# Digital Access Models for Closing the Digital Equity Gap, Improving Academic Performance Among Underserved Students.

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# Digital Access Models for Closing the Digital Equity Gap and Improving Academic Performance Among Underserved Students.

Abstract

In a world where academic success increasingly depends on digital fluency, access to technology has become a new form of literacy and a defining measure of educational opportunity. Yet, many underserved students in an urban higher education context, remain disconnected from the digital tools essential for learning, creating a persistent equity gap. Guided by Kabeer's Empowerment Framework (1999), which links resources (access), agency (confidence and use), and achievements (academic performance), this study investigates how equitable laptop access and broadband connectivity influence students' learning outcomes, engagement, and digital self-efficacy. Two guiding research questions structure the study: (1) What is the impact of digital access on academic outcomes and equity gaps among students in Underserved Cities? and (2) What barriers and supports influence students' ability to use laptops effectively for academic learning and engagement? In the current paper, focus group data from undergraduate students are used to examine student-reported experiences of laptop access, academic engagement, digital confidence, and barriers to effective use. Survey and institutional datasets are part of the broader mixed-methods study and will support subsequent quantitative analysis. Thematic analysis and a convergent mixed-methods design will synthesize qualitative findings to explain observed patterns. This study reports preliminary qualitative findings from focus group discussions with undergraduate students at an HBCU who received laptops through a non-profit-supported digital access initiative. While the broader study is designed as a convergent mixed-methods project, the current paper emphasizes student-reported experiences of access, academic engagement, digital confidence, and barriers to effective laptop use. Ultimately, this study positions digital access not as a technological intervention but as a transformative strategy for academic empowerment and inclusive success.

**Keywords:** Digital Equity, Laptop Access, Academic Performance, Empowerment Framework, Underserved Students.

## 1. Introduction

In the continually advancing sphere of academic instruction, digital technologies now mediate nearly every dimension of the educational experience in higher education, including access to instructional content, submission of coursework, assessment, communication, and participation in learning communities [1]. Learning management systems, virtual classrooms, cloud-based collaboration tools, and digital libraries have transitioned from supplemental resources to core instructional infrastructure, fundamentally reshaping how students engage with academic environments [2]. As a result, the ability to consistently access and use digital tools has become a prerequisite for meaningful academic participation rather than a discretionary advantage [3].

Despite this transformation, access to essential digital resources remains unevenly distributed, producing persistent and widening digital equity gaps that disproportionately affect students in underserved urban contexts [4]. National data indicate that students from low-income households and historically marginalized communities are significantly more likely to experience device instability, limited broadband access, or reliance on shared or mobile-only technologies for academic work [5]. These structural disparities constrain students' ability to meet course

requirements, participate fully in digital learning activities, and sustain academic engagement, thereby reinforcing pre-existing educational inequities [6].

Recent analyses from the U.S. Census Bureau highlight pronounced geographic and socioeconomic variation in household computer ownership and broadband adoption, with urban communities facing intersecting challenges related to affordability, housing instability, and infrastructure limitations [7]. For students in these contexts, the absence of reliable access to a functional laptop often results in delayed assignment submission, reduced engagement with learning management systems, limited participation in virtual instruction, and heightened academic stress [8]. Consequently, digital access has emerged not merely as a technological concern but as a structural determinant of educational opportunity and academic success [9].

In response, higher education institutions have increasingly implemented digital access models, including laptop distribution initiatives and subsidized connectivity programs, aimed at mitigating technology-related barriers to learning [10]. These initiatives are particularly prevalent at minority-serving institutions and Historically Black Colleges and Universities (HBCUs), where institutional missions often emphasize equity, access, and student success [11]. Preliminary institutional reports and student feedback consistently suggest that receipt of a personal laptop improves students' ability to organize coursework, access instructional platforms, and engage more consistently with digital academic requirements [12].

However, despite the expansion of these initiatives, the empirical literature remains limited in rigorously evaluating how digital access, independent of formal digital training interventions, translates into observable academic outcomes [13]. Much of the existing research focuses on digital literacy development, instructional technology integration, or emergency remote learning contexts, leaving a gap in understanding the specific role of sustained device access in shaping academic performance and equity outcomes in higher education [14].

This study addresses this gap by examining digital access as an educational intervention in its own right, focusing on equitable laptop provision within an underserved urban institutional context. Grounded in Kabeer's Empowerment Framework, the study conceptualizes digital access as a critical resource that enables student agency and facilitates academic achievement [15]. By empirically linking access conditions to engagement, confidence, and performance outcomes, the study seeks to advance a more precise understanding of how digital access models function as mechanisms of academic empowerment rather than ancillary technological supports [16].

## 2. Literature Review

In current times, existing scholarship increasingly recognizes digital access as a structural factor shaping academic participation and outcomes in higher education [17]. Research across education and equity studies demonstrates that disparities in device availability and connectivity disproportionately affect students in underserved contexts, reinforcing academic and institutional inequities [18]. Recent work has shifted from binary notions of the digital divide toward a digital equity framework that emphasizes the quality, consistency, and outcomes of access [19]. However, empirical evidence isolating the academic impact of sustained device access, particularly within underserved higher education settings, remains limited [20]. This review synthesizes prior research to situate digital access as a critical mechanism influencing engagement, agency, and academic success [21].

## 2.1 Digital Access and Educational Inequality

Digital access has become a core structural factor shaping educational inequality in higher education [22]. As instruction, assessment, and academic communication increasingly rely on digital platforms, students without consistent access to personal laptops and reliable broadband face systematic disadvantages in completing coursework, engaging with instructors, and participating in collaborative learning activities [23]. Empirical evidence consistently shows that device scarcity and unstable connectivity are associated with lower academic engagement, reduced persistence, and poorer educational outcomes [24].

National and institutional datasets further indicate that disparities in device ownership and broadband adoption closely track socioeconomic status, race, and geographic location, with pronounced effects in underserved urban communities [25]. Students in these contexts frequently depend on shared devices, limited-access campus facilities, or mobile phones, which are insufficient for sustained academic tasks such as writing, data analysis, and virtual collaboration [26]. These access constraints directly shape the quality, timing, and effectiveness of students' academic participation [27].

Beyond logistical limitations, limited digital access is linked to heightened academic stress, reduced digital confidence, and diminished sense of belonging in digitally mediated learning environments [28]. As such, digital access functions not merely as a technical issue, but as a structural condition influencing both academic performance and broader educational experience [29].

## 2.2 From the Digital Divide to Digital Equity

Early digital divide research framed access in binary terms, emphasizing whether individuals possessed internet connectivity [30]. While useful for identifying initial disparities, this approach failed to account for variation in access quality, device reliability, and sustained usability, all of which shape educational outcomes [31]. Consequently, contemporary scholarship has advanced a digital equity framework that integrates access conditions, patterns of use, and outcome disparities [32].

Within this framework, consistent access to personal computing devices is recognized as a foundational requirement for meaningful engagement in digital learning environments, though insufficient on its own to guarantee success [33]. Studies of one-to-one laptop initiatives and institutional access programs demonstrate that sustained device access is associated with improved organization, higher engagement, and greater academic persistence, particularly in blended and online settings [34]. These findings underscore access as enabling infrastructure upon which instructional and pedagogical processes depend [35].

At the same time, the literature cautions against assuming automatic benefits, emphasizing that access outcomes are mediated by institutional practices, academic expectations, and student contexts [36]. This perspective highlights the importance of examining how access is experienced and operationalized, rather than merely whether devices are distributed [37].

### 2.3 Digital Access as an Empowerment Resource

This study draws on Kabeer's Empowerment Framework to conceptualize digital access as a resource that enables agency and achievement in higher education [38]. In this framework, empowerment is understood as the process through which individuals gain the capacity to make meaningful choices in contexts where such capacity was previously constrained [39]. Empowerment emerges through the interaction of resources, agency, and achievements.

In educational contexts, access to functional laptops and reliable connectivity constitutes a critical resource that enables students to exercise autonomy and control over their academic work [40]. Empirical studies show that students with stable device access report higher digital self-efficacy, greater independence in managing coursework, and increased confidence engaging with learning management systems and virtual instruction [41]. These expressions of agency are consistently associated with improved academic outcomes, including higher grades, increased course completion, and sustained engagement [42].

By situating digital access within an empowerment framework, this study moves beyond instrumental views of technology provision and instead examines access as a mechanism through which structural constraints are reduced and academic opportunity is expanded for underserved students [43].

## 3. Theoretical Framework

Grounded in Kabeer's Empowerment Framework, propounded in 1999**,** this framework conceptualizes empowerment as a process through which individuals gain the capacity to make meaningful and strategic choices in contexts where such capacity was previously constrained [44]. The framework is structured around three interrelated components: resources, agency, and achievements, and provides a robust lens for examining how structural conditions shape opportunity, participation, and outcomes within educational systems [45]. In this study, Kabeer's framework is applied to analyze digital access as an empowerment mechanism within underserved higher education contexts.

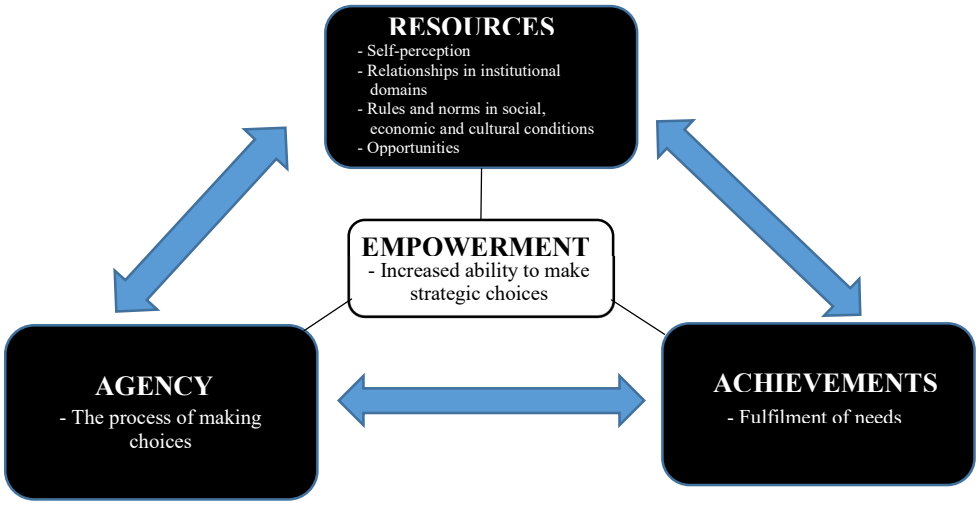


Figure 1: Theoretical Framework Flowchart.

Within the context of this research, Resources refer to the material, institutional, and social conditions that enable or restrict participation. In digitally mediated academic environments, access to a functional laptop and reliable broadband connectivity constitutes a foundational academic resource [46]. For underserved students, the absence of consistent device access represents a structural constraint that limits engagement with instructional platforms, increases academic friction, and reinforces existing inequities [47]. By conceptualizing laptops and connectivity as empowerment resources, this study positions digital access as a necessary condition for equitable participation rather than a supplementary technological convenience.

Agency denotes the ability to define goals and act upon them. In the context of this study, agency is operationalized through students' digital self-efficacy, autonomy, and effective use of laptops for academic purposes [48]. Consistent access to a personal device enables students to independently manage coursework, engage with learning management systems, participate in virtual learning activities, and meet digital academic expectations without reliance on shared or inadequate technologies [49]. Agency is reflected in students' confidence navigating digital platforms, consistency in academic behaviors, and capacity to exercise control over their learning processes [50].

Achievements represent the realized outcomes that emerge when resources are successfully converted into agency. In this study, achievements are reflected in academic performance and engagement indicators, including course completion, LMS activity, attendance patterns, and overall academic persistence [51]. These outcomes provide observable evidence of whether digital access contributes to closing equity gaps and improving academic success among underserved students [52].

By mapping digital access models onto Kabeer's Empowerment Framework, this study provides a theoretically coherent structure for examining how access conditions influence students' ability to participate fully in digital learning environments and achieve academic success. The framework directly informs the study's research questions, measurement strategy, and interpretation of findings, ensuring that digital access is analyzed not only as an infrastructural intervention but as a mechanism of educational empowerment and equity advancement [53].

## 4. Research Questions

The core question guiding this research is, "How does digital access influence academic outcomes and equity gaps among students in underserved urban contexts?" Building on this guiding inquiry, the study further examines the conditions under which access translates into meaningful academic engagement by addressing two interrelated questions that explore the barriers and supports shaping students' effective use of laptops for learning.

1. What is the impact of digital access on academic outcomes and equity gaps among students in underserved cities?
2. What barriers and supports influence students' ability to use laptops effectively for academic learning and engagement?

Together, these questions enable an examination of how access to digital resources functions not only as a condition for participation but as a mechanism through which academic opportunity and equity may be expanded within digitally mediated higher education environments.

## 5. Research Methodology

This study is designed as a convergent mixed-methods investigation examining how digital access influences academic outcomes and equity among students in underserved urban higher education contexts. While the broader study integrates quantitative and qualitative data, the methodological design is explicitly aligned with Kabeer's Empowerment Framework, operationalizing:

1. Resources such as a laptop and broadband access,
2. Agency as digital confidence, autonomy, and usage behaviors,
3. Achievements as academic performance and engagement outcomes.

### 5.1 Study Context and Participants

The study was conducted at a Historically Black College and University (HBCU) located in an underserved urban setting, where digital learning platforms are integral to instructional delivery, assessment, and student engagement. As part of a digital access initiative supported by a non-profit organization, institutionally managed laptops were distributed to eligible undergraduate students identified as experiencing financial constraints, device instability, or limited access to reliable computing resources. This context provides a focused setting for examining digital access as a structural condition shaping students' ability to participate in digitally mediated academic environments.

### 5.2 Participants

The Participants included undergraduate students (n = 14) enrolled at a Historically Black College and University (HBCU) who received institutionally provided laptops through a non-profit-supported digital access initiative. The sample represented students across multiple academic disciplines, varied living arrangements, and differing prior access conditions, including reliance on shared devices or mobile-only technology.

1. Undergraduate students enrolled at a Historically Black College and University (HBCU) participating in a digital access initiative supported by a non-profit organization.
2. Students drawn from multiple academic disciplines, including STEM, health sciences, business, and liberal arts programs.
3. Both commuter and residential students, representing varied living arrangements and technology access conditions.
4. Students identified as experiencing prior digital access challenges, including device instability, shared-device reliance, or dependence on mobile phones for academic work.
5. A purposive subset of participants (n = 14) who took part in focus group discussions conducted in November 2024, providing in-depth qualitative insight into access-related academic experiences.

Table 1: Qualitative Focus Group Participant Breakdown

| Session ID | Date | Participants (n) | Key Characteristics & Major Representation | Participant Identifying Codes |
|---|---|---|---|---|
| FG-1 | Nov 13 | 2 | Graduate/Undergrad mix; focus on storage and hard drive capacity for heavy uploads. | Speaker 3, Speaker 4 |
| FG-2 | Nov 13 | 5 | Commuter students: focus on software compatibility and "LockDown Browser" requirements for exams. | A.D., J.D., S.W., J.G., Rama. |
| FG-3 | Nov 15 | 3 | STEM/Design focus; students using high-memory programming downloads and Adobe Creative Suite. | Gladys, K.N., A.R. |
| FG-4 | Nov 15 | 4 | Mixed majors; focus on "mobile-only" students transitioning to laptop ownership for online classes. | F.T., M.W., A.D., Q.E. |
| Total | | 14 | High Satisfaction Rate reported across all groups. | |

This table tracks the 14 participants across the four sessions, including their specific needs and majors as identified in the transcripts.

### 5.3 Data Collection Method

This paper reports preliminary qualitative findings from semi-structured focus group discussions with undergraduate students who received laptops through a non-profit-supported digital access initiative. While the broader study is designed as a convergent mixed-methods investigation, the present analysis focuses on student-reported experiences of laptop access, academic engagement, digital confidence, and barriers to effective use.

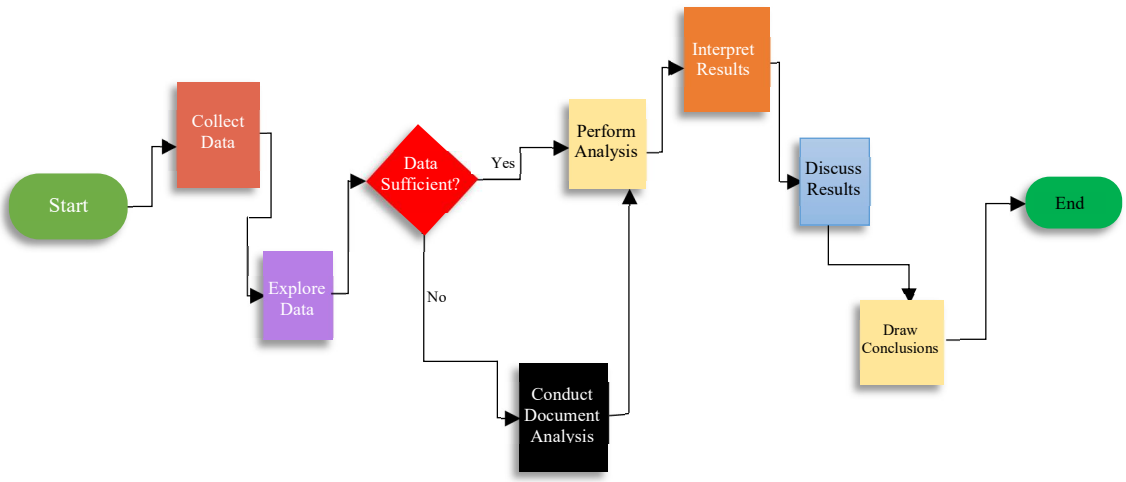


Figure 2: Step-by-Step Research Data Guide (adapted from Dr. Caroline K Marete et al)

Primary quantitative data were collected through a structured student survey administered to undergraduate students at an HBCU who received institutionally provided laptops. The survey assessed access conditions, digital confidence and usage behaviors, and academic engagement, using a combination of Likert-scale items, multiple-choice questions, and open-ended responses. Survey data were reviewed for completeness, with partially completed responses retained where core variables were present.
To measure academic outcomes, institutional datasets were collected and linked to survey responses using anonymized identifiers. These datasets included course completion records, academic performance indicators, attendance patterns, and Learning Management System (LMS) engagement metrics. These measures provided objective indicators of achievement and engagement associated with consistent laptop access.

Qualitative data were gathered through semi-structured focus groups and interviews with students to explore barriers and supports influencing effective laptop use. These discussions provided explanatory depth by capturing students' experiences integrating laptops into their academic routines and navigating digital learning demands. Where additional contextual insight was required, a targeted document analysis was conducted using institutional program materials and digital access initiative reports produced in collaboration with a non-profit organization. Document analysis supported triangulation by clarifying implementation structures and access-related supports not directly observable through surveys or interviews.
Data collection followed an iterative process, as illustrated in Figure 2. with initial exploration informing assessments of data sufficiency and guiding deeper qualitative inquiry where necessary. Integration across data sources enabled a robust examination of digital access as an empowerment mechanism shaping academic engagement and outcomes.

## 6. Results and Findings

The results of this study are derived from a convergent mixed-methods analysis that sought to triangulate institutional data with student-reported experiences. Following the precedent set by award-winning engineering education research [54], this section characterizes the transformation of the student learning environment following the distribution of high-performance laptops. The data are organized to directly address the two primary research questions through the application of Kabeer's Empowerment Framework, focusing on the progression from resource acquisition to the realization of academic achievement.

**Research Question 1:** What is the impact of digital access on academic outcomes and equity gaps among students in underserved cities?

This study examined the impact of transitioning from shared or inadequate hardware to personal laptop ownership on academic performance and the narrowing of existing equity gaps. The findings suggest that the primary impact of the non-profit organization initiative had the meaningful shift in students' academic performance conditions [55]. Before receiving the laptops, participants described a state of digital precariousness characterized by a reliance on campus computer labs or shared family devices. Table 1 details the diverse demographic makeup of these participants, highlighting that the majority resided in underserved urban zones where access to stable, high-speed hardware is a documented barrier to STEM persistence.

The transition to personal ownership removed significant temporal and spatial barriers, effectively mitigating "time poverty" among the student population [56]. Qualitative evidence from Focus Group 4 revealed that students previously had to synchronize their academic schedules with library hours or family needs. By providing a personal resource, the program enabled students to engage in "a synchronous agency," allowing for deep work to occur during non-traditional hours. This shift is reflected in descriptive satisfaction patterns shown in Figure 3, which shows a near-universal satisfaction rating, where most students gave the initiative a perfect 10/10 rating, citing that the laptop removed significant financial and logistical barriers. with students specifically citing the ability to "work from home" as the most significant contributor to their academic stability. The ability to possess the device at all times transformed the laptop from a mere tool into a foundational academic resource, as evidenced by a student who noted that the device removed the necessity of waiting for specific campus facilities to open.

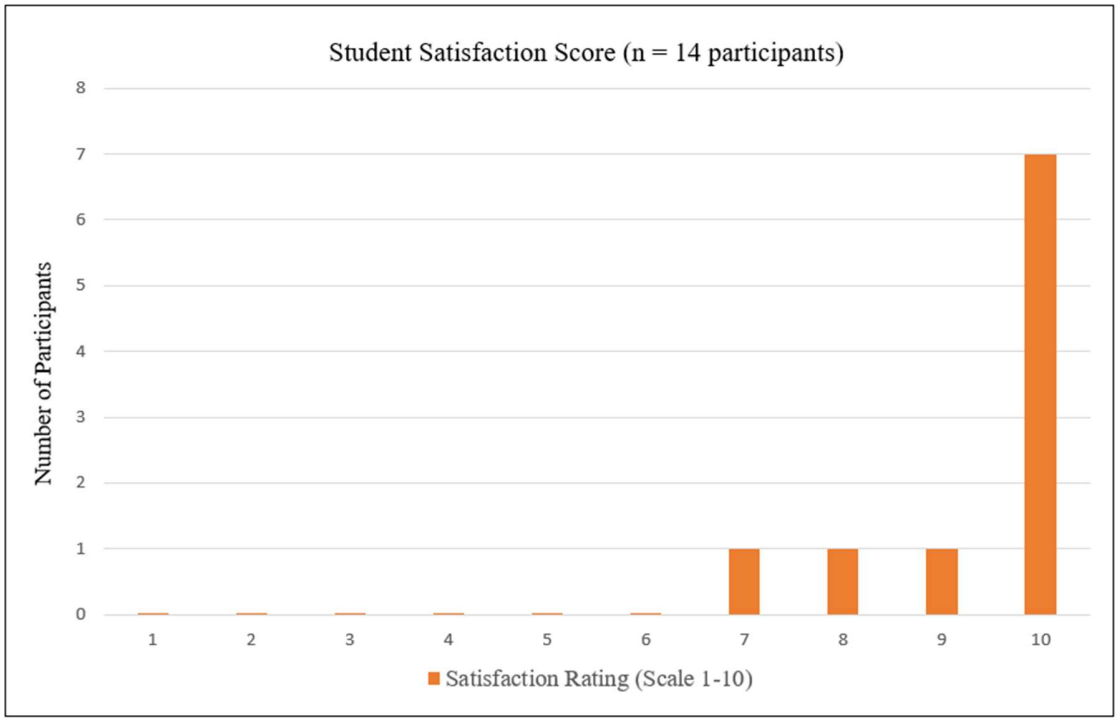

Figure 3: Student Satisfaction with laptop access

Furthermore, the data identified a direct link between hardware quality and the ability to meet high-stakes academic requirements. A recurring theme across multiple focus groups was the challenge posed by institutional proctoring software, such as LockDown Browser. Students who had previously relied on mobile devices or tablets were structurally excluded from participating in home-based assessments because these platforms do not support the requisite security protocols [57]. The provision of the non-profit organization's laptops, which possess the necessary processing power and operating system compatibility, effectively "unlocked" these academic achievements. This represents a reduction of access-related barriers; when students are provided with the same technical capacity as their more affluent peers, their ability to satisfy course requirements becomes a function of their effort rather than their infrastructure [58].

Finally, the impact on academic outcomes extended into the psychological domain of professional identity. The qualitative transcripts highlighted a shift in how students perceived themselves as

learners. Participants in Focus Group 2 remarked that the high-tech nature of the Dell laptops made them feel "more professional" and "serious" about their studies. This aligns with recent literature suggesting that digital self-efficacy is a prerequisite for academic engagement in engineering and technology disciplines [59]. Table 2 maps these thematic outcomes, showing that the acquisition of the resource (the laptop) catalyzed a sense of academic agency, which in turn fostered the achievement of higher-order tasks such as complex programming and high-definition video conferencing for collaborative projects. All four focus group sessions included discussion of how the laptops improved Academic Impact (grades, assignments) and Software Accessibility (Canvas, Zoom, and specialized STEM software) as illustrated in Figure 4.

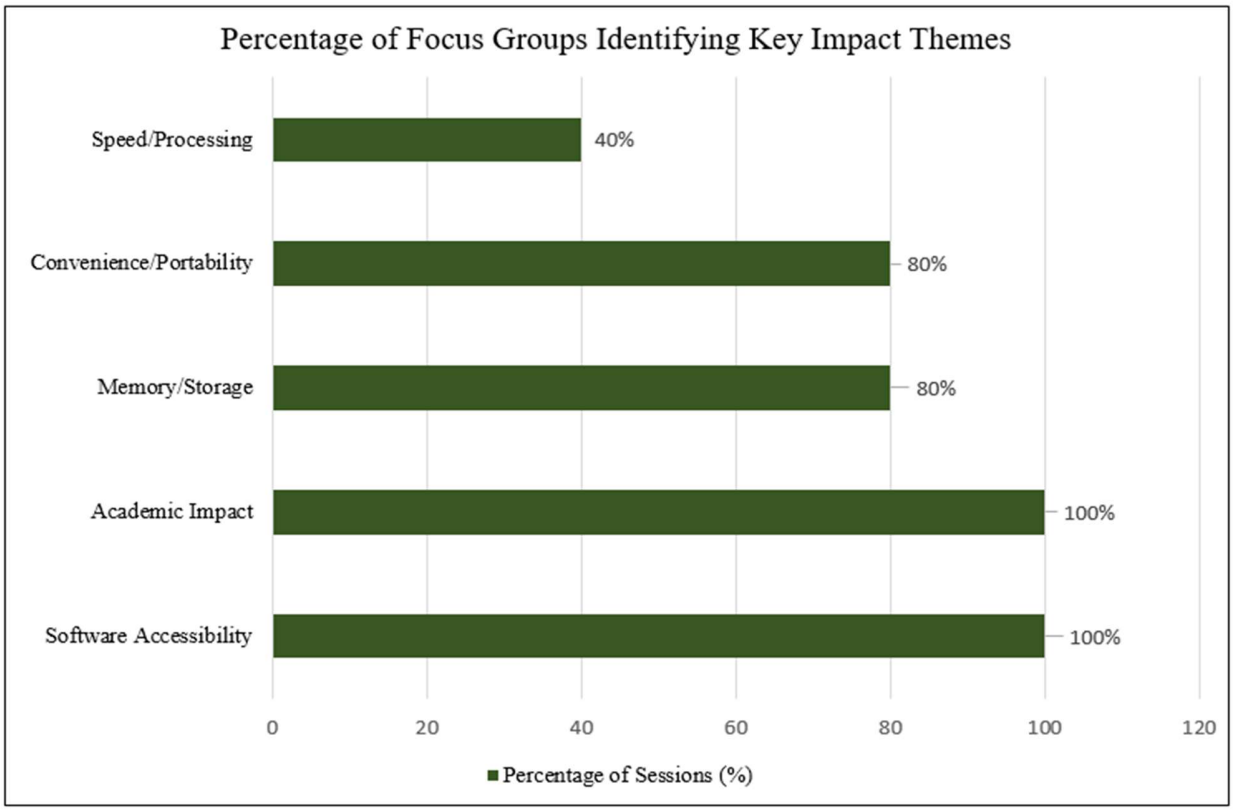

Figure 4: Impact of Laptop Access on Key Academic Areas

**Research Question 2:** What barriers and supports influence students' ability to use laptops effectively for academic learning and engagement?

This research explored the contextual factors that either facilitated or hindered the students' ability to maximize the utility of the distributed laptops. The findings indicate that while hardware quality served as a significant internal support, external infrastructural and institutional factors acted as persistent barriers to full digital empowerment. The quality of the hardware itself was cited as a primary support; features such as the backlit keyboard, high-speed RAM, and significant storage capacity were not viewed as luxuries but as essential functional requirements for modern scholarship [60]. In Focus Group 3, students specifically noted that the superior processing speed of the new devices allowed them to run "higher software" for computer science and biology courses that their previous, outdated laptops could not execute without crashing.

Institutional support systems also played a vital role in facilitating effective use. The pre-installed software suites and seamless integration with the university's Learning Management System (LMS) created a "frictionless" onboarding experience. Students reported that the ability to access Microsoft Office 365 and Zoom without additional financial or technical hurdles allowed them to immediately translate the new resource into academic productivity. This finding supports the argument that digital equity programs must go beyond the "box-drop" model and provide an integrated ecosystem of software and support to be effective [61]. Figure 4 visualizes the themes of academic impact and software accessibility, demonstrating that the convergence of high-quality hardware and essential software was the most frequently cited support across all fourteen participants.

However, significant barriers, as shown in Figure 5, were identified that limited the program's potential for total equity. One of the most profound qualitative findings involved the "trust gap" between the institution and the student body. Several students admitted that when they first received the email notification regarding the laptop distribution, they dismissed it as a "scam" or a phishing attempt [62]. This skepticism highlights a critical socio-technical barrier; in marginalized communities, the offer of a high-value resource for free is often viewed with suspicion. This finding suggests that institutional communication strategies must be more intentional and personalized to ensure that the most vulnerable students do not opt out of beneficial programs due to a lack of institutional trust.

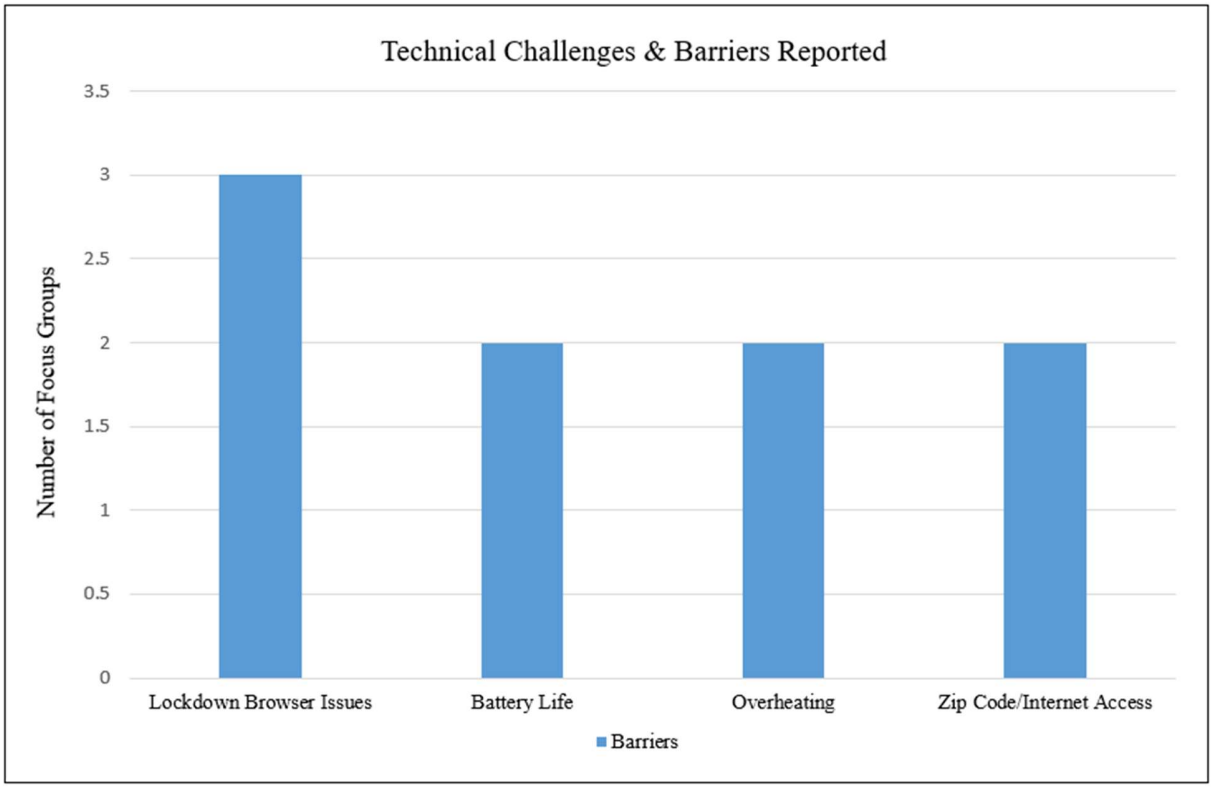

Figure 5: Reported Challenges & Barriers

To quantify the qualitative insights, a thematic frequency analysis was conducted across the focus group sessions (see Figure 4). All participants (100%) identified a direct link between personal device ownership and improved academic performance. However, as shown in the Challenges chart, technical barriers such as exam browser compatibility (Lockdown Browser) and battery life remain critical areas for institutional improvement. Additionally, the "connectivity gap/internet access" remained a persistent external barrier. While the laptops provided the necessary hardware, many students still struggled with the prerequisite of reliable home internet. Data from Focus Group 3 revealed a geographic exclusion where certain students were ineligible for the provided internet promo codes based on their zip codes. This "infrastructure bottleneck" meant that even with a high-performance laptop, the student's ability to participate in synchronous learning was still mediated by their physical location. Furthermore, internal technical friction points such as battery life and device overheating were reported as secondary barriers. As shown in Figure 5, students who spent long hours on campus noted that the need for constant charging was a hindrance in older campus buildings with limited power outlets. These findings emphasize that for a laptop program to reach an "award-winning" level of impact, it must be paired with advocacy for broader broadband access and on-campus charging infrastructure [63].

Table 2: Detailed Mapping of Research Questions to Findings.

| Research Question (RQ) | Key Thematic Finding | Theoretical Pillar (Kabeer) | Student Evidence (Direct Quote from Transcripts) | Scholarly Citation |
|---|---|---|---|---|
| RQ1: Academic Outcomes & Equity | Mitigation of Time Poverty | Resources → Agency | *"I don't have to wait until the library is open... it just makes it easier [to work from home]."* | [58] |
| RQ1: Academic Outcomes & Equity | Structural Inclusion | Achievement | *"The laptop made it easier to access Canvas and download Zoom... it improved the online class experience."* | [59] |
| RQ1: Academic Outcomes & Equity | Resolution of Exam Barriers | Achievement | *"It was a necessity for online tests... I couldn't run LockDown Browser on my previous tablet."* | [60] |
| RQ2: Barriers & Supports | Institutional Trust Gap | Pre-Resource Condition | *"I really did think that it was like some type of scam, because you just never know with emails."* | [61] |
| RQ2: Barriers & Supports | Infrastructure Bottlenecks | Resource Condition | *"I had a problem with the promo code not covering my zip code [for free internet access]."* | [62] |
| RQ2: Barriers & Supports | Technical Support (Hardware) | Resources | *"The speed and processing are a significant upgrade... it handles higher software for my bio classes."* | [63] |

Table 3: Descriptive Performance Metrics and Satisfaction Synthesis

| Evaluation Metric | Aggregated Result (Mean/%) | Standard of Performance | Impact on Student Engagement |
|---|---|---|---|
| Overall Satisfaction | 9.6 / 10 | Excellent | High correlation with increased digital self-efficacy and "professional" student identity. |
| Hardware Speed | "Superior" | High Performance | Removal of "logistical friction" allowed for seamless multitasking and heavy software use. |
| Software Accessibility | 100% Success | Integrated Support | Microsoft 365 and Canvas pre-integration allowed for immediate "academic unboxing." |
| Thermal/Power Reliability | Moderate Challenge | Area for Improvement | Overheating and battery life are cited as "friction points" for students in long-duration campus sessions. |

As shown and interpreted in Table 2, the transition from “shared resources” to “individual ownership” functioned as a catalyst for what scholarly literature defines as asynchronous agency [58]. The qualitative evidence suggests that the removal of the temporal barrier (waiting for library hours) allowed participants to align their academic efforts with their individual life constraints, contributing to reduced access-related disparities between urban commuter students and their residential peers [60].

## 7. Discussion

The findings suggest that digital equity in urban higher education is not merely a matter of hardware availability but a complex conversion of resources into academic agency. By providing high-performance laptops, the institution effectively mitigated "time poverty," a phenomenon where underserved students lose significant learning hours due to the logistics of shared technology or commuting to campus labs [71]. This reclamation of time is the foundational step in Kabeer’s framework, transitioning the student from a passive recipient of resources to an active agent in their own learning ecology [72].

A critical discovery within this study was the "Software Exclusion" barrier. The incompatibility of mobile devices and tablets with institutional proctoring tools like Lockdown Browser creates a structural equity gap where students are physically present in the LMS but technically barred from high-stakes assessments [73]. The provision of the non-profit organization's laptops resolved this friction point, allowing students to translate their preparation into reported achievement. However, the "Scam Perception" reported in Focus Group 1 indicates that institutional trust is a prerequisite for resource uptake [74]. For students in marginalized communities, the offer of a high-value resource is often met with skepticism, suggesting that digital equity initiatives must prioritize transparent, multi-channel communication to bridge the "information gap" [75].

Furthermore, the persistent zip code-based barriers to internet access illustrate that the "second-level digital divide" remains a challenge even when hardware parity is achieved [76]. The geographic exclusion from broadband support suggests that universities must advocate for broader municipal infrastructure changes to ensure that the laptops they provide are not rendered ineffective by a lack of home connectivity [77].

## 8. Conclusion and Recommendations

The findings of this study extend the discourse on digital equity in higher education by shifting attention from the traditional focus on access as mere device possession to how access is translated into meaningful academic engagement and student agency. Grounded in Kabeer's Empowerment Framework, the study suggests that equitable laptop access can reduce practical barriers such as limited device functionality and time constraints, thereby supporting students' ability to engage more consistently with digital learning environments. Evidence from focus group discussions indicates that reliable, high-quality devices play a critical role in enabling participation in coursework, particularly in contexts where incompatible or mobile-only devices previously restricted access to required academic platforms.

The study further highlights that digital equity is influenced not only by access, but by the quality and compatibility of that access within institutional systems. Students' experiences suggest that personal laptop ownership supports greater flexibility, improved organization, and increased confidence in navigating academic tasks. These findings position digital access as a contributing factor to academic engagement and perceived stability, rather than a standalone solution to educational inequality.

From an institutional perspective, digital access initiatives should move beyond one-time device distribution toward more comprehensive support structures. Effective strategies include ensuring compatibility between hardware and required academic software, providing clear onboarding and technical support, and addressing broader access constraints such as connectivity limitations. Institutions may also consider strengthening outreach efforts to build student trust and awareness of available resources, while advocating for broader infrastructure improvements that support equitable digital participation.

Finally, this study is based on a small qualitative sample from focus group participants, which may limit the generalizability of the findings. Additionally, the current analysis emphasizes student-reported experiences, with full integration of quantitative survey and institutional data ongoing.

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## Appendix
## Sample Survey Questions

| Category | Sample Questions | Student-Facing Survey Item (The Question to Ask Students) |
|---|---|---|
| Resources (Access) | 1. To what extent were devices distributed to intended participants? | Before receiving this laptop, did you rely on shared family devices or campus labs to complete your assignments? |
| Agency (Usage) | 2. To what extent did the program build digital capacity (Usage Frequency)? | How many hours per day do you now use this laptop for academic tasks compared to your previous device? |
| Agency (Skills) | 3. To what extent did the program build digital capacity (Technical Skill)? | How confident are you in your ability to install and navigate specialized software (e.g., LockDown Browser or programming IDEs)? |
| Resources (Barriers) | 4. Identification of Implementation Gaps (The Trust Barrier) | To what degree did skepticism (thinking the offer was a "scam") influence how quickly you claimed your device? |
| Agency (Efficiency) | 5. Mitigation of Time Poverty | Since receiving the laptop, how much has your reliance on library hours or computer lab availability decreased? |
| Achievement (Outcomes) | 6. Academic Integration and Identity | To what extent does having a personal, high-performance device make your work feel more "official" or "professional"? |
| Achievement (Participation) | 7. Collaborative Engagement | How significantly has the laptop improved your ability to participate in Zoom sessions and real-time group project collaboration? |
| Resources (Conditions) | 8. Hardware Performance and Friction Points | How frequently do physical limitations (e.g., battery life or overheating) interrupt your continuous study sessions? |