

The Impact of Technology Access on Digital Engagement and Success Among HBCU Students

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Abstract

Technology plays a critical role in shaping student engagement and academic success in higher education. However, disparities in access to reliable devices and digital resources continue to affect students at minority-serving institutions, particularly Historically Black Colleges and Universities (HBCUs). This study examines how technological access, with a specific focus on laptop usage, satisfaction with device performance, perceived academic importance, and skills development, influences digital engagement and success among HBCU students. Using a quantitative descriptive design, survey data were collected from 91 students who received laptops through an institutional technology initiative. Findings indicate high levels of daily laptop use, strong satisfaction with device performance, and overwhelming agreement regarding the importance of laptops for completing academic tasks. This study utilized a quantitative survey research design to examine students' access to technological devices and their perceived impact on academic performance. These results highlight the central role of technology access in supporting academic participation and skill development and underscore the need for sustained institutional strategies that promote digital equity and student success at HBCUs.

Keywords: technological access, digital engagement, academic success, HBCUs, digital equity

1. Introduction

Technology plays an increasingly critical role in shaping student learning, engagement, and academic success in higher education, particularly as digital platforms have become central to accessing course materials, completing assignments, collaborating with peers, and communicating with instructors [1], [2]. As institutions rely more heavily on technology, students are expected to use laptops as primary tools for academic participation. However, this growing dependence on technology has also revealed persistent disparities in access, usage, and digital participation, particularly among students attending minority-serving institutions such as Historically Black Colleges and Universities (HBCUs) [1], [2].

Although technology is essential for academic participation, not all students experience the same level of access or benefit from technological resources. Students may face challenges related to how often they can use their laptops, the performance of these devices, and the extent to which technology supports academic tasks. When access is consistent, students are more likely to remain engaged and organized in their academic work, while limited or inconsistent access can hinder participation and negatively affect academic performance [2], [3]. As coursework increasingly depends on digital platforms, these challenges can influence students' academic engagement, satisfaction, and skills development. Consequently, understanding students' experiences with laptop usage and their perceptions of technology is necessary for identifying gaps that may affect academic success.

Given these challenges, the purpose of this study is to examine how students use their laptops and how they perceive the role of technology in their academic lives. Specifically, the study focuses on the frequency of laptop usage, satisfaction with laptop performance, the perceived

importance of technological devices for academic performance, and the contribution of laptops to students' skills improvement.

To address this purpose, the study is guided by the following research questions:

RQ1. How frequently do students use their laptops for academic purposes?

RQ2. How satisfied are students with the performance of their laptops?

RQ3. How important do students perceive technological devices to be to their academic performance?

RQ4. How have laptops contributed to students' skills improvement?

By addressing these questions, this study contributes to a broader understanding of how technology functions in students' academic lives beyond basic access. The findings are expected to inform institutional decision-making related to technology support, device performance standards, and resource allocation, particularly within HBCU contexts.

2. Literature Review

2.1 The Digital Divide in Higher Education

The digital divide refers to unequal access to technological resources, including reliable devices, internet connectivity, affordability of digital tools, and the ability to effectively use technology for academic and professional purposes [1], [2]. In higher education, the digital divide extends beyond simple device ownership and includes the quality of access, consistency of internet availability, digital literacy, and students' ability to meaningfully participate in technology-mediated learning environments. As colleges and universities increasingly rely on learning management systems, virtual classrooms, online assessments, and digital communication platforms, technology access has become a foundational requirement for academic participation rather than a supplementary resource.

Digital engagement refers to students' active participation in academic activities through the use of technology, including accessing course materials, completing assignments, engaging in online discussions, conducting research, and communicating with faculty and peers. When students have consistent access to reliable technological devices, they are more likely to remain academically engaged, organized, and connected to institutional support systems [2], [3]. In contrast, limited access to devices or unstable internet connectivity can reduce participation, increase frustration, and negatively affect academic performance and persistence.

Within U.S. higher education, digital equity has become a critical issue because technology now shapes nearly every aspect of the student experience. From course registration to academic advising and online examinations, students are expected to maintain continuous digital access. Institutions that fail to address disparities in technological access risk reinforcing existing educational inequities, particularly among historically underserved student populations. This concern is especially significant for minority-serving institutions such as Historically Black Colleges and Universities (HBCUs), where students may experience greater financial barriers and structural inequalities that affect access to educational technology [1], [2].

2.2 Context and Structural Inequities HBCU

Historically Black Colleges and Universities (HBCUs) were established to provide educational opportunities for Black students who were excluded from predominantly White institutions (PWIs) due to systemic racism and segregation. Today, HBCUs continue to play a critical role in promoting educational access, upward mobility, and professional advancement for students from historically marginalized communities. Despite their significant contributions, many HBCUs continue to operate within longstanding structural inequities, particularly in institutional funding, campus infrastructure, and technological capacity.

Compared to PWIs, many HBCUs receive lower levels of public and private funding, which can affect the availability of campus technology resources, internet bandwidth, computer laboratories, and institutional support services [7], [8]. Limited financial resources may reduce institutions' ability to maintain updated learning management systems, expand virtual learning infrastructure, and provide students with reliable institutionally supported devices. These disparities create conditions where students may depend heavily on personal laptops or smartphones for academic participation, increasing vulnerability when technology access is inconsistent.

In addition to institutional limitations, many students attending HBCUs may face broader socioeconomic barriers that influence their access to technology, including financial constraints, unstable housing, and inconsistent internet access. These conditions may intensify the impact of the digital divide and make technology access a critical factor in student engagement and academic persistence. Understanding technology access within the HBCU context therefore requires attention to both institutional structures and student-level realities.

2.3 Technology Access and Digital Engagement

Technology access plays a central role in students' ability to engage in modern learning environments. Learning management systems (LMS) such as Blackboard Learn and Canvas are now essential platforms for instructional delivery, assignment submission, academic communication, and student collaboration. Students are expected to participate in online discussions, access virtual laboratories, complete hybrid and remote coursework, and take online examinations using digital platforms. As a result, reliable access to laptops and internet connectivity directly influences students' capacity to remain engaged in academic life.

Research suggests that students with consistent access to functional technological devices demonstrate stronger academic participation and are better able to manage coursework demands [4], [5]. Reliable laptop performance improves students' confidence in completing assignments, conducting academic research, and participating in virtual learning activities. Conversely, poor device performance, software incompatibility, and unstable internet access can create barriers to engagement, resulting in missed deadlines, reduced participation, and lower academic satisfaction.

Although smartphones and tablets increasingly support academic communication and access, laptops remain the most essential device for higher-order academic tasks such as writing research papers, completing projects, and participating in online examinations. For students attending institutions with limited on-campus technology infrastructure, access to a reliable personal laptop may significantly determine their level of academic participation and success.

2.4 Technology Access and Academic Success

Technology access is strongly associated with multiple indicators of academic success, including grade point average (GPA), retention, graduation rates, and persistence in academically demanding disciplines such as STEM. Students who experience consistent access to technological resources are more likely to complete assignments on time, maintain stronger communication with instructors, and remain connected to institutional support services, all of which contribute to academic persistence [3], [6].

Digital access also supports the development of critical academic and professional skills, including digital literacy, time management, research competence, and problem-solving abilities [4], [5]. These competencies extend beyond immediate coursework and contribute to long-term academic success and workforce readiness. Students who lack consistent access to reliable devices may experience reduced opportunities to develop these skills, creating long-term disadvantages that extend beyond graduation.

For HBCU students, the relationship between technology access and academic success may be particularly significant because institutional and personal resource limitations often intersect. Technology support initiatives, such as institutionally distributed laptop programs, may therefore serve as important equity interventions that improve both immediate academic participation and long-term student success outcomes.

2.5 Gaps in Existing Research

Although prior studies have established strong relationships between technology access, student engagement, and academic performance, fewer studies examine how students perceive the academic value of institutionally distributed laptops within HBCU environments. Existing research often focuses broadly on digital access or online learning outcomes without examining specific dimensions such as frequency of laptop usage, satisfaction with laptop performance, perceived importance for academic tasks, and the contribution of laptops to students' skills development.

Additionally, limited research explores these factors collectively from students' perspectives within a single institutional context. Understanding how students experience technology access beyond simple ownership is essential for evaluating whether institutional technology initiatives effectively support academic success and digital equity.

This study addresses this gap by examining undergraduate students' use of institutionally distributed laptops at an HBCU and exploring how laptop usage, satisfaction, perceived academic importance, and skills improvement collectively shape digital engagement and academic success. These findings provide practical insight into institutional decision-making related to technology support, resource allocation, and student success strategies.

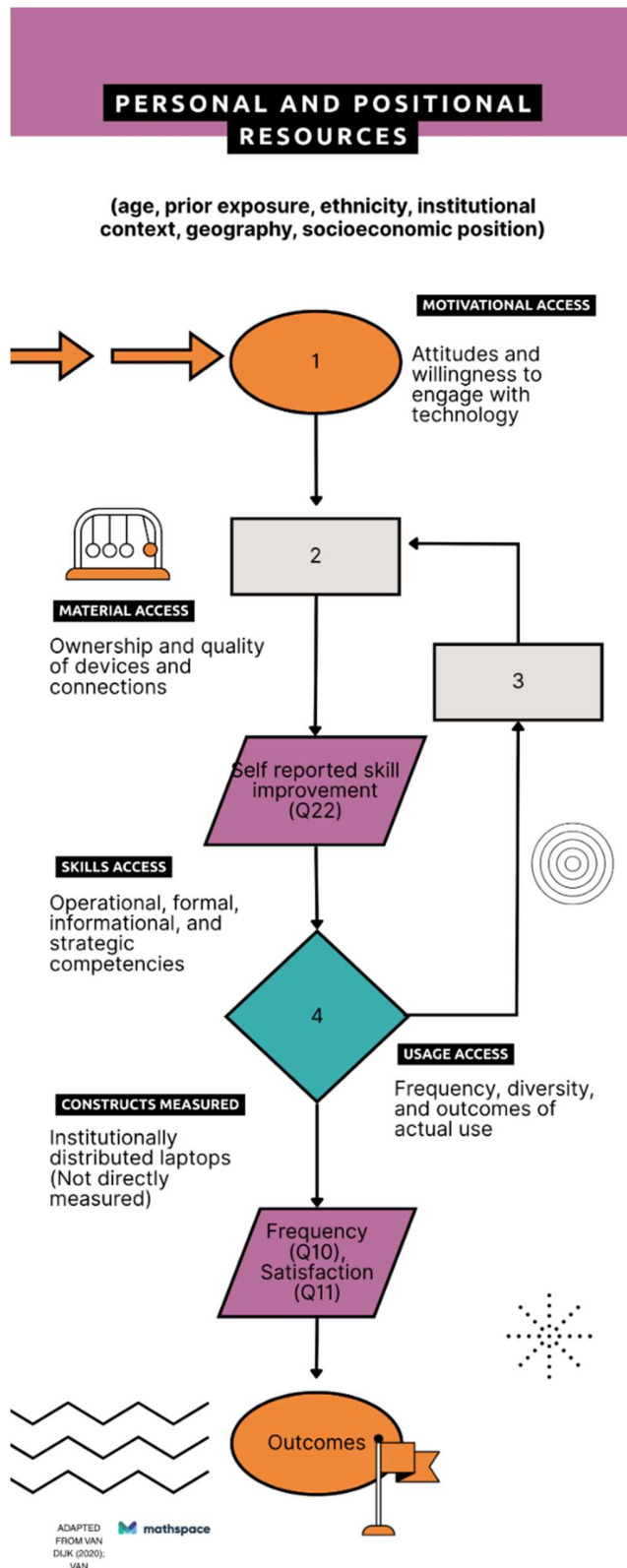


Fig. 1. Mapping of study constructs onto van Dijk's resources and appropriation theory.

3. Methodology

Guided by the focus of this study and the gaps identified in the literature, a quantitative descriptive research design was employed to examine students' laptop usage and perceptions of technology in relation to academic engagement, success, and skills development. A survey approach was used to capture students' experiences with laptop use, satisfaction with laptop performance, perceived importance of technological devices for academic tasks, and perceived skills improvement. This design was appropriate because the study was grounded in a technology access and digital equity framework and aimed to describe quantitative patterns in students' reported technology access, usage frequency, and perceived importance of laptops for academic engagement, task completion, and skills development, rather than to test causal relationships or interventions. The study focused on students attending an HBCU who received laptops through an institutional technology support initiative. A total of 91 students participated in the survey, all of whom were undergraduate students who received institutionally distributed laptops through a campus-based technology access initiative. Demographic details, including academic classification at the time of laptop receipt and expected graduation date, were collected using a structured online survey to characterize the study sample. Additional background information related to device ownership, internet availability, and patterns of laptop usage was also gathered to provide contextual insight into students' technology access and engagement in relation to the study objectives.

Although the sample included 91 participants, this group represents a meaningful proportion of students who received institutionally distributed laptops during the implementation period. Because the study employed a descriptive rather than predictive design, the sample size was adequate for identifying clear patterns of usage and student perceptions within the targeted cohort.

While the investigation centered specifically on institutionally distributed laptops, it is important to recognize that students may also engage with academic content through smartphones, tablets, or shared desktop computers. These additional forms of technology were not measured in the current survey and therefore constitute an important area for future research.

3.1. Data source

Data were collected using a structured survey instrument designed to align directly with the study's research questions. The survey included multiple-choice and Likert-scale items that examined students' access to technology, patterns of laptop usage, satisfaction with laptop performance, and perceptions of the importance of laptops for completing academic tasks. For example, students were asked how often they used their laptops over the past 30 days, how satisfied they were with their laptops' performance, and how important laptops were for activities such as completing coursework, submitting assignments, conducting research, collaborating on coursework, taking online exams, and communicating with instructors. Additional items asked students to identify skills they believed had improved since using the laptop, including digital literacy, research abilities, time management, and course performance.

3.2. Characteristics of the Study Sample

Most respondents reported receiving their laptops in Fall 2025 (90.43%), while smaller proportions received laptops in Spring 2025 (6.38%) and Fall 2024 (3.19%), indicating that most

participants were relatively recent recipients of the devices. At the time they received their laptops, most participants were freshmen (78.72%), followed by juniors (10.64%), sophomores (7.45%), and seniors (3.19%). In addition, most respondents reported an expected graduation date of May 2028 (68.09%), suggesting that the sample largely consisted of students in the early stages of their academic programs.

3.3. Data extraction and Analysis

The survey was administered electronically using Google Forms, an online survey platform that facilitated the collection of structured, closed-ended responses for quantitative analysis. This method supported accessibility and efficiency while aligning with the technology-centered focus of the study. Participation was voluntary, and responses were collected anonymously to encourage honest reporting. No identifying information was included in the analysis.

Following data collection, survey responses were analyzed using descriptive statistical techniques. Frequency counts and percentages were calculated for each survey item to summarize students' responses. For instance, analysis of laptop usage frequency showed that most respondents reported using their laptops every day (80.22%), while smaller percentages reported using them often (14.29%) or sometimes (4.40%). Similarly, descriptive statistics were used to summarize students' satisfaction with laptop performance and their perceptions of the importance of laptops for academic tasks. This approach was appropriate because the purpose of the study was to provide an overview of students' experiences and perceptions rather than to make inferential claims or predictions.

Ethical considerations were addressed throughout the research process. Participation was voluntary, and students were informed of the purpose of the study prior to completing the survey. Confidentiality was maintained, and data were used solely for research and evaluation purposes. By adhering to these ethical principles, the study ensured that participants' experiences were respected and responsibly represented.

Overall, the methodological approach provided a clear and systematic framework for examining students' laptop usage and perceptions of technology. The use of a descriptive survey design allowed the study to capture meaningful patterns in students' responses, which are presented and interpreted in the following chapter in relation to the research questions.

4. Results

4.1. Frequency of the Impact of Technological Devices on Academic Performance

Fig. II. illustrates students' perceptions of how frequently technological devices influence key academic activities, including course completion, course submission, collaboration, research conduction, online examination administration, email management, and access to the virtual learning environment (VCL). The distribution of responses reflects varying levels of perceived importance, ranging from *very important* to *not important*.

Across all academic functions, most respondents rated technological devices as *very important*. Course completion and course submission recorded the highest frequencies within this category, indicating that students rely heavily on technological devices to meet academic deadlines and successfully complete required coursework. This finding suggests that access to technology is closely tied to students' ability to fulfill core academic responsibilities.

Similarly, strong concentrations in the *very important* category were observed for research conduction, online examination administration, and VCL access. These results underscore the growing dependence on digital tools for instructional delivery, assessment, and scholarly engagement. The high frequency of responses in these areas indicates that technological devices are essential for students to participate fully in academic activities that extend beyond traditional classroom instruction.

In contrast, relatively few respondents selected *slightly important* or *not important* across the measured categories. These lower frequencies suggest that technological devices are not perceived as optional or supplementary resources but rather as integral components of students' academic experiences. Email management and course collaboration, while slightly lower than course completion and submission, still demonstrated strong reliance on technological access, reinforcing the role of technology in facilitating communication and peer engagement.

Overall, the pattern observed in Fig. II highlights the central role of technological devices in supporting academic performance. The dominance of the *very important* category across all academic functions indicates that consistent access to technology is critical for effective academic engagement. Consequently, students who experience limited or inconsistent access to technological devices may face challenges in completing coursework, engaging in research, and participating in online academic activities, which may ultimately affect their academic success.

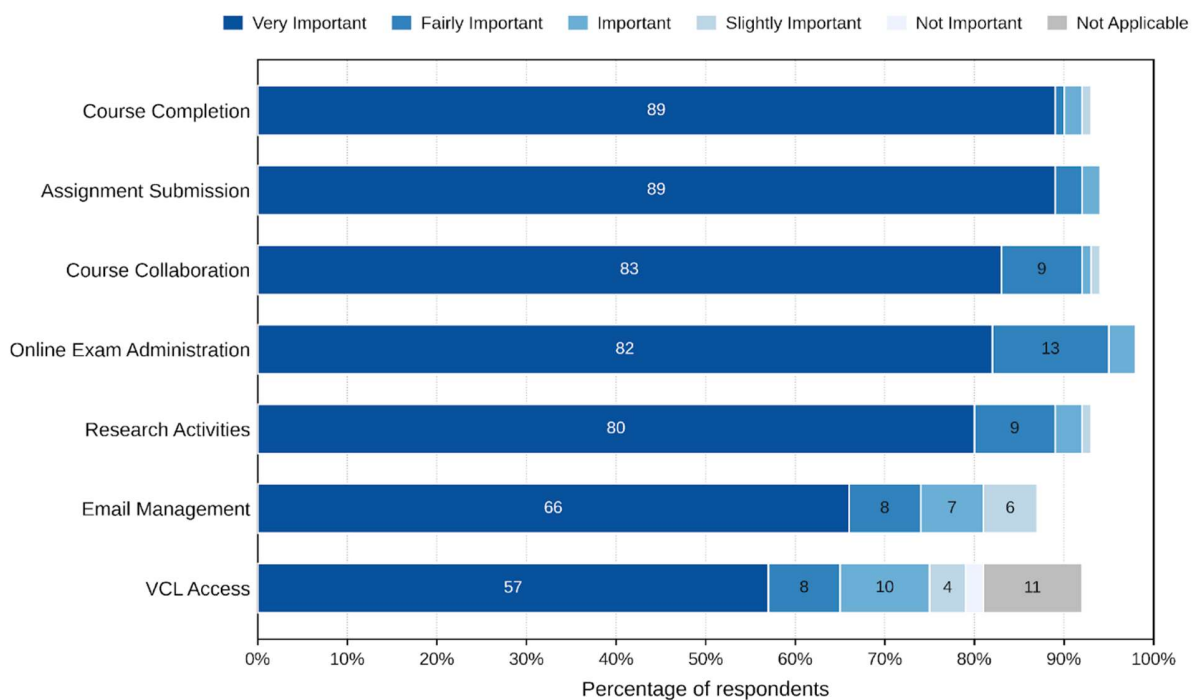


Fig. II. Frequency of the Impact of Technological Devices on Academic Performances

To further examine whether these perceptions differ significantly across academic functions, inferential analyses were conducted and are presented in the subsequent section.

4.2. Statistical Analysis of Survey Data

Chi-Squared Test Results and Interpretation

Chi-squared goodness-of-fit tests were performed on each question to test the null hypothesis that responses are uniformly distributed across all response categories. The test statistics are calculated as:

$$\chi^2 = \sum [(Observed - Expected)^2 / Expected]$$

Effect Size

Cramér's V was calculated as a measure of effect size, with interpretation guidelines: $V < 0.3$ = small effect, $0.3 \leq V < 0.5$ = medium effect, $V \geq 0.5$ = large effect.

Confidence Intervals

Wilson score intervals (95% confidence level) were calculated for modal response proportions to provide precision estimates.

Results indicate consistently high levels of laptop usage among participants. Most respondents reported using their laptops every day (80.2%), with an additional 14.3% reporting frequent use. A chi-square test confirmed that usage responses were not evenly distributed, $\chi^2(4, N = 91) = 212.02$, $p < .001$, $V = 0.76$, indicating strong concentration of daily use.

Table 1 illustrates this pattern, highlighting sustained digital engagement among students.

Satisfaction with laptop performance was overwhelmingly positive. Most respondents reported being very satisfied (60.4%) or satisfied (34.1%). Responses differed significantly from a uniform distribution, $\chi^2(4, N = 91) = 128.62$, $p < .001$, $V = 0.59$, suggesting that the laptops met students' academic needs.

Across academic task categories, including completing coursework, submitting assignments, conducting research, collaborating on coursework, and taking online exams, participants consistently rated laptops as very important. Chi-square analyses across these items revealed strong consensus, with large effect sizes ($V = 0.56\text{--}0.97$), indicating that laptops were viewed as essential rather than optional academic tools.

Participants also reported improvements across multiple skill areas since using the laptops, including digital literacy, typing accuracy, time management, research abilities, and course performance. Responses were more evenly distributed across skills, $\chi^2(5, N = 284) = 53.69$, $p < .001$, $V = 0.19$, suggesting broad-based skill development rather than improvement in a single domain.

Table 1. Summary of the Statistical Tests highlighting sustained digital engagement among students.

Summary of Statistical Tests

Question	N	χ^2	df	p-value	Cramér's V	Modal Response %
Q10	91	212.02	4	< .001	0.763	80.2%
Q11	91	128.62	4	< .001	0.594	60.4%
Q12	91	431.40	5	< .001	0.974	97.8%
Q13	91	431.40	5	< .001	0.974	97.8%
Q15	91	370.67	5	< .001	0.908	92.2%
Q16	91	326.16	5	< .001	0.847	86.8%
Q17	91	356.63	5	< .001	0.885	90.1%
Q19	91	211.31	5	< .001	0.681	72.5%
Q20	91	142.87	5	< .001	0.560	62.6%
Q22	284	53.69	5	< .001	0.194	21.1%

The larger sample size (N = 284) reflects the multiple-response format of this survey item, where participants were allowed to select more than one skill they believed had improved since receiving the laptop. This indicates that laptop access supported broad-based academic and professional skill development rather than improvement in a single isolated domain.

5. Discussion

The findings demonstrate that laptops play a central role in students' academic engagement and success. High levels of daily usage and strong satisfaction with device performance indicate that access to reliable technology supports consistent participation in digitally mediated learning environments. These results align with digital divide theory, which emphasizes that meaningful access includes both availability and effective use [2].

Students' overwhelming agreement regarding the importance of laptops for academic tasks further highlights the extent to which technology has become embedded in higher education. Laptops function not merely as supportive tools but as essential resources for completing coursework, conducting research, and communicating within academic settings.

The reported improvements across multiple skill areas suggest that laptop access contributes to broader academic and professional skill development. Rather than concentrating benefits in a single area, students experienced gains through digital literacy, time management, and research skills, supporting the role of technology in holistic student development.

6. Limitations and Future Research

This study is subject to several limitations that should be considered when interpreting the findings. One primary limitation concerns the sample size of 91 participants drawn from a single historically Black college or university (HBCU). Although the results demonstrated statistically significant and consistent response patterns, the findings should be understood as institution-specific rather than broadly generalizable to all higher education contexts. Because the data were collected from undergraduate students within one institutional setting, variations in institutional characteristics, resource availability, and student demographics may influence technology access and learning experiences differently across campuses. Prior research indicates that such contextual factors can significantly shape patterns of technology use and academic engagement, suggesting that outcomes may vary in other higher education environments [7], [8]. Future research should therefore replicate this study across multiple HBCUs and larger student populations to generate broader comparative insights and more representative estimates of student technology perceptions.

Second, the study relied on self-reported survey responses, which may be influenced by individual perceptions or response bias. While self-reported data are commonly used in educational research to capture students' experiences and perceptions, they may not fully reflect objective measures of academic performance or engagement. Third, cross-sectional design captures students' experiences at a single point in time and does not allow for examination of changes in technology use, academic engagement, or skill development as students' progress through their academic programs. Another limitation relates to the relatively small sample size of 91 participants, which may restrict the representativeness of the findings across the broader HBCU student population. Although descriptive statistics revealed strong patterns of laptop usage and perceived academic importance, a larger multi-institutional sample would provide more stable estimates and improve the generalizability of results.

Given these limitations, future research should expand data collection across multiple cohorts and institutions to obtain more comprehensive and average student feedback regarding the academic usefulness of laptops and adopt longitudinal designs to examine how technological access influences academic engagement, skill development, and student success over time. Longitudinal approaches would allow researchers to better understand how sustained access to technology supports learning trajectories and academic persistence. Additionally, future studies could explore how technology access interacts with other institutional support structures, such as academic advising, tutoring services, and faculty support, to better understand the combined impact of these factors on student outcomes. Expanding this line of inquiry to include multiple institutional contexts would further strengthen the evidence base and enhance the applicability of findings across higher education environments.

7. Conclusion

This study examined undergraduate students' access to institutionally distributed laptops and their perceived importance for academic engagement, task completion, and skills development within an HBCU context. The findings demonstrate that laptops play a central role in supporting students' ability to complete coursework, conduct research, communicate with instructors, participate in virtual learning environments, and develop essential academic and professional skills. High levels of daily laptop usage, strong satisfaction with device performance, and overwhelming agreement regarding the academic importance of laptops indicate that technology access is not merely supportive, but foundational to student success in contemporary higher education [1], [2], [7].

The results further show that technology access contributes to broader academic development, beyond course completion alone. Students reported improvements in digital literacy, research competence, time management, and overall academic performance, suggesting that institutionally distributed laptops serve as important tools for both immediate academic engagement and long-term student development [4], [5]. These findings are particularly significant within HBCU environments, where structural inequities, funding disparities, and infrastructure limitations may intensify the consequences of limited technology access [7], [8].

By grounding this study in digital divide theory and examining students' lived experiences with institutionally supported technology, this research contributes to the growing conversation on digital equity in higher education. The findings suggest that institutional investments in laptop distribution programs should be viewed as equity-centered student success interventions rather than optional support services. Universities must continue to prioritize reliable technological access as part of broader efforts to improve retention, persistence, and academic achievement among historically underserved student populations [2], [3], [8].

Although this study is limited to one institutional context and a relatively small sample size, it provides a foundation for future multi-institutional and longitudinal research examining how sustained technology access influences graduation outcomes, retention patterns, and workforce readiness across diverse student populations. Future studies should also explore how technology access interacts with advising, tutoring, faculty engagement, and other institutional support systems to shape student success outcomes.

Access to reliable technology should no longer be viewed as a supplemental student service, but rather as a foundational component of academic equity, persistence, and institutional success in higher education, particularly within HBCU environments.

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