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Bridging the Digital Divide in Higher Education: Evaluating the META Zones Project at an HBCU

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Bridging the Digital Divide in Higher Education: Evaluating the META Zones Project at HBCU.

Abstract

Although digital technologies are now central to teaching and learning in higher education, many students at Historically Black Colleges and Universities (HBCUs) continue to experience limitations in device reliability, home connectivity, and digital readiness.

This study evaluates early outcomes of the META Zones Initiative, a multicomponent digital-inclusion effort designed to strengthen academic participation and socio-technical capacity at HBCU. The evaluation draws on laptop allocation records (n = 850), including 338 devices allocated to students across two distribution cycles and 98 distributed to underserved community workforce groups; student survey responses (70 of 278 eligible recipients); community broadband data from the NTIA Broadband and Health Connectivity Survey (n = 53); and workforce-training outcomes from three NPower cohorts. Students consistently described the issued laptops as essential for navigating coursework, accessing the learning management system (LMS), and participating in online assessments. Reported improvements in digital literacy including typing proficiency, research ability, and time management indicate early gains in academic readiness.

Community findings revealed ongoing connectivity challenges, including reliance on mobile-only home internet access alongside strong interest in digital- and telehealth-training opportunities. Workforce-training results showed promising progressive attainment in digital credentials, supporting the program initiative on the corridors of human-capital objectives.

Collectively, these early findings suggest that coordinated interventions combining reliable connectivity pathways, and targeted skills development can dwindle digital friction for students while HBCU is strategically positioned as a regional anchor for digital equity. Ongoing work will incorporate longitudinal tracking and additional administrative datasets to refine a scalable model for digital-inclusion practice at HBCUs and peer institutions.

Keywords: Digital Inclusion; HBCU; Broadband Access; Laptop Deployment; Engineering Education; Digital Literacy; Workforce Development; Virtual Learning; Telehealth Readiness; Mixed-Methods Evaluation.

1. Introduction

The META Zones Initiative at HBCU represents a multicomponent digital inclusion and workforce-capacity model designed to address persistent gaps in device access, broadband affordability, digital literacy, and academic technology readiness among students at HBCU. Supported by federal, state, and private partners, META Zones integrates campus-facing and community-facing interventions to position HBCU as a regional anchor institution for digital equity [17–21].

National estimates indicate that millions of Americans live in households without broadband subscriptions or dedicated computing devices, despite widespread infrastructure availability [1]. According to the U.S. Census Bureau's Digital Equity Act Population Viewer, broadband adoption and computer access remain substantially lower among low-income households, racial and ethnic minorities, and communities experiencing historic systemic barriers [23]. These patterns are especially consequential for Historically Black Colleges and Universities (HBCUs), whose student populations often mirror the "covered populations'' prioritized under the Digital Equity Act [15].

Within higher education, digitally mediated instruction has become foundational. Learning management systems (LMS), remote assessments, programming environments, virtual computing labs, and cloud-based engineering tools require stable broadband, powerful devices, and sufficient digital skills for full participation [5,12]. Students lacking access to capable laptops or reliable connectivity face measurable barriers to course engagement, timely submissions, and collaborative learning challenges that disproportionately affect underrepresented and low-income students [6,9]. These challenges are heightened in engineering and computing education, where coursework demands computational capacity, specialized software, and frequent online tool usage [12,13].

HBCU launched the META Zones initiative to address these persistent gaps by integrating device access, broadband affordability, campus Wi-Fi upgrades, and digital skills development [17,18]. Supported by state, federal, and private partners, the initiative includes large-scale laptop distribution, subsidized broadband codes for eligible ZIP codes, partnerships such as NPower for digital training, and community-facing programming in North Central Maryland [17,21].

Despite increasing national attention to digital equity initiatives, higher education literature lacks systematic evaluations of integrated digital inclusion interventions at HBCUs. Existing research often focuses on device distribution alone, with limited examination of how combined support devices, broadband assistance, infrastructure upgrades, and digital skills shape academic engagement, especially in engineering and computing contexts [10,11]. The present study addresses this gap using administrative data, survey results, and student focus group narratives from the META Zones initiative.

Preliminary evidence indicates improvements in students' academic workflow, LMS participation, and perceived readiness for coursework patterns, particularly relevant for Science, Technology, Engineering, and Mathematics (STEM) pathways requiring computationally intensive tools [12,13]. This paper contributes to the national discourse by documenting early implementation outcomes and their implications for digital equity, engineering education, and community engagement.

1.1 Impact of Digital Connectivity and Skill Support

Students residing in eligible ZIP codes received information and promotional codes for low-cost home broadband through participating internet service providers. While early awareness remained limited among students, broadband support was intended to alleviate financial barriers to stable home connectivity for LMS use, remote testing, and engineering software access [18,19]. The initiative also included major improvements to campus wireless infrastructure through the Division of Information Technology (DIT). Upgrades targeted high-demand academic buildings, residence halls, and commuter-heavy zones to reduce connectivity bottlenecks and enhance learning continuity [18]. META Zones partnered with NPower, a national workforce development organization, to build employability and human capital for students pursuing engineering, technology, and computing pathways [16] through provision of training in: Digital literacy, IT fundamentals, career readiness, technology support roles, Certification pathways (e.g., Google IT Support).

1.2 Research Questions (RQs)

1. How did the META Zones laptop initiative influence students' ability to participate in coursework, LMS activities, and academic digital tasks at a public HBCU?
2. What perceived academic and digital-skills benefits did students report through focus group narratives regarding their use of META Zones laptops and supports?
3. How can implementation lessons from this HBCU digital-equity model inform broader strategies in engineering education and community-based digital inclusion efforts?

2. Background of Study

Digital inclusion includes broadband access, suitable devices, digital literacy, and meaningful technology use for academic and workforce activities [15,10]. Even while infrastructure is getting better, national data shows that there are still notable differences in broadband application, usage and device availability amongst the racial and socio-economic groups [20,4]. Marginalized Students populations from low-income backgrounds well represented at HBCUs are disproportionately dependent on usage of smartphones or unstable connectivity for coursework [8,9]. These inequalities influence students' ability to attend synchronous online sessions and fully participate in LMS activities (i.e., assignments submission, use STEM software) [6].

HBCUs educates a significant number of underserved engineering and technology students; nonetheless, these students frequently encounter restricted device accessibility and inadequate broadband access at home [7,9]. National datasets confirm that Black households are still less likely than White households to possess a computer or broadband subscription [1,8]. These distinctions make it difficult for engineering and computing majors to get specified hardware, programming tools, and a stable bandwidth required for effective class learning experience. This leads to missed classes and minimum collaboration among the students [12,13].

Although research is increasingly advocating for multi-component strategies that integrate access with institutional infrastructure, enhance affordability and improve digital competencies [11], numerous digital equity initiatives concentrate on certain elements, such as devices or broadband [10]. The META Zones project is a full HBCU model that includes device provisions, broadband incentives, Wi-Fi upgrades, and digital training which aligns with

federal initiatives under the Broadband Equity, Access, and Deployment (BEAD) program. [15].

Engineering and computing programs require consistent use of programming environments, virtualization systems and cloud-based simulation platforms [12,13]. Students with inadequate devices or unstable broadband encounter barriers in (i.e., executing code, uploading assignments, running simulations, group work participation etc.). META Zones Provision of laptops and Broadband connectivity addresses barriers that directly affect student success hence reducing dependency on low-performance devices.

3. Theoretical Framework

This study is anchored on three complementary frameworks to guide interpretation and analysis of digital-inclusion outcomes at HBCU. Human Capital Theory (HCT) explains the position of digital literacy and access as an investment that generates economic and academic returns [2]. The Technology Acceptance Model (TAM) provided insight on how ease of use perception influences student engagement with academic technologies [5]. The Triple Bottom Line (TBL) framework offers benefits outcomes in social, economic, and environmental dimensions, including reduced commuting demands and improved participation in learning activities [7].

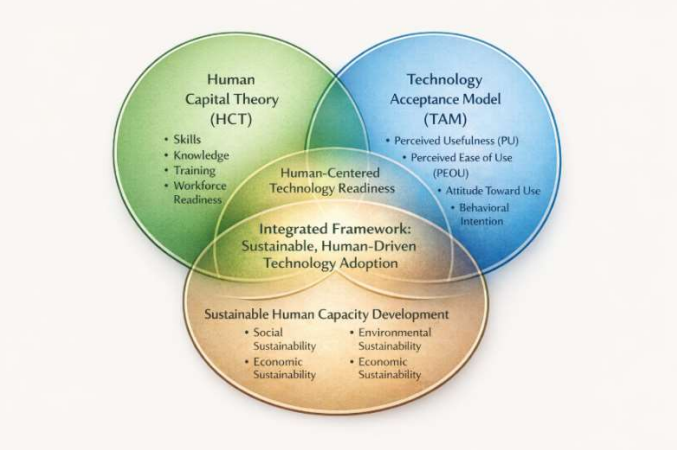

Figure 1: Integrated Theoretical Framework for Sustainable, Human-Centered Technology Adoption

Together, these frameworks provide the analytical basis for examining patterns at which digital resources shape behaviors of students, availing digital confidence in technology enabled learning.

Digital equity has been broadly examined previously, but few studies apply established analytical frameworks to institution-wide, integrated digital-inclusion initiatives at HBCUs [27,3,22]. The present study begins to address this gap by organizing administrative surveys, and qualitative evidence within a unified structure, illustrating how coordinated digital supports may influence early academic engagement, digital confidence, and technology-enabled learning [12,25]. This aligned framework helps to provide clarity where emerging evidence exists, where gaps persist, and which areas require further investigation that will strengthen digital-inclusion practice and policy in underserved higher-education [27,3,22,25].

4. Methodology

This impact assessment study follows a mixed-methods design approach to analyze documented quantitative data and synthesize digital-engagement outcomes associated with the META Zones initiative at HBCU. The methodological approach utilized administrative records, student survey data, and qualitative focus group narratives to provide a multi-layered knowledge of student experiences in device usage and broadband support. HBCU serves a high number of students coming from digitally underserved households and especially the low-income earners. These include many enrolled in engineering, computer science, information systems, and technology related programs, where computational tools and stable connectivity are extremely essential for course efficiency and success [12,13].

4.1 Study Design

The study employed a scalable approach to examining patterns of device distribution while capturing students' perceptions of academic usefulness. Quantitative data were complemented by narrative insights obtained from four undergraduate focus groups, which explored students' digital, academic, and technological experiences. Data integration occurred during interpretation so that qualitative themes contextualized quantitative trends [18,19]. Two hundred and eighty (280) students at HBCU received laptops during Batch #1 in 2023–2024 implementation cycle and Three Hundred (300) during Batch #2 in 2024–25 academic sessions, representing majors across engineering, computer science, business, education, and health sciences [18]. A device and digital-engagement survey was administered to 278 eligible recipients, yielding 70 complete responses at 25% response rate from students in both STEM and non-STEM fields.

4.2 Data Sources

Table 4.2 summarizes the five data streams that informed this evaluation, combining (administrative records, survey responses, focus groups, training metrics) and broadband documentation. Collectively, these sources provided complementary evidence and guide that strengthened the mixed-methods analysis of digital access and academic engagement.

Table 1: Data Sources Used in the META Zones Evaluation

S/No.	Source of data	References	Data Description	Remarks in Study
1	Records of Laptop distribution	[18]	Distribution events, counts, academic discipline	Document scalability and program reach
2	Participant laptop survey (n=70)	[18]	Perceived laptop usefulness, access to LMS, digital tasks and coursework needs	Quantitative indicators of academic involvement
3	Focus group transcripts (4 groups, n=14)	[19]	Narratives about academic impact, digital tasks, challenges, and benefits	Thematic analysis of student experiences
4	Metrics of Npower digital training	[16]	Enrollment numbers, certifications, career readiness activities	Contextual insight into digital-skills

				pathway development
5	Broadband incentive documentation	[18],[21]	Code distribution, eligibility ZIP codes, student awareness	Supplemental indicator of broadband affordability

4.3 Data Analysis

Quantitative data analysis was carried out by grouping the student survey responses in a tabular structure and converting all percentage values into proportions to ensure consistent survey variables required for comparability. Each row in the analytic tables represents a specific skill improvement or task indicator. The output data from these tables were used to construct bar charts for visualization. These charts provided a clear understanding of response across the seventy (n=70) participants distributed in the survey. Based on the outcome, students could select multiple skill areas or academic tasks, thus; percentages show the proportion of respondents endorsing each item. Comparatively, this approach enhanced the analysis of digital skills development impact and laptop importance.

Qualitative data from the four (4) focus groups was reviewed to context the quantitative findings. Transcripts were examined for recurring patterns in students' descriptions of digital challenges, academic behaviors, and perceived benefits of receiving a laptop. Narrative observations were not coded into a full thematic framework but were used to provide details and explanation of the quantitative trends by highlighting experiences that aligned with or explained the survey outcomes.

5. Results

The combined findings from the METAZone Laptop distribution Survey and the NTIA Broadband and Health Connectivity Survey identifies both inequities in digital access and the potential transformation of localized training interventions. These results show consistency with national studies documenting the persistence of digital divides along race, channels of income, and geography. For example, a report revealed that 27% of low-income adults in the US rely solely on smartphones for internet access [20], a pattern also reflected in our survey, where more than one-quarter of households in north central Maryland reported mobile-only internet connection. Such dependence on mobile data has been linked to limitations in educational engagement and productivity tasks [21], underscoring the central role of affordability and infrastructure as barriers. Hence, this section summarizes quantitative and qualitative findings from three data streams: META Zones laptop distribution and HBCU student follow-up survey, NTIA community broadband and telehealth survey. All tables and figures referenced appear in Section 5 and Appendix A.

5.1 Laptop Distribution Across META Zones Groups

A total of 850 laptops were allocated across six target groups. Distribution reached 436 units overall (Table 2). HBCU Student Batch #1 achieved full deployment (100%), whereas Batch #2 had limited early uptake (19%). Community distribution varied, with Turner Station (94%) showing strong completion and Penn Lucy reporting zero distribution to date. Figure 2 visualizes allocation and distribution performance, highlighting disparities across groups. These results indicate that infrastructure readiness and community engagement structures

strongly influence device uptake, consistent with digital-equity implementation literature [10,11].

Table 2: Laptop Distribution Summary Across META Zones Groups

S/No	Group	Laptops Allocated	Laptops Distributed	Percent Distributed
1	HBCU Students – Batch #1 (2023–24)	280	280	64%
2	HBCU Students – Batch #2 (2024–25)	300	58	13%
	Total	580	338	78%
3	NPower Participants	20	14	3%
4	Turner Station Residents	50	47	11%
5	Wilson Park Residents	100	37	8%
6	Penn Lucy Residents	100	0	0%
	Sub-Total	270	98	22%
	Grand Total	850	436	100%

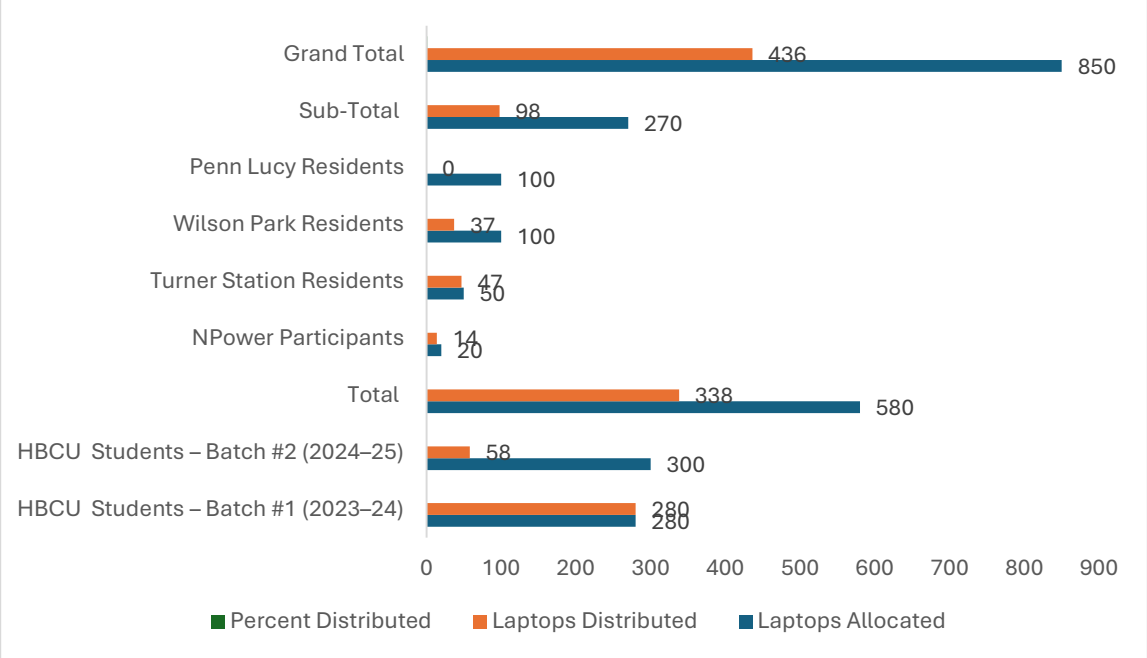

Figure 2: Laptop Distribution Across HBCU Student Cohorts (2023–2024)

5.2 Student Skill Development Outcomes

Among 70 HBCU laptop survey respondents, students reported measurable improvements across five academic and digital skills (Table 3). The highest reported gains were digital literacy (58%), typing speed and accuracy (56%), research ability (52%), and time management (50%). Figure 3 illustrates the distribution of improvements when students were allowed to select as many skills as they wanted. These findings align with studies showing that device access strengthens academic productivity and digital self-efficacy [14–16].

Table 3: Student-Reported Skill Improvements After Receiving META Zones Laptop

S/No.	Skill	Percent Reporting Improvement	Survey (n=70)	Number of respondents	Percentage Respondent
1	Digital literacy	58%	70	41	22%
2	Research abilities	52%	70	36	20%
3	Typing speed & accuracy	56%	70	39	21%
4	Time management	50%	70	35	19%
5	Course grades	49%	70	34	18%
				186	100%

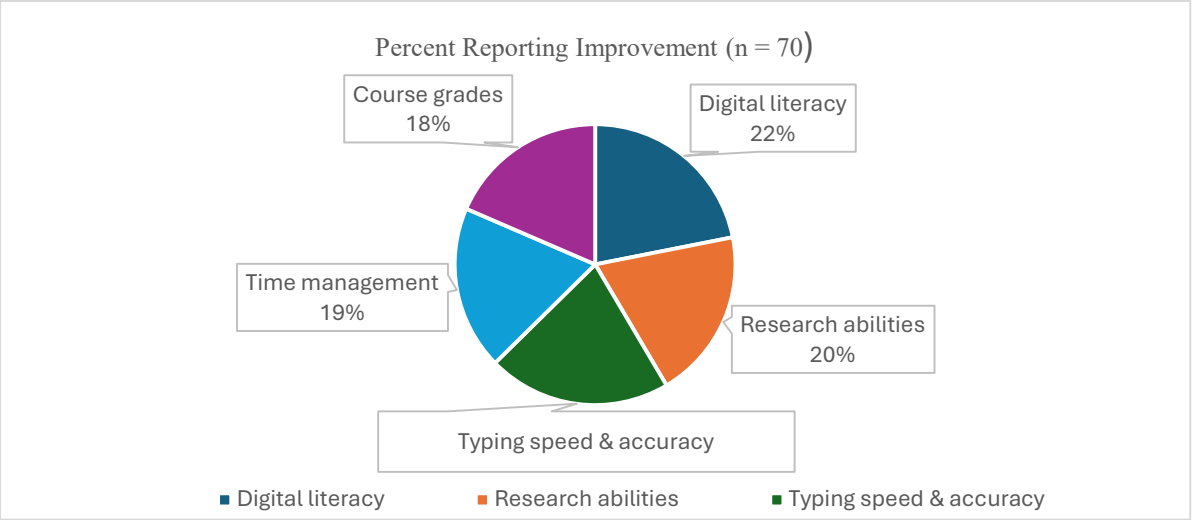

Figure 3: Student-Reported Skill Improvements After Receiving META Zones Laptop

5.3 Student Use of Laptops for Academic Activities (n=164)

Survey responses indicate that students used the laptops extensively for coursework-related activities [17]. Students reported using the devices to access learning management systems, submit assignments, communicate with instructors, conduct academic research, and complete online examinations [2], [11].

Table 4: Academic Activities Supported by META Zones Laptops (Student Survey Responses)

S/No.	Academic Activity	Students Reporting Use	Percent (%)
1	Accessing learning management systems (e.g., Canvas/Blackboard)	152	92.68%
2	Completing coursework assignments	149	90.85%
3	Conducting academic research	145	88.41%
4	Preparing written coursework (papers, reports, presentations)	138	84.15%
5	Communicating with instructors and classmates	131	79.88%

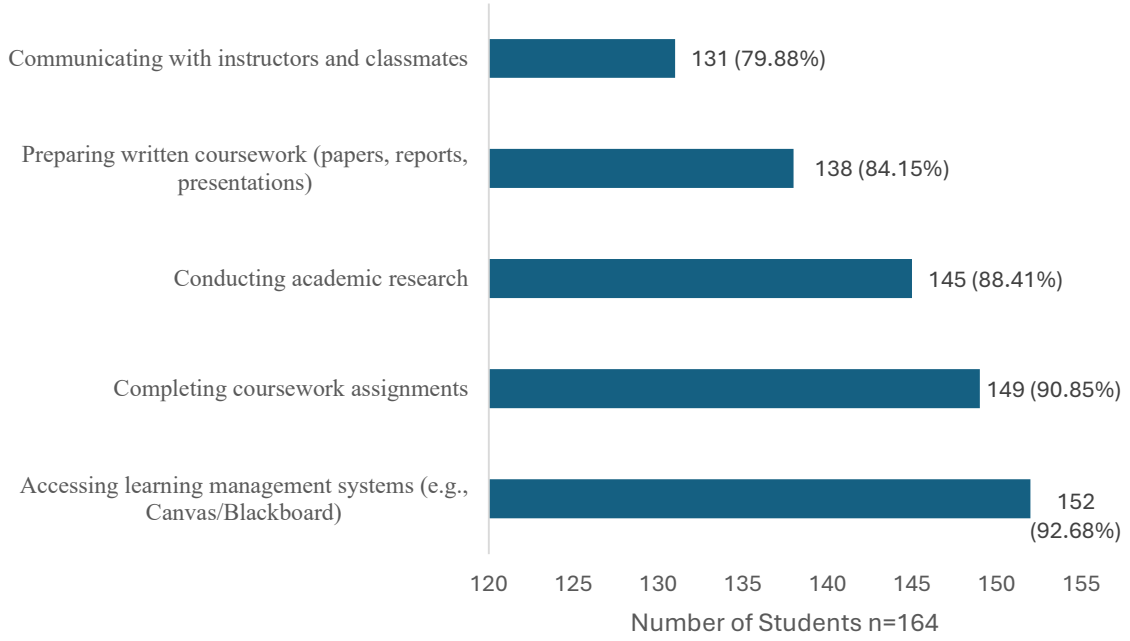

Figure 4: Student Utilization of Provided Laptops for Academic Activities

Across both survey cohorts, more than 95% of respondents reported that having a personal laptop was important for completing coursework tasks [17]. Students indicated that access to a reliable computing device enabled them to more easily access course materials, complete assignments, and participate in online academic activities.

These findings suggest that device access played an important role in supporting student participation in technology-mediated learning environments.

5.4 Community Connectivity and Digital-Inclusion Status

Demographic data from the NTIA community survey indicate that respondents were predominantly Black or African American (88–91%), consistent with the target communities served (Table 5). Gender distribution was 67% women and 33% men. Connectivity conditions remain uneven. Only 51% reported having high-speed broadband at home, while 26% rely on smartphone-only access and 8% reported no internet access (Table 5) [20]. Interest in telehealth training was high (87%, Table 4.1b), suggesting unmet digital-skills demand. Figure 4 and Figure 4a present demographic and connectivity patterns respectively.

Table 5: NTIA Telehealth Survey Demographics by Gender

S/No.	Gender	Number	Percent
1	Woman	35	67%
2	Man	17	33%
	Total	52	100%

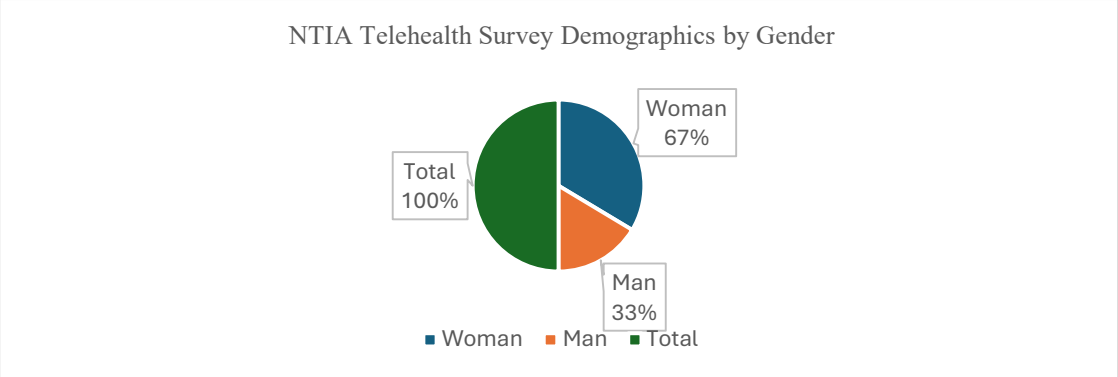

Figure 5: NTIA Telehealth Survey Demographics by Gender

5.6 Community Connectivity and Digital-Inclusion Status

Table 6 and Figure 6 show that NTIA survey respondents were overwhelmingly Black or African American (48 of 54 respondents, about 88–89%). White respondents accounted for only four cases, and two participants selected another race. This pattern confirms that the community data largely reflects the predominantly Black neighborhoods that the project targeted.

Table 6: NTIA Telehealth Survey Demographics by Race

S/No.	Race	Number	Percent
1	Black or African American	48	88%
2	White	4	8%
3	A race not listed	2	4%
	Total	54	100%

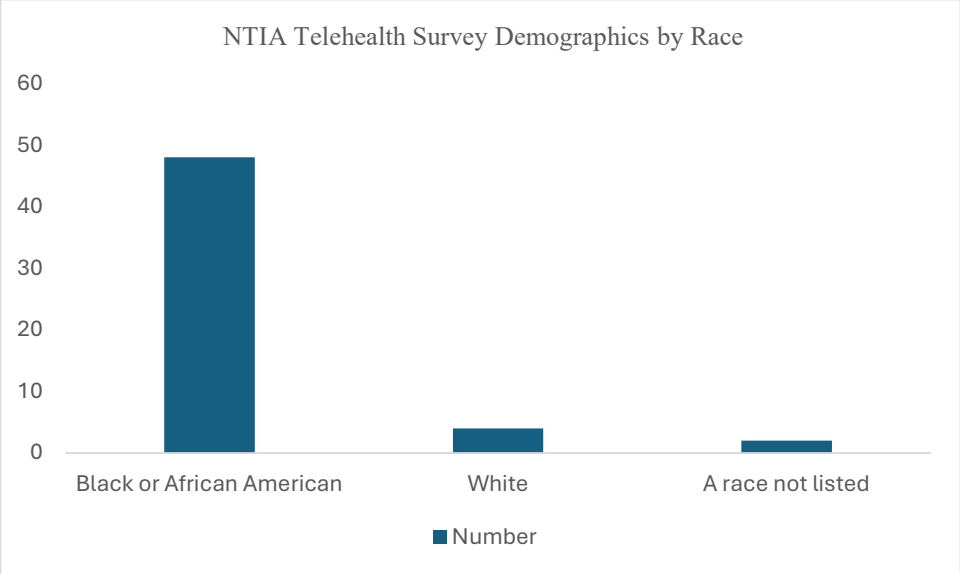

Figure 6. NTIA Telehealth Survey Demographics by Race

5.7 NTIA Connectivity and Telehealth Training Interest

Figure 7. Home Internet Connection Type Among NTIA Respondents (n = 53) Table 7 and Figure 7 indicate that just over half of respondents (51%) reported high-speed home broadband, while about one quarter (26%) relied on smartphone-only access and 15% combined broadband with smartphone data. A small but important group (8%) reported no home internet service. Together, these results show that almost half of surveyed households lacked stable fixed broadband, which can limit consistent access to online learning and telehealth platforms.

Table 7. Home Internet Connection Type Among NTIA Respondents (n = 53)

S/No	Internet Connection Type	Percent	Number
1	High-speed broadband	27	51%
2	Smartphone/mobile data only	14	26%
3	Broadband + smartphone	8	15%
4	No internet access at home	4	8%
	Total	53	100%

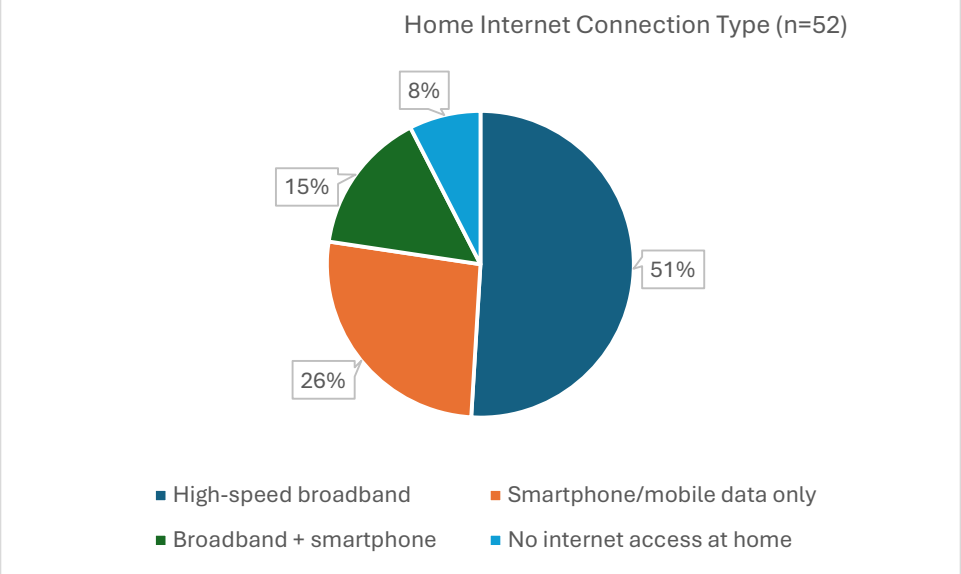

Table 7. Home Internet Connection Type Among NTIA Respondents (n = 53)

5.8 NTIA Connectivity and Telehealth Training Interest

Table 8 and Figure 8 show very strong interest in telehealth training: 45 of 52 respondents (87%) indicated that they would like to participate, and only seven respondents (13%) were not interested. This high level of demand suggests that once connectivity and device gaps are addressed, community members are ready to engage with guided instruction on how to use digital tools for health-related services.

Table 8. Interest in Telehealth Training Among NTIA Respondents (n = 52)

	Interest Level	Percent	Number
5	Interested	45	87%
6	Not interested	7	13%
	Total	52	100%

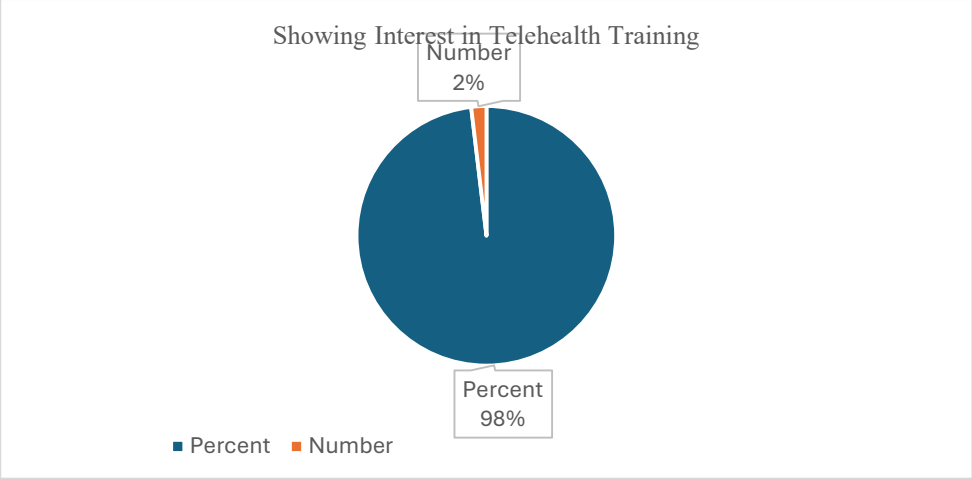

Figure 8. Interest in Telehealth Training Among NTIA Respondents (n = 52)

5.9 Student Use of Laptops for Academic Activities (n=164)

Survey responses indicate that students used the laptops extensively for coursework-related activities. Students reported using the devices to access learning management systems, submit assignments, communicate with instructors, conduct academic research, and complete online examinations.

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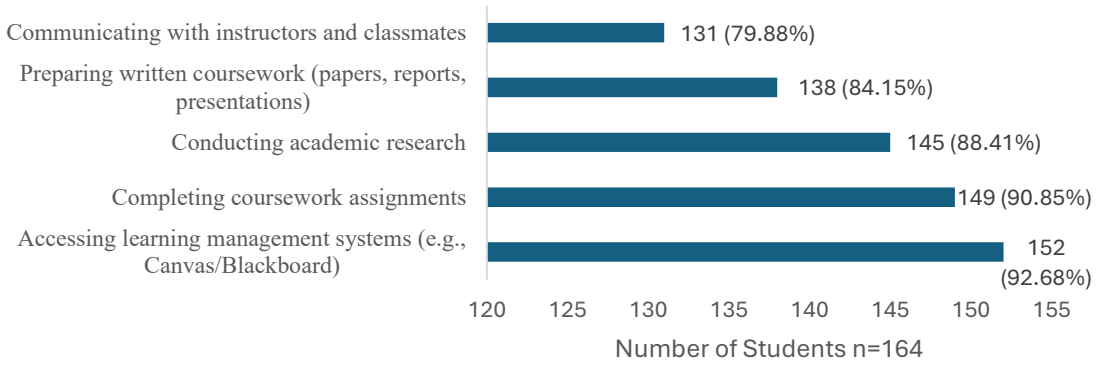

Figure 9: Student Utilization of Provided Laptops for Academic Activities

Across both survey cohorts, more than 95% of respondents reported that having a personal laptop was important for completing coursework tasks. Students indicated that access to a reliable computing device enabled them to more easily access course materials, complete assignments, and participate in online academic activities.

These findings suggest that device access played an important role in supporting student participation in technology-mediated learning environments.

5.10 Student-Reported Academic Impacts

In addition to reporting how they used the laptops, students also described how access to the devices influenced their academic experiences. Many respondents indicated that receiving a laptop improved their ability to complete assignments on time and increased their motivation to engage in academic activities.

Table 10: Student Perceptions of Laptop Access for Coursework Participation

S/No.	Response Category	Number of Respondents	Percent (%)
1	Improved coursework completion	156	95.12%
2	No change	5	3.05%
3	Unsure	3	1.83%
	Total respondents	164	100%

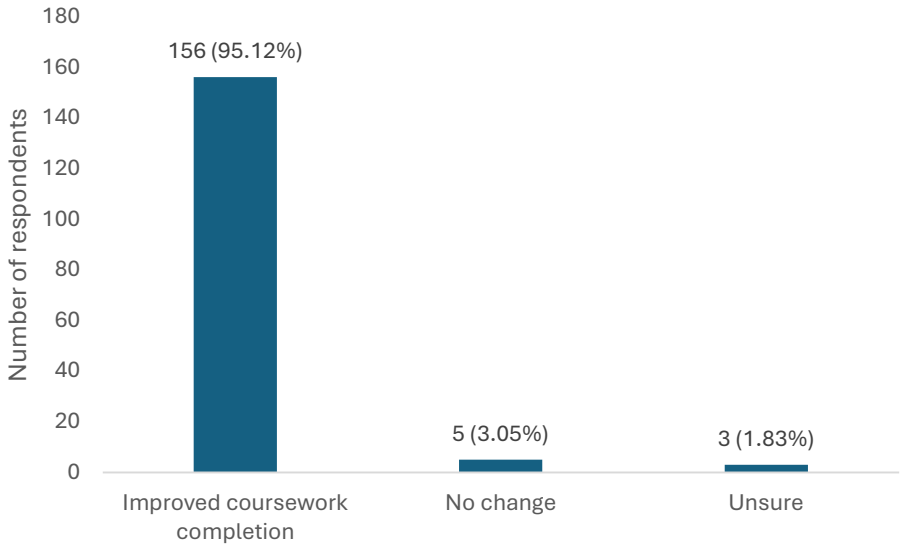

Figure 10: Student Perceptions of Laptop Access for Coursework Participation

Students reported several perceived academic benefits associated with laptops, which include (1) improved ability to complete coursework tasks (2) increased flexibility in managing assignments (3) enhanced research capabilities.

Some respondents also indicated that having a personal laptop helped them better organize their academic work and communicate more effectively with instructors and classmates.

5.11 Broadband Promotional Code Uptake

Table 11 and Figure 11 show that broadband incentives had very limited effect. Out of 151 promotional codes distributed, only two were redeemed, yielding a redemption rate of about 1.3%; 149 codes (98.7%) were not used. This near-zero uptake points to barriers beyond simple code availability, such as confusion about eligibility, low trust in providers, or competing financial priorities.

Table 11: Broadband Promotional Code Assessment (n = 151 codes)

S/No.	Indicator	Count	Percent (%)
1	Total promotional codes distributed	151	100%
2	Codes redeemed	2	1.32%
3	Codes not redeemed	149	98.68%

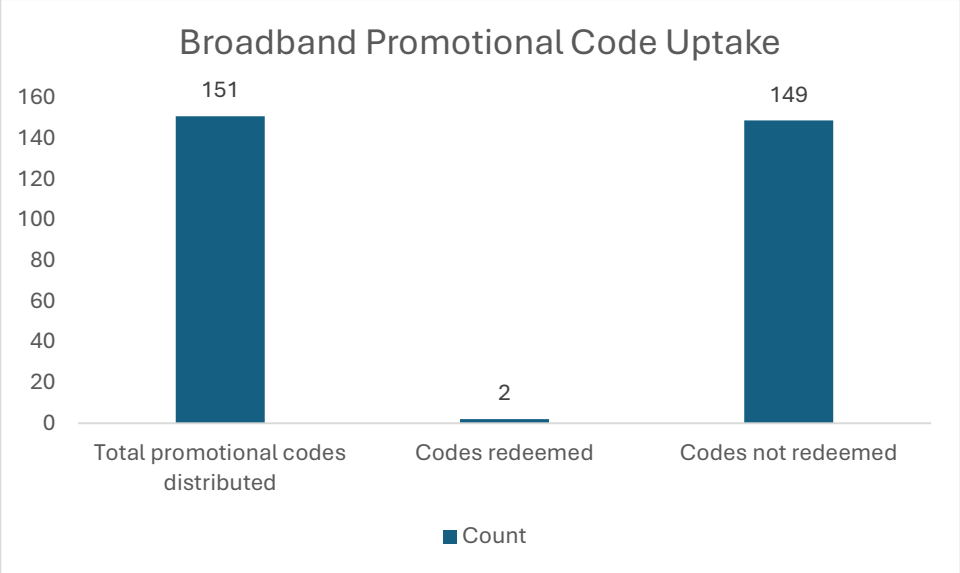

Figure 11. Broadband Promotional Code Uptake

5.12 Alignment of Findings with Research Questions

Table 5.7 shows that the META Zones initiative addressed all three research questions by improving student device access, supporting measurable gains in academic and digital skills, and strengthening pathways for workforce preparation. The alignment indicates that the program's components worked together to reduce digital barriers, although broadband affordability remains a significant constraint.

Table 12: Alignment of Findings with Research Questions (RQs)

S/No.	Research Question (RQ)	Summary of Data Findings
RQ1	Digital inclusion & access	Laptops improved device access; however, broadband inequities remain substantial.

RQ2	Academic & digital-skills outcomes	Students reported gains in digital literacy, research ability, and academic performance; laptops were essential for coursework and communication.
RQ3	Workforce development & capacity building	NPower data show high graduation and certification outcomes; laptop access supports job-seeking activities; But low broadband incentives uptake highlight structural barriers.

6. Discussion

The results show that access to a capable laptop had a direct influence on students' academic participation at HBCU. Table 2 and Figure 2 illustrate that laptop allocation reached 338 students across two distribution cycles. The near-complete distribution in Batch I and the lower early uptake in Batch II show that established campus engagement channels can shape program reach. Students in the survey (n = 70) consistently rated the laptop as essential for completing coursework and navigating academic tasks, with most reporting that the device supported online exams, research activities, and communication with instructors (Table 4; Figure 4). This level of agreement suggests that stable device access reduced disruption during academic work and strengthened students' ability to meet classroom expectations.

Skill-improvement findings also support this pattern. Table 3 shows that students reported progress in digital literacy, research ability, typing accuracy, and time management. When interpreted with Figure 3, these outcomes indicate that ownership of a personal device may help students practice digital tasks more consistently. Table 12 further shows that tasks rated as highly important align with the skills students said they improved, suggesting a logical relationship between device availability and academic readiness.

Community data also reveal continuing challenges that shape student learning environments. Broadband survey results show uneven home connectivity, including mobile-only access for a notable portion of respondents. This is consistent with the low redemption of broadband incentive codes (Table 11; Figure 11). These findings highlight affordability concerns and limited program awareness, which influence the stability of off-campus academic participation. Strong interest in digital and telehealth-related training suggests that when supports are accessible and trusted, community members are willing to adopt them.

Workforce-training metrics from the NPower cohorts strengthen these observations. Across groups, many participants completed training and earned certifications, showing that access to digital tools can support broader human-capital outcomes. When considered alongside student survey results, these findings indicate that digital support within academic institutions can also influence career-readiness pathways.

Overall, the combined evidence suggests that coordinated digital-inclusion efforts can reduce friction in academic work, support skill development, and expand institutional capacity to assist

surrounding communities. The patterns in the tables and figures confirm that device access, stable connectivity, and guided training each contributed to early gains in academic engagement and digital confidence.

7.0 Study Limitations

This assessment is constrained by several methodological data-related limitations. The student survey reached a 25% response rate (70 of 278 eligible students), which may limit the representativeness of reported academic and digital-skills improvements. Records of laptop distribution indicate uneven allocation across groups, with some cohorts receiving full deployment while others had limited attainment. This unevenness reduces the ability to build a standard for findings across HBCU populations. Broadband incentive data also showed low promotional-code redemption, but the study could not determine the reasons for this outcome because individual-level follow-up data were unavailable.

Qualitative insights were based on four small focus groups (n = 14), providing depth but limited breadth. The themes of this evaluation reflect experiences of volunteers and may not capture the full variation of student challenges. At the community level, NTIA connectivity data revealed persistent gaps, but these datasets were cross-sectional and did not have the channel for longitudinal tracking. Finally, as noted by reviewers, portions of the initial reporting style required refinement for clarity; some program elements (e.g., telehealth readiness, broadband decision-making) could not be examined in depth due to missing or incomplete indicators. Together, these constraints mean the findings should be interpreted as early, directional evidence rather than comprehensive impact estimates.

7.1 Conclusion

In this study, using a mixed-methods approach demonstrated that an integrated digital-inclusion model can meaningfully improve academic and digital readiness for students at HBCU. Students reported substantial gains in (typing proficiency, research skills, time management) or digital literacy and almost all respondents indicated that laptop devices were extensively beneficial in coursework experience, access to LMS, taking online exams, and general academic communication. The NTIA survey results showed that there are still structural inequities at the underserved community level, especially when it comes to relying only on mobile devices and having uneven access to broadband. However, the high interest in telehealth training and using laptops to receive digital health illustrates that there is a crucial need for capacity-building being delivered through trusted institutional channels.

The combination of device access, improved connectivity, and targeted skills training produced measurable benefits, while the low broadband-code redemption rate highlights ongoing affordability and trust barriers which requires a focused intervention. Collectively, these results position HBCU as an anchor institution for advancing regional digital equity in north central Maryland and US at large, (1) spanning academic readiness (2) digital-health

participation (3) provide a scalable framework for institutions seeking data-informed strategies to strengthen digital capacity across both campus and community contexts.

7.2 Recommendation

The results from this evaluation point to the need that strengthening digital inclusion at HBCUs requires a coordinated approach that goes beyond device access to encompass reliable broadband pathways in development of digital-skills and sustained community engagement. Institutions should invest in integrated support systems that simplify broadband enrollment, expand navigator-led outreach, and reinforce students' digital competency through targeted training embedded within academic programs. Given the clear dependence on laptops for (coursework, LMS access, online examinations) or academic communication, colleges should treat digital access as a core component of academic infrastructure and incorporate a routine monitoring of connectivity barriers that affect student performance. The high community interest in telehealth and digital-health training also points to an opportunity for institutions to broaden their role as regional digital-equity hubs by aligning campus resources with community-facing capacity-building efforts. Hence, through adopting these data driven strategies, HBCU as anchor institution, can create scalable, sustainable models with the capacity to enhance educational digital participation and reduce structural barriers for both students and surrounding underserved communities.

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