WIP: Assessing Student and Community Outcomes of Campus-to-Community Digital Equity Initiatives: An Evidence Mapping Study (2010–2025)

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Abstract

Campus-anchored partnerships are increasingly deploying digital-equity bundles that integrate devices, affordable broadband, digital skills training, navigator support, and, in some cases, privacy-ready spaces or telehealth portals. Although these initiatives are widespread, the existing evidence base remains fragmented and outcome measures inconsistent. This work-in-progress study develops an evidence map of campus-to-community digital-equity initiatives implemented between 2010 and 2025, with a particular focus on Minority-Serving Institutions (MSIs), including Historically Black Colleges and Universities (HBCUs) with their surrounding anchor communities.

Peer-reviewed and gray literature will be systematically reviewed using dual-screening procedures. Each record will be coded for bundle components, population and setting, study design, follow-up duration, cost reporting, and equity-related disaggregation. Outcomes will be grouped into five domains: adoption and activation (such as portal enrollment and device uptake), engagement and persistence (continued use of digital platforms and services), proficiency (digital skills and self-efficacy measures), academic performance (course completion rates, GPA, and student retention), and health-service utilization (telehealth session completion and modality preferences).

Visual heatmaps and a narrative synthesis will be used to identify the most frequently paired components, clusters of outcome evidence, and gaps in research design rigor. Preliminary findings suggest that bundles integrating devices, connectivity, and digital-skills training are the most common configurations. Initiatives that include navigator support and trusted community spaces tend to achieve higher activation and sustained engagement, while academic outcomes and cost-effectiveness remain insufficiently measured.

The resulting evidence map will provide a shared measurement framework, a library of standardized indicators, and adaptable study designs including stepped-wedge and matched difference-in-differences models to support institutions in translating digital access into measurable student and community outcomes. The findings will guide future policy, investment, and program design aimed at advancing long-term digital inclusion across HBCUs and their surrounding communities.

Keywords: campus community partnerships, digital-equity initiatives, evidence mapping, Minority-Serving Institutions (MSIs), Historically Black Colleges and Universities (HBCUs), anchor communities devices and affordable broadband, digital-skills training.

1. Introduction

1.1 Background and Motivation

Digital inequity continues to affect access to education, health care, and the economy, even in places where internet access has grown. A growing body of research shows that differences are becoming less about whether people can connect and more about how reliably, effectively, and productively they can use digital tools to get things done [1], [8], [12]. Disparities in connectivity quality, device suitability, digital proficiency, and institutional support systems perpetuate enduring inequities related to income, race, geography, and educational attainment [1], [8].

In higher education, these disparities directly influence student engagement, retention, and academic achievement. Empirical studies conducted during and after the COVID-19 pandemic show that students without stable broadband, dedicated devices, or technical support faced significant disruption, even as institutions swiftly shifted to online or hybrid delivery [4], [9], [34]. These results highlight a significant transformation in the conceptualization of digital equity: mere access is inadequate without accompanying skill development and ongoing support.

In response, colleges and universities have taken on more of an anchor-institution role, expanding their efforts to promote digital equity beyond campus boundaries to the communities around them. This change shows that people are starting to realize that student outcomes and community outcomes are linked, especially at Minority-Serving Institutions (MSIs) and Historically Black Colleges and Universities (HBCUs), which are often located in areas with multiple structural barriers [28], [30]. Instead of deploying technology in isolation, institutions are implementing coordinated interventions that combine infrastructure, training, and human support.

1.2 Digital Equity Bundles and Campus-to-Community Partnerships

This study employs the term "digital equity bundles" to describe coordinated interventions that deliberately integrate two or more elements aimed at mitigating complex barriers to digital participation. In the literature, these components typically encompass device provision, broadband or connectivity support, digital skills training, and navigator or coaching assistance, with certain initiatives also integrating trusted access points such as privacy-ready spaces or service portals.

Prior research consistently indicates that multi-component approaches are more effective in supporting sustained engagement compared to single-component interventions [8], [31]. Research on broadband affordability programs and device-lending initiatives indicates that participation increases when individuals receive onboarding assistance and troubleshooting support, especially among demographics with minimal prior digital experience [31], [32]. Similarly, digital-skills training and guided navigation have been shown to improve confidence, self-efficacy, and continued use of digital platforms beyond initial enrollment [14], [22].

Campus-to-community partnerships are particularly significant in the contexts of Minority Serving Institutions (MSIs) and Historically Black Colleges and Universities (HBCUs). Anchor institution scholarship stresses that these institutions serve as reliable intermediaries, adept at synchronizing institutional resources with community requirements through enduring relationships and localized commitments [28], [29]. Empirical research centered on HBCUs underscores their contribution to promoting equity-focused initiatives that disseminate educational and technological advantages beyond the enrolled student population [30]. When digital resources are provided through reliable institutional frameworks and accompanied by human assistance, activation and persistence outcomes are consistently superior compared to isolated access [31], [32].

Despite the growth of bundled initiatives, the evidence is still not clear. Numerous studies concentrate on program implementation or short-term adoption, whereas a limited number investigate persistence, academic outcomes, health-service utilization, or cost-effectiveness.

Outcome measures differ significantly, hindering cross-study comparisons and cumulative learning [26], [27].

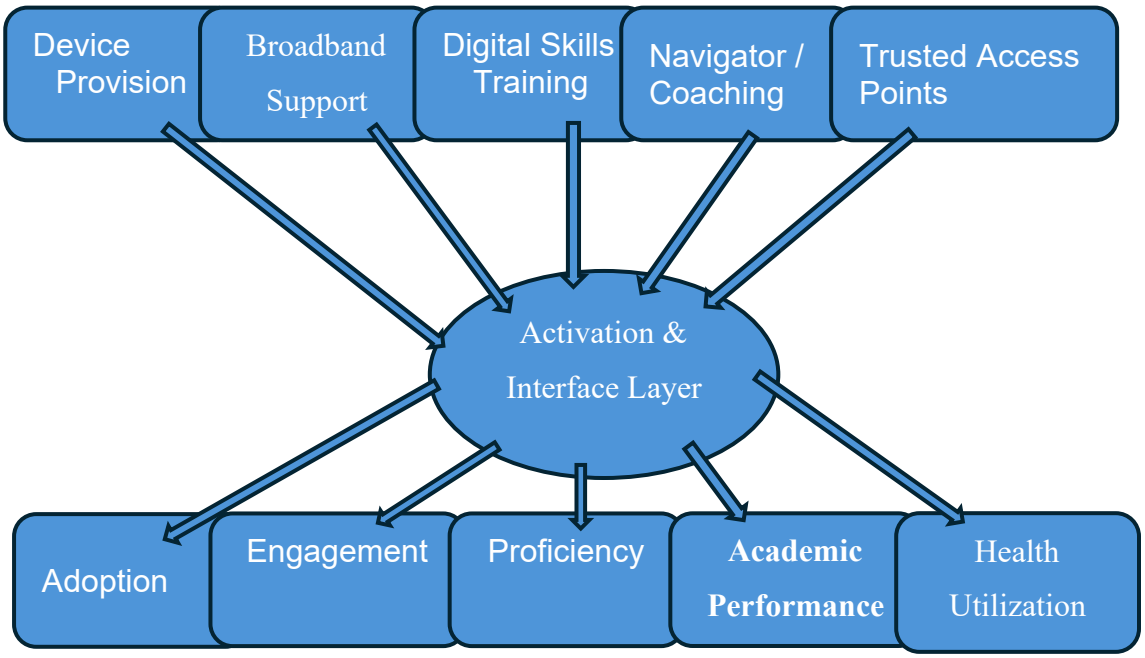

Figure 1 - Systems-Level Conceptual Model

1.3 Need for Evidence Mapping in Engineering and Higher Education Research

For engineering education researchers and institutional decision-makers, this fragmentation poses a practical challenge. Investments in digital infrastructure, support staffing, and community partnerships increasingly require evidence that links interventions to measurable outcomes.

However, the diversity of bundle configurations, populations, and evaluation designs renders conventional meta-analysis unsuitable in numerous instances.

Evidence mapping offers a methodologically appropriate alternative. Rather than estimating pooled effects, evidence maps they carefully list what has been studied, how it has been studied, and where evidence is concentrated or sparse [26], [27]. This approach has been widely used in education, public health, and policy research to guide future evaluation and identify design gaps when literatures are broad and methodologically diverse.

Within the context of digital equity, evidence mapping enables identification of prevalent bundle configurations, commonly reported outcome domains, and underutilized evaluation designs. For engineering and computing education audiences, this approach supports systems-level reasoning about how technical, human, and organizational components interact to produce outcomes.

1.4 Objectives and Contributions

The objective of this study is to develop a systematic evidence map of campus-to-community digital equity bundles implemented between 2010 and 2025, with particular attention to MSIs and HBCUs. The review is guided by four questions:

1. What combinations of digital-equity components are most frequently implemented in campus-anchored initiatives?
2. Which populations and settings are represented in the existing evidence base?

3. How are outcomes measured across adoption, engagement, proficiency, academic performance, and health-service utilization domains?
4. What study designs and follow-up periods are used, and where is stronger evaluation needed?

The study enhances the field by (i) organizing a fragmented literature into a coherent evidence map, (ii) introducing a shared measures framework to improve comparability, and (iii) identifying feasible evaluation designs aligned with real-world campus-to-community partnerships.

2. Methods

2.1 Evidence-Mapping Design

This study utilizes a systematic evidence-mapping methodology to characterize the landscape of campus-to-community digital equity bundles reported between 2010 and 2025. Evidence mapping is appropriate when interventions, populations, are diverse, and the main goal is to depict evidence coverage rather than to calculate effect sizes [26], [27].

The unit of analysis is a bundle initiative, defined as a coordinated intervention comprising at least two digital-equity components. Each included record was coded to identify bundle composition, population and setting, study design, follow-up duration, cost reporting, equity disaggregation, and reported outcomes.

2.2 Search Strategy and Information Sources

Searches were conducted across education, social-science, and health-focused databases using two complementary term families:
(1) digital-equity components (e.g., device access, broadband support, digital-skills training, navigator support, telehealth portals), and
(2) institutional configuration (e.g., campus-to-community, anchor institution, HBCU, MSI, community partnership).

The search window was restricted to 2010–2025 to align with the expansion of broadband affordability programs, mobile device diffusion, and institutional digital-inclusion initiatives. Peer-reviewed journal articles and gray literature with sufficient methodological detail were eligible for inclusion.

2.3 Eligibility Criteria

Records were included if they met all of the following criteria:

- The initiative was campus-anchored and served students, community members, or both.
- The intervention constituted a bundle, defined as two or more coordinated components.
- At least one outcome was reported within the study's scope.
- Enough program detail was provided to code bundle composition and setting.

Records were excluded if they focused solely on single-component infrastructure upgrades, general online pedagogy without equity supports, or lacked extractable outcome information.

2.4 Screening and Data Extraction

A dual-screening process was used for both abstract and full-text review to reduce selection bias. Discrepancies were resolved through discussion. A standardized extraction form captured bibliographic metadata, population characteristics, bundle components, study design, follow-up duration, outcome measures, equity disaggregation, and cost reporting.

Outcome indicators were harmonized into five domains: adoption and activation, engagement and persistence, proficiency, academic performance, and health-service utilization.

2.5 Synthesis and Visualization

Evidence was synthesized descriptively using component-by-outcome matrices and density visualizations. Narrative synthesis was used to interpret patterns, highlight gaps, and identify underrepresented designs and outcomes. No meta-analysis was conducted due to intervention and measurement heterogeneity.

3. Preliminary Results

3.1 Study Flow and Evidence Base

The PRISMA-style screening process yielded a corpus of peer-reviewed and gray literature documenting campus-anchored digital-equity initiatives implemented between 2010 and 2025. The included studies span a range of institutional types, with a substantial subset originating from MSIs and HBCUs or involving formal partnerships between campuses and community organizations. The evidence base reflects growth over time, with a marked increase in publications after 2020 corresponding to pandemic-era digital access interventions [4], [9].

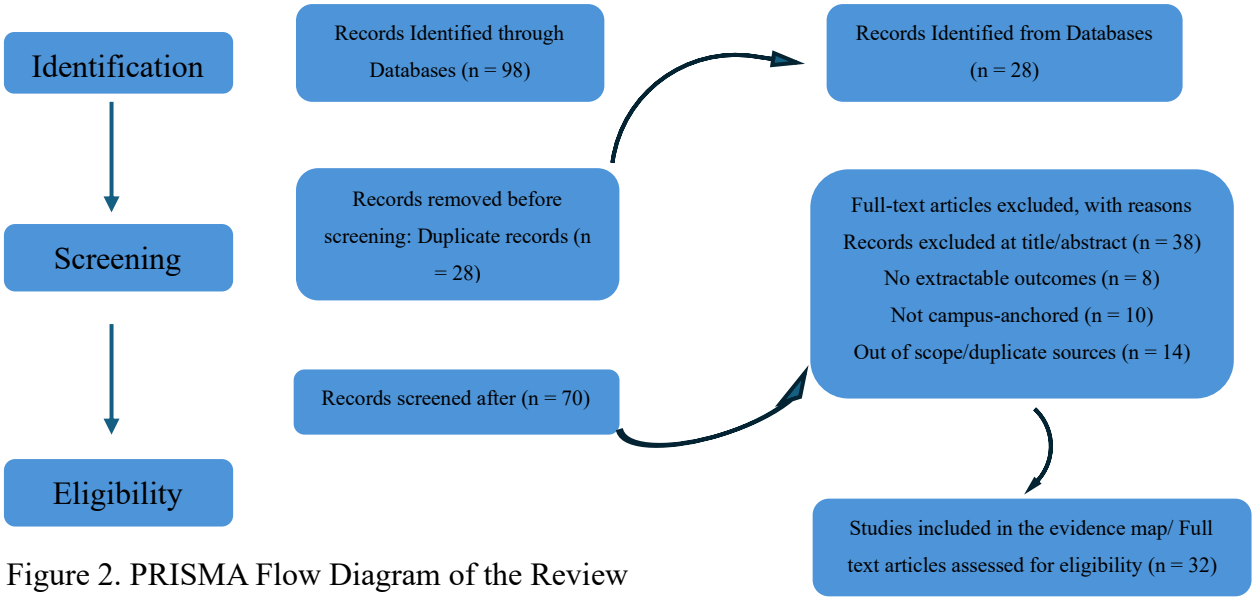

Figure 2. PRISMA Flow Diagram of the Review

3.2 Bundle Configurations and Co-Occurrence Patterns

Across the included studies, devices, broadband/connectivity support, and digital-skills training are the most frequently reported components and most commonly appear together as a foundational bundle [8], [31]. Device provision alone is less common than combined access models, reflecting recognition that hardware without connectivity or skills support is insufficient to enable sustained participation.

Navigator or coaching support appears less frequently in program descriptions but, when present, is consistently associated with higher activation and continued use [14], [22], [32]. Trusted access points such as community-based spaces or service portals are reported in a smaller subset of initiatives, typically in connection with health or public-service use cases. Their limited presence suggests either under-adoption or under-reporting rather than absence.

3.3 Outcome Coverage by Domain

Outcome reporting is uneven across domains. Proficiency outcomes, including digital skills and self-efficacy, are most frequently reported, often using self-report instruments or task-based assessments [7], [14]. Adoption and activation outcomes such as device uptake, broadband enrollment, or initial portal registration are also common but typically measured over short time horizons [31].

Engagement and persistence outcomes appear less consistently and are measured using heterogeneous indicators, including repeat logins, training completion, or continued subscription status [11]. Academic performance outcomes (e.g., GPA, course completion, retention) are reported in a relatively small subset of studies, often without robust counterfactuals [3], [24]. Health-service utilization outcomes, including telehealth session completion or modality choice, are rare and largely concentrated in studies explicitly designed around service portals or community access points [18], [25].

Bundle Component	Adoption	Engagement	Proficiency	Academic	Health
Device Provision	High	Moderate	Low	Rare	Rare
Broadband Support	High	Moderate	Low	Rare	Rare
Digital Skills	Moderate	Moderate	High	Low	Rare
Navigator Support	Moderate	High	Moderate	Low	Low
Trusted Access Points	Low	Low	Low	Rare	Moderate

Figure 3. Density of Outcome Reporting by Bundle Component

3.4 Study Design Rigor and Follow-Up

Descriptive and pre–post designs dominate the evidence base. Quasi-experimental approaches, including matched comparisons or difference-in-differences, are present but underutilized [11]. Randomized or stepped-wedge designs are rare. Follow-up periods are frequently short, particularly for access-focused initiatives, limiting insight into durability of outcomes.

3.5 Equity Disaggregation and Cost Reporting

Equity-focused disaggregation is inconsistently reported. While some studies stratify outcomes by race/ethnicity, income, first-generation status, or age, many report only aggregate results [1], [20]. Cost reporting is similarly sparse. Even when programs describe inputs such as devices or staffing, per-participant costs and sustainability considerations are rarely documented, constraining economic comparison and scalability assessment.

4. Discussion

4.1 From Access Provision to Outcome Production

The evidence map indicates that campus-to-community digital-equity initiatives have largely succeeded in delivering access, but far fewer studies document how access translates into sustained engagement and downstream outcomes. Bundles that integrate connectivity and skills training are common, yet outcomes often stop at proficiency or initial activation. This pattern reinforces prior findings that access is a necessary but insufficient condition for equity [8], [12].

4.2 The Role of Navigation and Trusted Contexts

Where navigator support or guided onboarding is documented, activation and persistence outcomes are consistently stronger [14], [22], [45]. From a systems perspective, navigation functions as the interface between infrastructure and users, translating technical capacity into practical use. Trusted spaces and portals appear to play a similar role for sensitive services, though they remain under-evaluated.

4.3 Implications for Evaluation Design

The predominance of short follow-up windows and descriptive designs limits causal inference. However, many campus-to-community initiatives are rolled out in phases or across cohorts, creating natural opportunities for stepped-wedge or matched difference-in-differences designs. Embedding such designs at program inception would substantially strengthen the evidence base without imposing unrealistic constraints.

4.4 Cost, Equity, and Sustainability

Sparse cost reporting and inconsistent equity disaggregation represent critical gaps. Without transparent cost metrics, institutions cannot compare bundle configurations or assess return on investment. Aggregate outcome reporting obscures whether initiatives narrow or reproduce disparities. Future studies should standardize reporting of per-participant costs and disaggregate key outcomes by relevant equity variables to support informed decision-making.

5. Limitations

This evidence-mapping study is subject to several limitations. First, coding relied on information explicitly reported in publications; under-reported components such as informal coaching may be undercounted. Second, heterogeneity across interventions and measures limits comparability and precludes effect-size synthesis. Third, the predominance of short follow-up periods constrains inference about long-term outcomes. Finally, some locally implemented initiatives may not be captured due to limited documentation.

6. Conclusion and Future Directions

This study maps the landscape of campus-to-community digital-equity bundles implemented between 2010 and 2025, with a focus on MSIs and HBCUs. The evidence shows widespread adoption of access-oriented bundles but limited measurement of academic, health, and long-term outcomes. By organizing outcomes into a shared framework and highlighting underused evaluation designs, this work provides a foundation for future studies that move digital equity initiatives from access provision toward demonstrable student and community impact.

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