclusion, vol. 8, no. 2, pp. 132–137, 2020, doi: 10.17645/si.v8i2.3184.

[11] Reddick, Christopher G., et al. "Determinants of broadband access and affordability: An analysis of a community survey on the digital divide." Cities 106 (2020): 102904.

[12] Gasman, Marybeth, et al. "Minority serving institutions: A data-driven student landscape in the outcomes-based funding universe." Berkeley Review of Education 7.1 (2017)

[13] C. Rhinesmith and A. Grant, Broadband Adoption and Digital Equity: Lessons From Community-Based Organizations. Benton Institute for Broadband & Society, 2022.

[14] A. J. A. M. van Deursen and J. A. G. M. van Dijk, “The digital divide shifts to differences in usage,” New Media & Society, vol. 16, no. 3, pp. 507–526, 2014, doi: 10.1177/1461444813487959.

[15] E. Hargittai, “Second-level digital divide: Differences in people’s online skills,” First Monday, vol. 7, no. 4, 2002, doi: 10.5210/fm.v7i4.942.