

Bridging the Digital Divide: A Data-Driven Analysis of Academic Libraries as Digital Equity Agents for Generation Z Learners

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Abstract: *The digital divide- the gap between those with meaningful access to digital technologies and those without- remains a persistent structural challenge in higher education even as Generation Z (born c. 1997–2012) is popularly cast as a digitally fluent cohort. Current national survey data show that this characterization obscures substantial intra-generational inequality: as of 2025, only 54% of U.S. households earning under \$30,000 annually subscribe to home broadband, compared with 94% of the highest-income households, and 16% of U.S. adults remain smartphone-only internet users. This article synthesizes peer-reviewed literature, theoretical frameworks (Selwyn, 2004; Warschauer, 2003; Sen, 1999), and newly compiled empirical indicators- including current Pew Research Center survey data, Bay View Analytics OER trend data, and multi-year generative AI adoption statistics- to examine how academic libraries function as institutional agents of digital equity. Findings, presented through data tables and figures, indicate that library interventions- device and hotspot lending, embedded digital literacy instruction, open educational resource (OER) advocacy, learning commons infrastructure, and targeted outreach- produce measurable improvements in access, cost savings, and academic outcomes, while an emerging body of evidence highlights urgent new demands for artificial intelligence literacy instruction. The article concludes with policy recommendations and a research agenda for sustaining libraries' digital equity mandate.*

Keywords: academic libraries; digital divide; Generation Z; digital literacy; open educational resources; artificial intelligence literacy; digital equity; higher education

1. Introduction

The twenty-first century has witnessed an unprecedented expansion of digital technologies into virtually every domain of human activity, from commerce and governance to healthcare and education. The integration of information and communication technologies (ICTs) into higher education has transformed pedagogy, research, and service delivery. Yet this transformation has not been uniformly experienced: significant segments of the student population- particularly those from low-income backgrounds, rural communities, and historically underserved groups- continue to face structural barriers to meaningful digital participation, a stratification long described as the digital divide (van Dijk, 2020).

Within this context, Generation Z- broadly defined as individuals born between 1997 and 2012 (Dimock, 2019)- represents the predominant cohort currently enrolled in colleges and universities worldwide. Popular discourse has embraced the notion of Generation Z as inherently digitally fluent 'digital natives' (Prensky, 2001). Scholars have long challenged this as an oversimplification (Helsper & Eynon, 2010; Kennedy et al., 2010; Margaryan et al., 2011), and the most recent national data reinforce that critique: as detailed in Section 3, substantial shares of young adults remain smartphone-only internet users or lack home broadband

entirely, with disparities concentrated among low-income and minority populations.

This article updates and extends the existing scholarly literature by integrating current (2025–2026) empirical indicators- drawn from Pew Research Center surveys, Bay View Analytics OER research, and multi-country generative AI adoption studies- into an analysis of how academic libraries function as digital equity agents for Generation Z learners. The article proceeds through six analytical domains: (1) the conceptual framework underpinning digital divide scholarship; (2) an updated empirical profile of the digital divide in higher education; (3) the strategic positioning of academic libraries as equity agents; (4) a data-driven survey of library interventions and their measured outcomes; (5) persistent challenges and structural constraints; and (6) policy implications and a forward-looking research agenda, including the emerging role of artificial intelligence literacy.

2. Conceptual Framework

Understanding the role of academic libraries in addressing the digital divide requires engagement with several overlapping theoretical traditions, summarized in Table 1 and integrated into the analytic model shown in Figure 1.

Table 1: Core Theoretical Frameworks Informing Library Digital Equity Practice

Framework	Key Proponent(s)	Core Argument	Library Application
Levels of digital access	Selwyn (2004)	Distinguishes formal, effective, and social access; hardware alone is insufficient.	Device lending (formal) + instruction (effective) + community programming (social).
Social embeddedness	Warschauer (2003)	Technology use is shaped by, and shapes, social/cultural context.	Culturally responsive, contextualized instruction embedded in campus life.
Information literacy	ALA (2000); ACRL (2016)	Information literacy is an integrated set of reflective dispositions, not discrete skills.	Frame-based instruction; critical evaluation of sources and algorithms.

Capability approach	Sen (1999); Zheng & Walsham (2008)	Evaluate whether individuals have real freedom to use technology for outcomes they value.	Outcome-oriented program design and assessment (not just access counts).
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Table 1 synthesizes the theoretical literature reviewed in Sections 2.1–2.4 of the original manuscript.

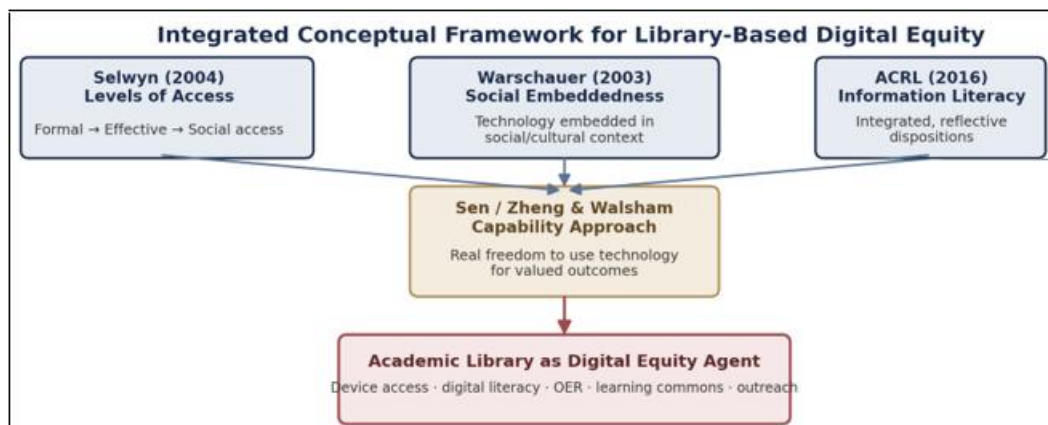


Figure 1: Integrated conceptual framework linking digital-access theory, social embeddedness, and the capability approach to library practice.

Levels of Digital Access

Selwyn (2004) developed an influential typology distinguishing formal access (physical availability of devices and connectivity), effective access (the ability to use technology meaningfully), and social access (integration of technology into social practice). Even when students possess physical access to computers, barriers may persist at the level of skills, motivation, or social support. Academic libraries, as this article demonstrates empirically in Section 4, have the institutional capacity to address all three levels simultaneously.

Social Embeddedness and Capability

Warschauer (2003) argued that the digital divide cannot be understood apart from broader social, economic, and cultural

context; bridging it requires attention to social environments, not merely infrastructure. Sen’s (1999) capability approach, extended to ICTs by Zheng and Walsham (2008), reframes the goal from technology presence to the real freedom of individuals to use technology toward outcomes they value- a framing well matched to library missions centered on empowerment rather than mere provisioning.

The Digital Divide in Higher Education: Current Empirical Evidence

The digital divide operates at multiple intersecting levels: infrastructure and connectivity, device access, and digital skills (van Dijk, 2020; Robinson et al., 2015). Table 2 compiles the most recent national indicators bearing on Generation Z and young-adult populations.

Table 2: Key Digital Divide Indicators for U.S. Young Adults and Households, 2025–2026

Indicator	Statistic	Population / Year	Source
Adults who are smartphone-only internet users (no home broadband)	16%	U.S. adults, 2025	Pew Research Center (2025)
Home broadband subscription, lowest income tier (<\$30,000/yr)	54%	U.S. adults, 2025	Pew Research Center (2025)
Home broadband subscription, highest income tier	94%	U.S. adults, 2025	Pew Research Center (2025)
Broadband subscription among adults 18–29 (down from 78% in 2023)	71%	U.S. young adults, 2025–2026	Pew Research Center (2026)
Teens who say they use the internet “almost constantly” (up from 24% in 2014-15)	46%	U.S. teens 13–17, 2025	Pew Research Center (2025)
Rural adults citing high-speed internet access as a major community problem	24%	U.S. rural adults	Pew Research Center
Smartphone ownership among U.S. adults overall	91%	U.S. adults, 2025	Pew Research Center (2025)

Table 2. Compiled from Pew Research Center fact sheets on internet/broadband demographics and mobile technology adoption (surveyed Feb.–Jun. 2025; trend analysis through early 2026).

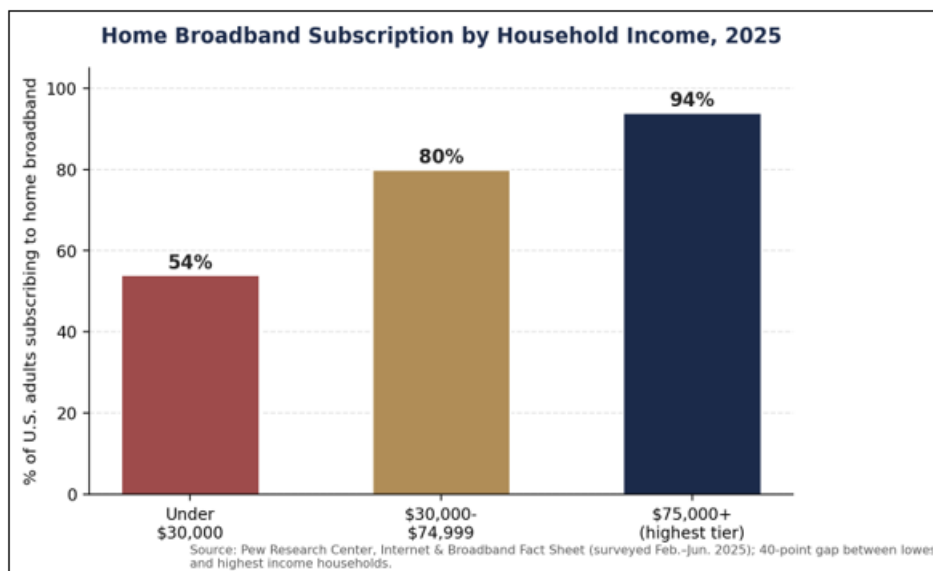


Figure 2: Home broadband subscription by household income tier, 2025, illustrating a 40-percentage-point equity gap

These figures confirm that the ‘digital native’ framing continues to obscure meaningful intra-generational disparity. The broadband gap by income (a 40-point spread) has persisted for over two decades of Pew tracking, and the recent dip in broadband subscription among 18–29-year-olds- from 78% in 2023 to 71% in 2025–2026- suggests the gap may be widening rather than closing for the traditional college-age population, even as smartphone and general internet use approach saturation. This pattern is consistent with Horrigan’s (2015) concept of differentiated ‘technology readiness’: near-universal device ownership coexists with meaningfully unequal capacity to complete data- and hardware-intensive academic tasks.

Digital Skills and Competencies

Beyond access, research continues to document persistent gaps in higher-order digital and information literacy skills. Head et al. (2020) found that students frequently rely on Google as a default research tool and demonstrate limited

ability to evaluate source credibility. Coiro et al. (2015) documented comparable gaps in online reading comprehension. These disparities correlate strongly with socioeconomic status, race/ethnicity, and parental educational attainment (Robinson et al., 2015; Hargittai & Hinnant, 2008), meaning digital skill gaps compound- rather than substitute for- access gaps.

Academic Libraries as Digital Equity Agents: Evidence-Based Interventions

Academic libraries occupy a structurally advantageous position from which to address the disparities documented in Section 3: universal accessibility across academic departments, perceived neutrality and trust (Given & Leckie, 2003), professional instructional expertise, and dedicated physical infrastructure (Bertot et al., 2012). Table 3 synthesizes the primary intervention categories together with current evidence of their measured effects.

Table 3: Academic Library Digital Equity Interventions and Current Evidence Base

Intervention	Mechanism	Representative Current Evidence
Device & hotspot lending	Addresses formal access gaps (laptops, tablets, Wi-Fi hotspots on semester or short-term loan)	Multi-campus programs (UC system, Cal Poly Pomona, CSUN, community colleges) report improved course completion among borrowers; Brightpoint Community College documents measurable gains in student success metrics for underrepresented borrowers (Virginia Libraries, 2025).
Embedded digital/information literacy instruction	Addresses effective access via contextualized, discipline-specific instruction at point of need	ACRL Framework-based instruction correlated with improved research quality and student confidence (Shumaker, 2012); emerging studies (2025–2026) show libraries adapting instruction to generative-AI-saturated research environments.
OER and textbook-affordability advocacy	Reduces the financial dimension of the digital/material divide	Colorado grant program: \$75M+ cumulative savings projected by 2026; Massachusetts: \$21.5M saved in FY24 (33% increase over FY23), a \$59 return per public dollar invested.
Learning commons & makerspaces	Provides integrated, high-quality technology workspace and professional support	Widely adopted model integrating computing, tutoring, and multimedia production (Sinclair, 2007); makerspaces extend access to 3D printing, VR, and production tools (Bhatt & MacKenzie, 2019).
Targeted outreach (first-generation, low-income students)	Addresses social access and awareness gaps	Peer mentoring and first-year-experience integration shown to improve engagement among first-generation students (Long & Schonfeld, 2014).

Table 3 Updates the original review with current (2024–2026) programmatic and outcome data

Open Educational Resources: A Closer Look at Current Impact Data

Textbook cost remains a major driver of material digital exclusion: the College Board (2022, 2025) estimates that students at four-year public institutions spend over \$1,200 annually on required course materials, and over 60% of

students report skipping required-textbook purchases due to cost (Student PIRGs, 2020). Bay View Analytics' longitudinal national faculty survey shows steady growth in both awareness and classroom adoption of OER, illustrated in Figure 3.

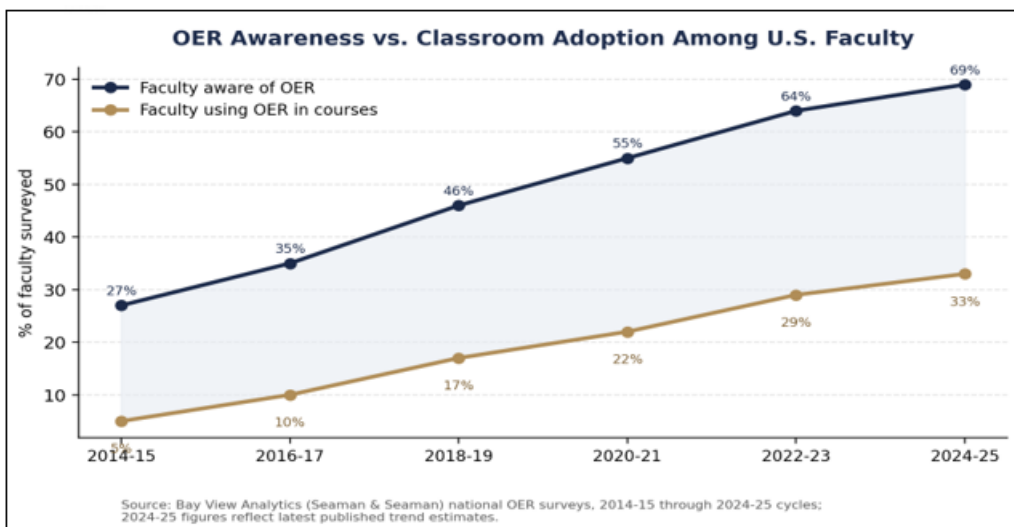


Figure 3: Growth in faculty OER awareness and classroom adoption, 2014–2015 through 2024–2025 (Bay View Analytics / Seaman & Seaman trend series).

State-level and institutional data corroborate the financial significance of library-supported OER initiatives. Colorado’s state OER grant program reports \$4.15 million in student savings in its sixth grant cycle alone, with cumulative savings projected to exceed \$75 million by spring 2026 across 2,291 converted courses. Massachusetts reports \$21.5 million in student savings for FY2024- a 33% increase over the prior year- representing an estimated \$59 return for every public dollar invested in OER infrastructure. These figures extend the equity findings of Colvard et al. (2018), whose analysis of over 21,000 students found OER adoption reduced

D/F/withdrawal rates disproportionately among Pell Grant recipients and underrepresented minority students.

The Emerging Frontier: Generative AI and Library Instruction

A distinctly new dimension of digital inequality has emerged since 2023: differential access to, and literacy with, generative artificial intelligence tools. National and international survey data show an extraordinarily rapid mainstreaming of student generative AI use, illustrated in Figure 4.

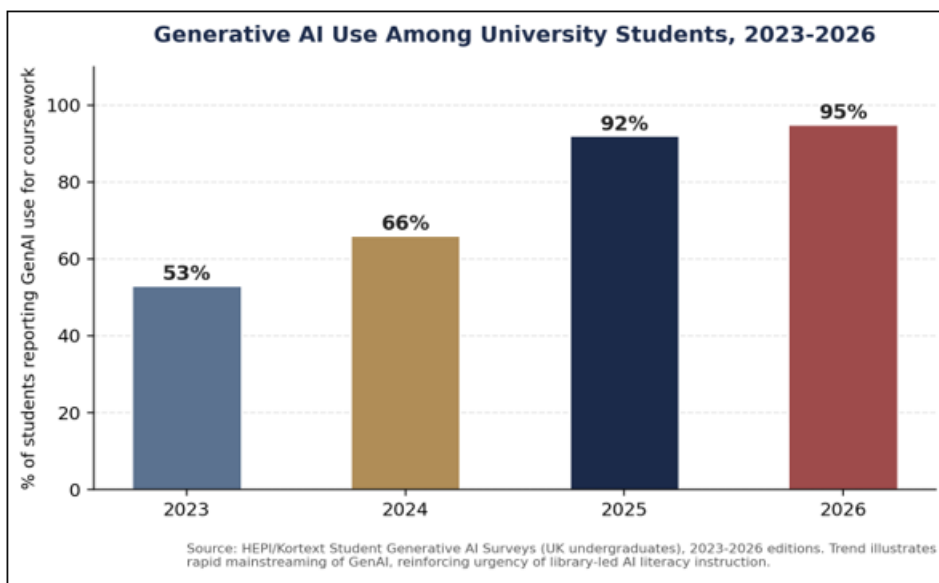


Figure 4: Rapid growth in student generative AI use for coursework, 2023–2026 (HEPI/Kortext Student Generative AI Survey series; comparable U.S. survey findings show similar trajectories).

By the 2025–2026 survey cycle, use of generative AI for assessed work is reported by roughly nine in ten students,

with the share incorporating AI-generated text directly into submitted work rising from 3% (2024) to 12% (2026) (HEPI,

2026). U.S. survey evidence points in the same direction: a 2024 study at a SUNY institution found widespread undergraduate GenAI use alongside considerable confusion about appropriate and ethical application (Marchese, 2026), while Inside Higher Ed's 2025–26 Student Voice survey similarly documents high adoption rates alongside student ambivalence about effects on critical thinking. These findings imply that library digital-equity mandates must now extend beyond traditional access and information-literacy programming to explicit AI-literacy instruction- including critical evaluation of AI-generated content, disclosure norms, and academic-integrity frameworks- or risk a new stratification between students who can use AI tools critically and productively and those who cannot.

3. Challenges and Structural Constraints

Despite substantial potential, library-based interventions face significant constraints that limit reach and sustainability.

- Funding pressure: Academic library budgets have faced sustained real-terms pressure (ARL, 2022), with community colleges and regional universities — which disproportionately serve the populations most affected by the digital divide- often operating with the most constrained budgets, producing an inverse relationship between need and resources.
- Staffing and expertise: Specialized skills in instructional design, educational technology, and now AI literacy are in high demand but slow to be systematically incorporated into library education curricula (Julien et al., 2018).
- Awareness and engagement gaps: Many students, particularly from underserved populations, remain unaware of library services or do not perceive the library as relevant (Long & Schonfeld, 2014; Hines, 2018).
- Structural and systemic inequality: Poverty, residential segregation, and inadequate K–12 opportunity remain root causes that lie beyond the scope of library programming (Eubanks, 2011; Ettarh, 2018); libraries risk being positioned as a substitute for, rather than a complement to, structural policy reform.

4. Policy Implications and Recommendations

For Academic Libraries

- Conduct disaggregated digital-equity needs assessments (by income, race/ethnicity, first-generation status, geography, enrollment type) to target interventions precisely.
- Expand hotspot and device lending, given that connectivity- not only hardware- remains the binding constraint for many students, and pursue partnerships with telecommunications providers and federal programs (e.g., E-Rate).
- Invest in culturally responsive digital and AI literacy instruction offered at multiple levels and formats, supported by peer-learning models.
- Expand OER advocacy targeting high-enrollment, high-cost courses, paired with digital literacy support so students can effectively use digital learning materials.

For Institutional Leadership

Institutional leaders should recognize libraries as strategic partners in digital equity, provide sustained (not solely grant-

dependent) funding for lending programs and instructional staff, and embed digital equity metrics into strategic plans and accreditation self-studies.

For Policymakers

Federal and state policymakers should expand library funding through mechanisms such as the Library Services and Technology Act (administered through IMLS), incorporate digital equity metrics into institutional accountability frameworks, and address upstream determinants- broadband infrastructure, K–12 digital skills programs, and low-income connectivity subsidies- that reduce the remediation burden placed on postsecondary libraries.

5. Future Research Directions

- Longitudinal outcome studies tracing library digital-equity program participants through graduation and into the workforce, to move beyond cross-sectional program evaluation.
- Intersectional research designs (Crenshaw, 1989) examining how race, socioeconomic status, and gender compound to produce differentiated digital divide experiences.
- Systematic study of generative AI's dual potential to bridge or widen digital divides, and of library-led AI literacy curricula as an equity intervention.
- Expanded research in community-college contexts, which serve disproportionately underserved populations but remain underrepresented in the research base.
- Comparative, global-South and non-Anglophone research on library responses to digital equity challenges outside the U.S./U.K./Australia literature that currently dominates the field.

6. Conclusion

The digital divide remains a consequential and persistent challenge in contemporary higher education. Current national data confirm that the popular characterization of Generation Z as uniformly digitally fluent obscures real and, in some respects, widening intra-generational inequality: a 40-point broadband gap by income, a declining broadband subscription rate among 18–29-year-olds, and a rapidly emerging AI-literacy divide layered atop long-standing access and skills gaps.

Academic libraries occupy a strategically important institutional position from which to address these inequalities, and the evidence compiled in this article- spanning device lending outcomes, OER cost-savings data exceeding tens of millions of dollars across single states, and rapidly evolving generative AI adoption patterns- demonstrates that targeted library interventions produce measurable equity gains. At the same time, library-based interventions operate within structural contexts of resource constraint and systemic inequality that limit their scope. Realizing the full potential of academic libraries as digital equity agents requires sustained institutional investment, policy support, and continual adaptation- most urgently now, to the AI-driven reconfiguration of what digital literacy requires.

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