

The Impact of Digital Inclusion Initiatives: A Systematic Literature Review

Erezi Ogbo-Gebhardt
 North Carolina Central University
eogbo@nccu.edu

Abstract

The significant expansion in the array of digital inclusion initiatives has generated renewed interest among researchers and policymakers on the impact of these initiatives in the communities that they serve. While the impact of broadband connectivity on individuals and communities has been well established in the literature, the broader impact of digital inclusion initiatives is comparatively understudied. Through a systematic review of 32 empirical studies, this paper examines the evidence for the impact of digital inclusion initiatives. This research synthesis presents a profile of the types of initiatives studied (types of solutions offered and the target populations) and the types of impact evaluated (outputs, outcomes, and impacts).

Keywords: Digital Inclusion, Program Evaluation, Outcomes, Broadband, Digital Divide

1. Introduction

The concept of the digital divide has experienced significant transformation since it was first defined in the early 1990s as the difference between the ‘haves’ and the ‘have nots.’ Today, its definition acknowledges the complexities of the phenomenon and covers the differences in Information and Communications Technology access, usage, and outcomes (NDIA, n.d.).

Considerable evidence has accumulated to show that the main barriers to the adoption and use of broadband and related digital technologies are lack of broadband access, affordability issues (covering both broadband service and devices), limited digital literacy and technical skills, and a lack of perceived relevance of connectivity (Consumer Reports, 2021; Horrigan & Duggan, 2015; Perrin, 2021). Previous research has established that sociodemographic and socioeconomic characteristics, such as income, age, race, education, and urbanization, are key predictors of the digital divide (Lythreath et al., 2022). However, the importance of each barrier can differ among various sociodemographic and socioeconomic groups. For

instance, digital literacy may be a significant challenge for senior citizens, while low-income households may recognize the importance of broadband connectivity but struggle to afford it (Dailey et al., 2010; Reisdorf et al., 2018; Whitacre & Rhinesmith, 2016).

Recently, a comprehensive list of sociodemographic and socioeconomic groups that are most likely to be digitally disadvantaged was defined in the Digital Equity Act Sec. 60302(8) and includes low-income families, people with low literacy, racial and ethnic minorities, veterans, and English learners, among others. These identified groups, referred to as the ‘covered populations’ are prioritized in current efforts to bridge the digital divide.

With the substantial expansion of the digital economy, the persistent digital divide is increasingly recognized as a major societal challenge. In addition, largely due to the Covid-19 pandemic, there has been an exponential increase in the interest in digital equity and inclusion over the last five years (World Economic Forum, 2024). The pandemic emphasized the digital equity challenges faced by marginalized communities around the world, including within the United States (Becker et al., 2020; Lai & Widmar, 2021; Watts, 2020).

Addressing digital inequity in communities across the U.S. has risen on the policy agenda of policymakers and practitioners at the local, state, and federal levels, with billions of dollars appropriated to establish initiatives to promote digital equity and inclusion (Morang & Yager, 2022; Pressgrove, 2020). These initiatives vary in scope and aim to address the barriers to broadband adoption and effective use faced by unconnected and underconnected households. Some of the initiatives address the affordability barrier through offerings of free or subsidized broadband service and devices, or public-use broadband and computers. For example, Chicago Connected and PHLConnectED at the city level and the Alabama Broadband Connectivity Program for Students at the state level provided free broadband service to eligible families with K-12 children (ADECA, 2020; *Chicago Connected*, n.d.; *PHLConnectED*, 2024). At the federal level, the Affordable Connectivity Program (ACP) provided monthly rebates on the broadband

service bill of eligible low-income households (*Affordable Connectivity Program*, n.d.).

Some initiatives tackle the issue of internet access by providing hotspots or subsidizing investments in broadband infrastructure. For instance, Alabama, Arkansas, and Oklahoma distributed wireless hotspots to school districts across their states (ADECA, 2020; *CARES Act Hotspot Grants Page*, n.d.; Oliva, 2020). Other efforts focus on improving digital literacy and technical skills by offering free or subsidized training and support from digital navigators. According to the National Digital Inclusion Alliance (NDIA), digital navigators are “trusted guides who assist community members with ongoing, individualized support for accessing affordable and appropriate connectivity, devices, and digital skills” (NDIA, n.d.). In 2022, the Biden-Harris Administration launched the Internet for All initiative, which allocates over \$48 billion for “infrastructure deployment, skills training and access to technologies essential for Americans to connect with their communities, their democracy, and one another” (*Internet for All*, n.d.).

The recent surge in digital inclusion initiatives at various levels has sparked increased interest from researchers and policymakers in evaluating their impact on the communities they aim to serve. With a growing array of programs—such as subsidized broadband, digital literacy training, and digital navigation support—there is a valuable opportunity to examine how these interventions affect communities and individuals who have historically lacked reliable broadband access. Additionally, assessing how effectively current programs achieve their goals can provide insights for designing and implementing more effective and sustainable digital inclusion efforts.

This paper conducts an in-depth review of over 30 sources to explore the literature on the impact of digital inclusion initiatives. It also analyzes the types of programs offered and the digitally vulnerable populations studied.

The structure of this paper is as follows: The next section outlines the methodological approach used in the literature review. Section three presents the findings from the review, and section four offers concluding remarks.

2. Methodology

This study was conducted using a systematic literature review, following the methods and techniques in widely cited review articles (Borges et al., 2021; Jungell-Michelsson & Heikkurinen, 2022; Paul & Feliciano-Cestero, 2021). The key components of the literature review method applied to this study are summarized in Table 1.

Given that this paper attempts to synthesize the recent findings on this topic, in addition to peer-reviewed journal articles, the search also included books and book chapters and sources in the grey literature, including white papers, conference papers, reports, and preprints. Publications were included in the literature review if they were published between January 2019 and April 2024 with the full text available online, written in English, and presented evidence on the impact of one or more digital inclusion initiatives. Therefore, papers that presented findings from a literature review, proposed a framework to guide the evaluation of digital inclusion initiatives, or offered theoretical discussions on the impact of digital inclusion initiatives were excluded.

The search was conducted in two phases. During the first phase, the search strings in Table 2 were used to search online scholarly databases and retrieve articles that met the initial inclusion and exclusion criteria. The first phase search was performed on North Carolina Central University’s (NCCU) library catalog and on Google Scholar to retrieve articles written in English. Although many literature reviews use one or two databases, using an institution’s library search to facilitate searching across multiple databases at once is frequently used in reviews (Li et al., 2021) and suitable for a rapidly growing area of inquiry. The library catalog retrieves results from online scientific databases widely used in literature reviews in the field such as Web of Science, ProQuest, ScienceDirect, JSTOR, etc. The institutional catalog allowed additional filter on subject terms; therefore, the following were selected as additional filter: internet; digital literacy; low-cost; digital tech; digital divide; evaluation; internet access.

Table 1. Key components of the systematic literature review. Adopted from Callahan’s (2014) six W’s framework.

Who conducted the search?	The paper’s author
When was the search conducted?	Dec. 2023 – April 2024
Where were the data collected?	Peer-reviewed journal articles, books/book chapters, theses, and the grey literature including white papers, reports, and conference papers
How were the data found?	1. Database searches 2. Backward snowballing 3. Expert consultation
What was found?	Final dataset of 32 articles
Why were certain works included?	English; published between 2019 and April 2024; analyzed the impact of at least one digital inclusion program

Table 2. Final search strings used to retrieve records from scientific databases.

Database	Search String
Institutional Catalog	("impact" OR "outcomes" OR "effectiveness" OR "evaluation") AND ("digital equity program" OR "digital equity initiative" OR "digital inclusion initiative" OR "digital inclusion program" OR "broadband subsidy" OR "subsidized broadband" OR "low-cost internet" OR "digital literacy training" OR "digital navigator")
Google Scholar	("impact" "outcomes" "effectiveness" "evaluation") AND ("digital equity program" "digital equity initiative" "digital inclusion initiative" "broadband subsidy" "subsidized broadband" "low-cost internet" "digital literacy training" "digital navigator")

Due to the limited search filtering options on Google Scholar, which initially returned over 5,600 articles, the 200 most relevant articles were selected using the Publish or Perish tool (Harzing, 2007). Publish or Perish utilizes Google Scholar's Advanced Scholar Search features to rank results according to their relevance to the search query. This tool enabled us to limit the number of results and ensured that only the most relevant articles were included in the review.

The titles and abstracts of the articles from both the institutional catalog and Publish or Perish were screened. Articles that did not include an empirical assessment of the impact of at least one digital inclusion initiative were excluded. The full text of the remaining articles were then downloaded and further assessed for eligibility.

A secondary search consisting of backward snowball search on the full-text articles from the first phase and the author's expertise in the field was conducted. The author is a multidisciplinary researcher with over 9 years of experience in digital inclusion research. The combined list of articles from the initial and secondary search were read in detail to identify articles that do not meet the study inclusion criteria. The final dataset included in this literature review contained 32 articles, see Appendix A for the complete list. Figure 1 presents an overview of the search and review process with the total number of articles in each phase.

3. Findings and discussions

Taken together, the selected research presents evidence that the increased interest in digital equity and inclusion due to the COVID-19 pandemic among practitioners and policymakers is reflected in the research. The sample shows a marked increase in publications evaluating the impact of digital inclusion initiatives in the years following the start of the pandemic. Among the 32 articles included in the

sample, 9.1% (3 articles) were published in 2019, 12.1% (4 articles) in 2020, 18.2% (6 articles) in 2021, and 27.3% (9 articles) in 2022 and 2023, respectively. While peer-reviewed publications represent the largest share of types of articles in the sample, with 24 articles (72.7%), looking to the grey literature also provides additional insight. See Figure 2 for the distribution of the types of sources included in the final review.

Although the digital divide is a global phenomenon, past research has established that emerging economies are more likely to face significant barriers in access, adoption, and use of broadband. In 2023, compared to 93% of individuals in high-income countries using the internet, in upper- and lower-middle-income countries the rate falls to 81% and 55% respectively, and in low-income countries, only 27% of the population use the internet (*ITU World Telecommunication*, 2023). The articles in the sample suggest that the research on the impact of digital equity initiatives is concentrated in high-income countries. The majority of the articles (73%) investigated initiatives in the United States. Of the eight articles that examined initiatives outside the United States, five focused on high-income countries, two on upper-middle-income countries, and one on a lower-middle-income country. This finding may be because higher-income countries are spending significantly more on digital inclusion initiatives or may reflect an underrepresentation in the research.

3.1. Types of initiatives that have been studied

Several lines of evidence show that beyond the lack of broadband access, the high cost of broadband services and devices, lack of digital skills, and perceived lack of relevance of broadband and related digital technologies are the main reasons why millions of households do not subscribe to broadband at home. For many households, their barrier to subscription is a combination of multiple factors. To meet the needs of the target populations, many digital inclusion initiatives offer solutions that address one or more of these key barriers to home broadband subscription.

Figure 3 presents the proportions of different types of solutions offered by the initiatives in the articles in this review. Just under a third of the articles (30%) evaluated initiatives that offered multiple types of solutions. The most common solution provided by the initiatives studied in the articles is digital literacy training (in 42% of studies), closely followed by subsidized service in just over a third of the studies (36%), and subsidized infrastructure in 21% of the papers.

In 2021, Congress passed the Digital Equity Act Sec. 60302(8) which defined the groups that digital

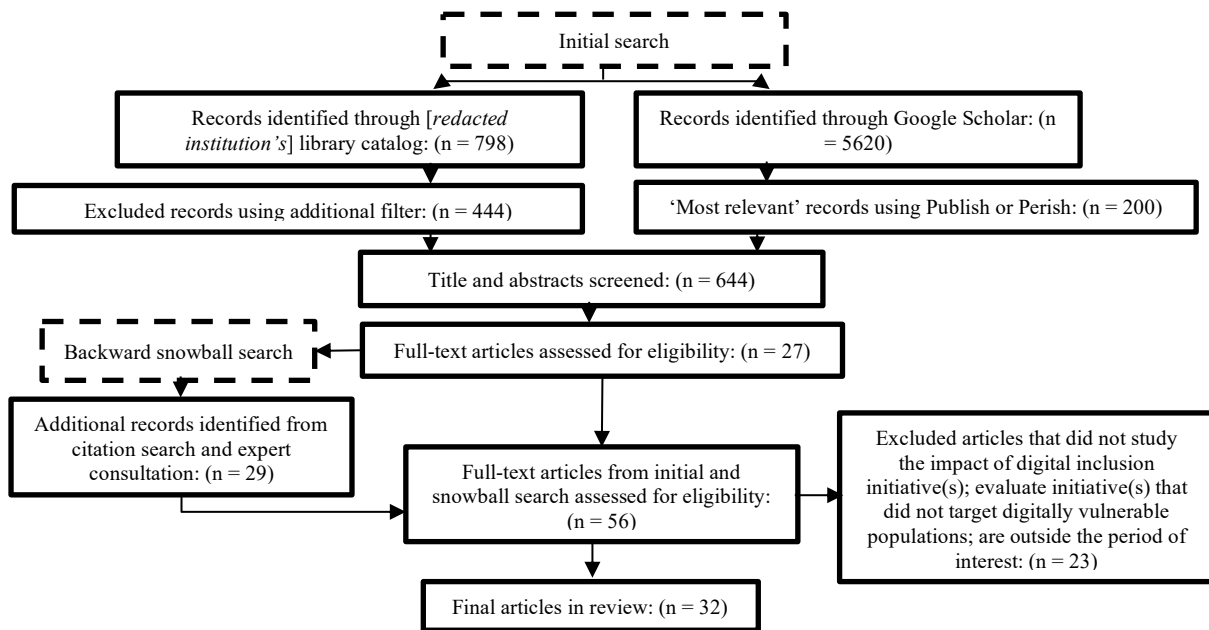


Figure 1. PRISMA flow diagram.

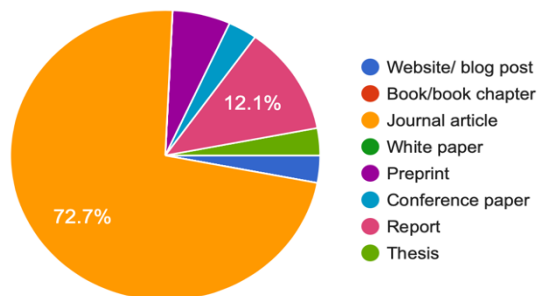


Figure 2. Types of sources.

inclusion efforts should prioritize, called the “covered populations,” and includes veterans, low-income families, people with disabilities, people with low literacy, English learners, racial and ethnic minorities, among others (Digital Equity Act of 2021, 2021). As shown in Figure 4, the leading covered population represented in the research is low-income populations – in just under half of the studies (45%), closely followed by seniors (in 21% of articles) and rural residents (in 18% of the articles). Some articles researched initiatives that targeted groups that are omitted from the “covered populations” such as women, K-12 students and their parents, and refugees and immigrants.

3.2. Impact of digital inclusion initiatives

Overall, this review revealed a breadth in the research on evaluating the impact of digital inclusion initiatives. This finding is somewhat surprisingly

given the fact that the lack of available, systematically-collected program data has been cited as a key challenge to comprehensive program evaluation (Bauer et al., 2023). Reviewing the evaluation practices of digital inclusion organizations in the United States, Rhinesmith (2016) reported that although most organizations recognized the importance of an outcomes-based evaluation, the majority do not have the capacity to support the systematic and timely data collection needed to estimate outcomes. The findings in this review suggests that organizations are increasingly adopting an outcomes-based evaluation.

This paper used the logic model framework of outputs, outcomes, and impacts, which is widely accepted by policymakers and researchers across disciplines, to categorize the findings on the evaluation of digital inclusion initiatives (Rhinesmith, 2016). Figure 5 presents the logic model with the findings on the outputs, outcomes, and impacts seen in the review.

3.2.1. Program outputs. Program outputs are typically quantifiable immediate products or services by the initiative, such as program participation, number of training hours completed, and number of devices distributed. Surprisingly, only two studies in the sample focused on program outputs, see Table 3. While this differs from the findings presented by Rhinesmith (2016) who found that the majority of digital equity organizations evaluate their programs

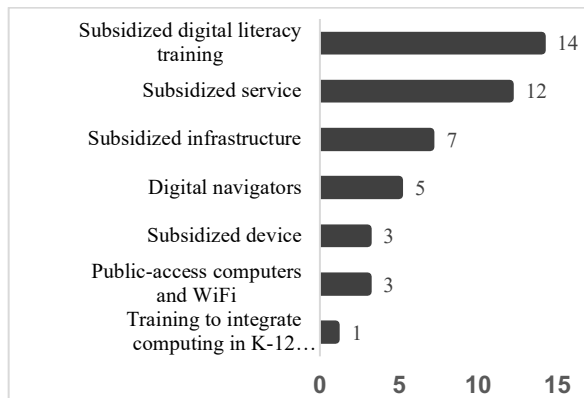


Figure 3. Distribution of solutions offered by the initiatives.

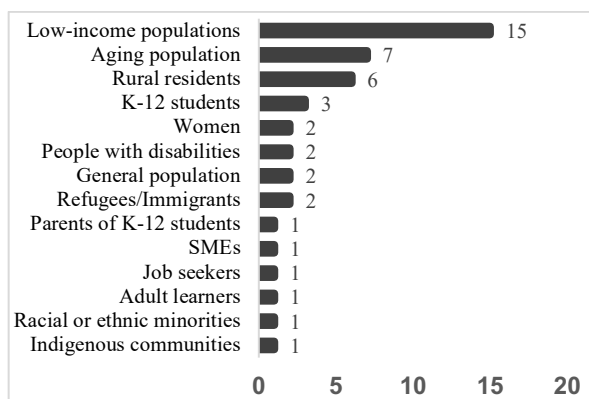


Figure 4. Distribution of covered populations focused on in the literature.

using outputs measures, this inconsistency may be due to limited capacity within these organizations to publish the findings in peer-reviewed journals or the grey literature. Overall, the findings in the articles suggest significant uptake in digital inclusion programs. For instance, using participation rate to normalize the enrollment rate, Ogbo (2022) estimated that over 60% of eligible low-income Alabamian K-12 households enrolled in the statewide broadband subsidy program. While Gauvreau (2023) reported

interesting absolute numbers of appointment requests, clients served, and devices distributed, the findings are somewhat limited by the absence of a discussion about the target population.

3.2.2. Program outcomes. The program outcomes refer to the changes or benefits that result from the program's outputs. They are usually short- to medium-term effects that indicate whether the program is achieving its intended goals.

Over half of the articles (22 papers) examined program outcomes, categorized into broadband adoption, digital literacy, user experiences, and increased use of the internet for economic, health, and education tasks. They measured various factors such as changes in broadband adoption rates, technophobia, misinformation identification, self-confidence, and quality of life (see Table 4 for details).

The studies show mixed results on the impact of digital inclusion initiatives on broadband adoption and digital literacy. Some studies suggest that some initiatives improve broadband adoption rate, particularly among low-income unconnected households, (e.g., Horrigan, 2023; Pender et al., 2022). In contrast, other studies find no evidence of increased adoption or report that initiatives led to plan changes among already connected households, sometimes resulting in lower-speed plans (Galperin, 2022; Hidalgo & Sovinsky, 2023).

The most notable finding is the strong evidence that digital literacy programs enhance participant's skills (e.g., Aggarwal, 2019; Elbaz et al., 2024). Of the six studies showing positive impacts, five focused on seniors. However, there is no evidence that informal help, for example, from unpaid caregivers, improves digital literacy skills (Atasoy, 2023; MacPherson, 2021)

3.2.3. Program impacts. These are the long-term, broader effects of the program on the recipients or their communities. It includes the ultimate and often

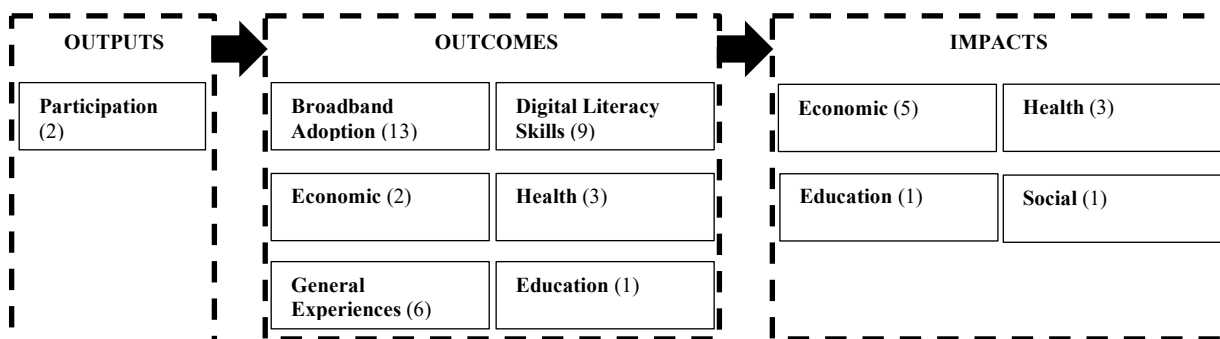


Figure 5. An overview of the high-level impacts that emerged from the review using an outcomes-based program evaluation logic model, with select sources.

Table 4. Summary of findings on program outputs.

Impact	How Impact is Measured <i>Estimated:</i>	Summary of key Findings	Sources in the Literature
Participation	<ul style="list-style-type: none"> Percent of eligible population enrolled in the program. Total appointment requests with a digital navigator; total unique clients served; total devices distributed. 	<ul style="list-style-type: none"> Over 60% of eligible households participated in a statewide broadband subsidy program, with higher participation rates in places with lower median income, higher rates of Black or Hispanic populations, and higher rates of Democrat voters. Within nine months of launching the program across four libraries, there were 1,600 appointment requests, over 700 clients served, and 380 devices distributed. Almost half of the clients required multiple meetings with the digital navigator. 	<ul style="list-style-type: none"> Ogbo, 2022 Gauvreau, 2023

systemic changes due to the program. Bauer et al. (2023) highlight that evaluating the long-term impacts of digital inclusion initiatives requires detailed longitudinal data from various sources and an analysis of how local contexts and policies influence outcomes. Surprisingly, just under a third of the studies (9) examined these impacts, which are categorized into economic, health, education, and social outcomes, as shown in Table 5.

Five studies assessed the economic impacts – such as change in employment rate, income, and improved

farm sales – and reported positive results across varied contexts. These studies focused on rural residents (3) and low-income population (2), evaluating initiatives that offered subsidized infrastructure (4), subsidized service (3), and digital navigation, public Wi-Fi and tech support (1).

The findings on health benefits were mixed, showing varying impacts of digital inclusion initiatives on health. For instance, Vicentin et al. (2020) found significant neuropsychological

Table 3. Summary of findings on program outcomes.

Impact	How Impact is Measured <i>Changes in:</i>	Summary of key Findings	Sources in the Literature
Broadband adoption	<ul style="list-style-type: none"> Challenges using the internet (including difficult to use, unstable, slow, and expensive). Broadband adoption rate. 	<ul style="list-style-type: none"> Initiatives provide internet solutions that are easier to use, more stable, faster, and low-cost or gratis. Low-income families need significant subsidies. DII account for a percentage of new adoption, notably among low-income households; increased adoption across different types of connections (e.g. wireline, wireless, etc.) and devices (with participants owning and being able to use multiple simultaneously) <i>No evidence of increased broadband adoption; households likely to switch to a subsidized plan that has lower speeds</i> <i>No evidence of increased device ownership</i> 	<ul style="list-style-type: none"> Atasoy, 2023; Mendez et al., 2021 Horrigan, 2022, 2023; Pender et al., 2022; Rosston & Wallsten, 2020 Beard et al., 2022; Chang, 2021; Galperin, 2022; Hidalgo & Sovinsky, 2023; Manlove & Whitacre, 2019 Rosston & Wallsten, 2020
Digital literacy	<ul style="list-style-type: none"> Digital literacy scores – using: Computer Proficiency Questionnaire; Mobile Device Proficiency Questionnaire; and Northstar Digital Literacy Assessments –; ability to use various digital applications and digital literacy techniques; technophobia; identifying fake news. 	<ul style="list-style-type: none"> Most studies reported an improvement in digital skills, digital literacy, and confidence in using digital technology. Direct and indirect computer experiences associated with improved tech-related self-efficacy among 4th and 5th graders. Increased accuracy in identifying fake news. <i>Informal help is ineffective in improving sophisticated internet use</i> 	<ul style="list-style-type: none"> Aggarwal, 2019; Elbaz et al., 2024; Lee & Kim, 2019; Moore & Hancock, 2022; Ngiam et al., 2022; Ollerenshaw et al., 2021; Quialheiro et al., 2023 Atasoy, 2023; MacPherson, 2021
Economic	<ul style="list-style-type: none"> Internet use to search/apply for jobs. Participation in economic benefit programs 	<ul style="list-style-type: none"> <i>No evidence of improved employment outcomes</i> Increased SSDI participation, with larger effect in areas with limited access to physical SSA offices 	<ul style="list-style-type: none"> Valentin-Sívico et al., 2023 G. Zuo & Powel, 2023
Health	<ul style="list-style-type: none"> Health literacy; health-related searches; use of telehealth and patient portal. 	<ul style="list-style-type: none"> Significant improvement in health literacy <i>No evidence of significant increase in health-related use</i> 	<ul style="list-style-type: none"> Lee & Kim, 2019; Quialheiro et al., 2023 Valentin-Sívico et al., 2023
Education	<ul style="list-style-type: none"> Self-reported distance learning, homework, and search for education. 	<ul style="list-style-type: none"> <i>No evidence of changes in internet use for education.</i> 	<ul style="list-style-type: none"> Valentin-Sívico et al., 2023
Other experiences	<ul style="list-style-type: none"> Self-confidence; quality of life; use of time. 	<ul style="list-style-type: none"> Improved self-confidence, independence, and reconfiguration of time spent by women on domestic responsibilities – with women negotiating more time to spend online. 	<ul style="list-style-type: none"> Aggarwal, 2019; Arroyo, 2020; MacPherson, 2021

Negative findings are italicized.

Table 5. Summary of findings on program impacts.

Impact	How Impact is Measured <i>Changes in:</i>	Summary of key Findings	Sources in the Literature
Economic	<ul style="list-style-type: none"> • Employment rate; income; remote work; and farm sales. 	<ul style="list-style-type: none"> • Evidence of improved employment rates, earnings, farm sales, and telework reported by multiple sources, with some evidence of a spillover effect on nearby locations that did not participant in a program. 	<ul style="list-style-type: none"> • (Bai et al., 2022; Horrigan, 2024; Pender et al., 2022; Rupasingha et al., 2023; G. W. Zuo, 2021)
Health	<ul style="list-style-type: none"> • Quality of life and personal wellbeing); mental health outcomes (such as social functioning and negative thoughts); scores on neuropsychological tests 	<ul style="list-style-type: none"> • Improved neuropsychological outcomes compared to control group, with additional training linked with higher scores • <i>No evidence of improvement in mental health clinical outcomes or personal wellbeing</i> 	<ul style="list-style-type: none"> • Vicentin et al., 2020 • Camacho & Torous, 2023; Ngiam et al., 2022
Education	<ul style="list-style-type: none"> • Attitudes towards STEM. 	<ul style="list-style-type: none"> • Improved STEM attitudes among 4th and 5th graders with direct and indirect computer experiences. 	<ul style="list-style-type: none"> • Huang et al., 2020;
Social	<ul style="list-style-type: none"> • Self-reported social connectedness and loneliness. 	<ul style="list-style-type: none"> • <i>No improvements in loneliness, social connectedness, quality of life, and personal well-being</i> 	<ul style="list-style-type: none"> • Ngiam et al., 2022

Negative findings are italicized.

improvements in older adults who participated in a digital literacy training while Ngiam et al. (2022) found no evidence of improved quality of life or reduced loneliness among older adults in Singapore who joined a similar program.

4. Conclusion

To bridge the digital divide, federal, state, and local entities are creating digital inclusion initiatives to help digitally vulnerable populations access and use the internet effectively. The expansion of these initiatives has renewed interest in their impact in communities. Ongoing research is essential to understand and improve their effectiveness in bridging the divide. This study provides a review of research on the evaluation of digital inclusion initiatives, focusing on: (1) the types of evaluated solutions; (2) the populations studied; and (3) their impact.

Digital literacy training was the most common solution that has been evaluated, followed by broadband subsidies. Low-income populations were the most studied group. However, some covered populations, such as veterans and incarcerated individuals, were notably absent from the research. The literature presents mixed results on the impact of digital inclusion initiatives. While some studies report improved adoption rates, employment, earnings, and eHealth literacy, others find no benefit.

This review has some limitations. It used NCCU’s library catalog, which, while comprehensive, affects reproducibility. Further, the relationship between outputs, outcomes, and impacts is not assessed.

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References

- ADECA. (2020). *Memorandum of Understanding Between the State of Alabama Department of Finance and ADECA*. <https://governor.alabama.gov/assets/2020/07/Finance-ADECA-MOU-ABC-for-Students.pdf>
- Affordable Connectivity Program. (n.d.). Universal Service Administrative Company. Retrieved June 13, 2024, from <https://www.usac.org/about/affordable-connectivity-program/>
- Aggarwal, S. (2019). *Opportunities and Challenges in Digital Literacy: Assessing the Impact of Digital Literacy Training for Empowering Urban Poor Women*. <https://www.defindia.org/wp-content/uploads/2021/11/Final-Report-Digital-literacy-Institute-of-Home-Economics.pdf>
- Arroyo, L. (2020). *Implications of Digital Inclusion: Digitalization in Terms of Time Use from a Gender Perspective*. 8(2), 180–189. <https://doi.org/10.17645/si.v8i2.2546>
- Atasoy, H. (2023). *Lessons from the Social Impact Evaluation of Project OVERCOME*. US Ignite. <https://www.us-ignite.org/wp-content/uploads/2023/05/Lessons-from-Social-Impact-Evaluation-of-Project-OVERCOME.pdf>
- Bai, Y., Wang, R. Y., & Jayakar, K. (2022). What \$2.5 billion can buy: The effect of the Broadband Initiatives Program on farm productivity. *Telecommunications Policy*, 46(7), 102404. <https://doi.org/10.1016/j.telpol.2022.102404>
- Bauer, J. M., Dagg, P. R., Rhinesmith, C., Byrum, G., & Schill, A. (2023). A Comprehensive Framework to Monitor, Evaluate, and Guide Broadband and Digital Equity Policy. *TPRC51*. The Research Conference on Communication, Information and Internet Policy, Washington DC. <https://doi.org/10.2139/ssrn.4557340>
- Beard, T. R., Ford, G., & Stern, M. (2022). *Bridging the Digital Divide: An empirical analysis of public programs to increase broadband adoption*. 67(101754). <https://doi.org/10.1016/j.tele.2021.101754>

- Becker, J., Washington, J., Naff, D., Woodard, A., & Rhodes, J. (2020). Digital Equity in the time of COVID-19: The Access Issue. *MERC Publications*. https://scholarscompass.vcu.edu/merc_pubs/115
- Borges, A. F. S., Laurindo, F. J. B., Spinola, M. M., Gonçalves, R. F., & Mattos, C. A. (2021). The strategic use of artificial intelligence in the digital era: Systematic literature review and future research directions. *International Journal of Information Management*, 57, 102225. <https://doi.org/10.1016/j.ijinfomgt.2020.102225>
- Callahan, J. L. (2014). *Writing Literature Reviews: A Reprise and Update*. 13(3), 271–275. <https://doi.org/10.1177/1534484314536705>
- Camacho, E., & Torous, J. (2023). Impact of Digital Literacy Training on Outcomes for People With Serious Mental Illness in Community and Inpatient Settings. *Psychiatric Services*, 74(5), 534–538. <https://doi.org/10.1176/appi.ps.20220205>
- CARES Act Hotspot Grants Page. (n.d.). Oklahoma State Department of Education. Retrieved June 13, 2024, from <https://sde.ok.gov/cares-act-hotspot-grants-page>
- Chang, J. (2021). Broadband technology opportunities program public computer center grants and residential broadband adoption. *Telecommunications Policy*, 45(8), 102147. <https://doi.org/10.1016/j.telpol.2021.102147>
- Chicago Connected. (n.d.). Chicago Public Schools. Retrieved June 13, 2024, from <https://www.cps.edu/strategic-initiatives/chicago-connected/>
- Consumer Reports. (2021). *Broadband Survey. A Nationally Representative Multi-Mode Survey*. https://advocacy.consumerreports.org/wp-content/uploads/2021/08/CR_Broadband-Survey_8_2021_VF.pdf
- Dailey, D., Bryne, A., Powell, A., Karaganis, J., & Chung, J. (2010). *Broadband Adoption in Low-Income Communities*. <https://www.ssrc.org/publications/broadband-adoption-in-low-income-communities/>
- Digital Equity Act of 2021, H.R. 1841, Congress (2021). <https://www.congress.gov/bills/117th-congress/house-bill/1841/text?s=1&r=86&q=%7B%22search%22%3A%5B%22hr+3%22%5D%7D>
- Elbaz, S., Gruber, J., Elberhoumi, K., Bukhari, S. N., Rej, S., & Sekhon, H. (2024). Evaluation of a virtual 4-week digital literacy program for older adults during COVID-19: A pilot study. *Educational Gerontology*, 50(4), 296–303. <https://doi.org/10.1080/03601277.2023.2268499>
- Galperin, H. (2022). A Failed Regulatory Remedy? An Empirical Examination of Affordable Broadband Plan Obligations. *International Journal of Communication*, 16(0), Article 0.
- Gauvreau, C. (2023). Digital navigation pilots in four public libraries. *Public Services Quarterly*, 19(2), 119–124. <https://doi.org/10.1080/15228959.2023.2169804>
- Harzing, A.-W. (2007). *Publish or Perish* [Computer software]. <https://harzing.com/resources/publish-or-perish>
- Hidalgo, J., & Sovinsky, M. (2023). *Subsidies, Speed and Switching? Impacts of an Internet Subsidy in Colombia*. Research Square. <https://doi.org/10.21203/rs.3.rs-3197174/v1>
- Horrigan, J. B. (2022). *Broadband Benefit Programs are Helping to Close the Digital Divide Four Lessons for Policymakers*. Benton Institute for Broadband & Society. <https://www.benton.org/sites/default/files/FourLessons.pdf>
- Horrigan, J. B. (2023, November 1). *Gain and Sustain: The Affordable Connectivity Program is Getting More People Online*. Benton Foundation. <https://www.benton.org/blog/gain-and-sustain-affordable-connectivity-program-getting-more-people-online>
- Horrigan, J. B. (2024). *The Affordable Connectivity Program Creates Benefits that far Outweigh the Program's Cost*. Benton Institute for Broadband & Society. https://www.benton.org/sites/default/files/ACP-Cost-Benefit_0.pdf
- Horrigan, J. B., & Duggan, M. (2015). Home broadband 2015. *Pew Research Center*, 21.
- Huang, K.-T., Ball, C., Cotten, S., & O'Neal, L. (2020). *Effective Experiences: A Social Cognitive Analysis of Young Students' Technology Self-Efficacy and STEM Attitudes*. 8(9). <https://doi.org/10.17645/si.v8i2.2612>
- Internet for All. (n.d.). Internet for All. Retrieved June 13, 2024, from <https://www.internetforall.gov/>
- ITU World Telecommunication (Version Version November 2023, for Facts and Figures 2023). (2023). [Dataset]. ICT Indicators database. <https://www.itu.int:443/en/ITU-D/Statistics/Pages/stat/default.aspx>
- Jungell-Michelsson, J., & Heikkurinen, P. (2022). Sufficiency: A systematic literature review. *Ecological Economics*, 195, 107380. <https://doi.org/10.1016/j.ecolecon.2022.107380>
- Lai, J., & Widmar, N. O. (2021). Revisiting the Digital Divide in the COVID-19 Era. *Applied Economic Perspectives and Policy*, 43(1), 458–464. <https://doi.org/10.1002/aep.13104>
- Lee, O. E.-K., & Kim, D.-H. (2019). Bridging the Digital Divide for Older Adults via Intergenerational Mentor-Up. *Research on Social Work Practice*, 29(7), 786–795. <https://doi.org/10.1177/1049731518810798>
- Li, J., Brar, A., & Roihan, N. (2021). The use of digital technology to enhance language and literacy skills for Indigenous people: A systematic literature review. *Computers and Education Open*, 2, 100035. <https://doi.org/10.1016/j.caeo.2021.100035>
- Lythreathis, S., Singh, S. K., & El-Kassar, A.-N. (2022). The digital divide: A review and future research agenda. *Technological Forecasting and Social Change*, 175, 121359. <https://doi.org/10.1016/j.techfore.2021.121359>
- MacPherson, A. (2021, August 1). *Exploring the Outcomes of Digital Inclusion for Vulnerable Populations in Canada during the COVID-19 Pandemic*. ERA. <https://doi.org/10.7939/r3-mf4g-gg62>

- Manlove, J., & Whitacre, B. (2019). An evaluation of the Connected Nation broadband adoption program. *Telecommunications Policy*, 43(7), 101809. <https://doi.org/10.1016/j.telpol.2019.02.003>
- Mendez, S., Molnar, G., & Savage, S. J. (2021). The Impacts of the Lifeline Subsidy on High-Speed Internet Access. *Journal of Law & Economics*, 64(4), 745–782.
- Moore, R. C., & Hancock, J. T. (2022). A digital media literacy intervention for older adults improves resilience to fake news. *Scientific Reports*, 12(1), 6008. <https://doi.org/10.1038/s41598-022-08437-0>
- Morang, J., & Yager, S. (2022, November 2). *Digital Equity and the Future of Work: How Six Governors are Advancing Digital Skills for Equitable Economic Participation*. National Governors Association. <https://www.nga.org/news/commentary/digital-equity-and-the-future-of-work-how-six-governors-are-advancing-digital-skills-for-equitable-economic-participation/>
- NDIA. (n.d.). *Definitions*. National Digital Inclusion Alliance. Retrieved May 4, 2024, from <https://www.digitalinclusion.org/definitions/>
- Ngiam, N. H. W., Wan, W. Q., Teo, N., Yow, K. S., Soundararajan, A., Lim, J. X., Lim, H. A., Tey, A., Tang, K. W. A., Tham, C. Y. X., Tan, J. P. Y., Lu, S. Y., Yoon, S., Ng, K. Y. Y., & Low, L. L. (2022). *Building Digital Literacy in Older Adults of Low Socioeconomic Status in Singapore (Project Wire Up): Nonrandomized Controlled Trial*. e40341. <https://doi.org/10.2196/40341>
- Ogbo, E. (2022). *Broadband Voucher Programs: Evaluating the Alabama Broadband Connectivity Program* (SSRN Scholarly Paper 4178771). <https://doi.org/10.2139/ssrn.4178771>
- Oliva, J. (2020, July 28). *DESE Arkansas Hotspot Project*. Arkansas Department of Education. <https://adecm.ade.arkansas.gov/ViewApprovedMemo.aspx?Id=4490>
- Ollershaw, A., Corbett, J., & Thompson, H. (2021). Increasing the digital literacy skills of regional SMEs through high-speed broadband access. *Small Enterprise Research*, 28(2), 115–133. <https://doi.org/10.1080/13215906.2021.1919913>
- Paul, J., & Feliciano-Cestero, M. M. (2021). Five decades of research on foreign direct investment by MNEs: An overview and research agenda. *Journal of Business Research*, 124, 800–812. <https://doi.org/10.1016/j.jbusres.2020.04.017>
- Pender, J., Goldstein, J., & Mahoney-Nair, D. (2022). Impacts of the Broadband Initiatives Program on broadband adoption and home telework. *Telecommunications Policy*, 46(8), 102365. <https://doi.org/10.1016/j.telpol.2022.102365>
- Perrin, A. (2021). *Mobile Technology and Home Broadband 2021*. Pew Research Center: Internet, Science & Tech. <https://www.pewresearch.org/internet/2021/06/03/mobile-technology-and-home-broadband-2021/>
- PHLConnectED. (2024, April 24). City of Philadelphia. <https://www.phila.gov/programs/phlconnected/>
- Pressgrove, J. (2020, November 30). *States Prioritized Broadband as COVID-19 Took Hold*. Government Technology. <https://www.govtech.com/network/States-Prioritized-Broadband-as-COVID-19-Took-Hold.html>
- Quialheiro, A., Miranda, A., Garcia Jr, M., Carvalho, A. C. D., Costa, P., Correia-Neves, M., & Santos, N. C. (2023). Promoting Digital Proficiency and Health Literacy in Middle-aged and Older Adults Through Mobile Devices With the Workshops for Online Technological Inclusion (OITO) Project: Experimental Study. *JMIR Formative Research*, 7, e41873. <https://doi.org/10.2196/41873>
- Reisdorf, B., Hampton, K., Fernandez, L., & Dutton, W. H. (2018). Broadband to the Neighborhood: Digital Divides in Detroit. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.3103457>
- Rhinesmith, C. (2016). *Digital Inclusion and Meaningful Broadband Adoption Initiatives*. Benton Foundation.
- Rosston, G. L., & Wallsten, S. J. (2020). Increasing low-income broadband adoption through private incentives. *Telecommunications Policy*, 44(9), 102020. <https://doi.org/10.1016/j.telpol.2020.102020>
- Rupasingha, A., Pender, J., Williams, R., Goldstein, J., & Nair, D. (2023). Place-based subsidies and employment growth in rural America: Evidence from the broadband initiatives programme. *Papers in Regional Science*. https://www.sciencedirect.com/science/article/pii/S1056819023026581?ref=pdf_download&f=RR-9&rr=8687ad51d8a13b5f
- Valentín-Sívico, J., Canfield, C., Low, S. A., & Gollnick, C. (2023). Evaluating the impact of broadband access and internet use in a small underserved rural community. *Telecommunications Policy*, 47(4), 102499. <https://doi.org/10.1016/j.telpol.2023.102499>
- Vicentin, A. P., Simões, E. J., Bonilha, A. C., Lamoth, C., Andreoni, S., & Ramos, L. R. (2020). Effects of combined digital inclusion and physical activity intervention on the cognition of older adults in Brazil. *Gerontechnology*, 19(3), 1–10. <https://doi.org/10.4017/gt.2020.19.003.10>
- Watts, G. (2020). COVID-19 and the digital divide in the UK. *The Lancet. Digital Health*, 2(8), e395–e396. [https://doi.org/10.1016/S2589-7500\(20\)30169-2](https://doi.org/10.1016/S2589-7500(20)30169-2)
- Whitacre, B., & Rhinesmith, C. (2016). Broadband unadopters. *Telecommunications Policy*, 40(1), 1–13. <https://doi.org/10.1016/j.telpol.2015.11.008>
- World Economic Forum. (2024, January 16). *Accelerating digital inclusion for 1 billion people by 2025*. World Economic Forum. <https://www.weforum.org/impact/digital-inclusion/>
- Zuo, G., & Powel, D. (2023). *The Impact of Affordable and Accessible Broadband on SSDI and SSI Participation*. University of Michigan Retirement and Disability Research Center (MRDRC) Working Paper. <https://mrdrc.isr.umich.edu/publications/papers/pdf/wp467.pdf>
- Zuo, G. W. (2021). Wired and Hired: Employment Effects of Subsidized Broadband Internet for Low-Income Americans. *American Economic Journal: Economic Policy*, 13(3), 447–482. <https://doi.org/10.1257/pol.20190648>

Appendix A. Final data from the systematic literature review

Source	Target Population(s)	Program Offering(s)	Impact Studied	Period of analysis
Aggarwal et. al (2019)	Rural residents, Women	Digital literacy training	Digital literacy, General experiences	2018
Arroyo (2020)	Women	Digital literacy training	General experiences	2014
Atasoy (2023)	General population	Subsidized infrastructure	Broadband adoption, Broadband use patterns, General experiences	2021-2022
Bai et al. (2022)	Rural residents	Subsidized infrastructure	Economic outcomes	2008-2013
Beard et al. (2022)	General population	Digital literacy training, Public Computer and Public Internet Access	Broadband adoption	2007-2015
Camacho & Torous (2023)	Mental Health Patients	Digital literacy training, Digital navigators	Health outcomes	2021
Chang (2021)	-	Digital literacy training, Public Computer and Public Internet Access	Broadband adoption	2009-2014
Elbaz et al. (2024)	Seniors	Digital literacy training	Digital literacy	2021
Galperin (2022)	Low-income	Subsidized service	Broadband adoption	2014-2020
Gauvreau (2023)	Low-income, Seniors, Refugees, Immigrants, K-12 Parents, Adult Learners, Graduating High School Seniors	Digital navigators	Program participation	2021-2022
Hidalgo & Sovinsky (2023)	Low-income	Subsidized service	Broadband adoption, Switching plans	2013-2014
Horrigan (2022)	-	Not Specified	Broadband adoption	2019 - 2021
Horrigan (2023)	Low-income	Subsidized service	Broadband adoption	2019; 2021; 2022
Horrigan (2024)	Low-income	Subsidized service	Economic outcomes	2019 - 2022
Huang et al. (2020)	Low-income, Racial or ethnic minorities, K-12 students	Training to integrate computing in K-12 curriculum	Education outcomes, General experiences	2012 - 2013
Lee & Kim (2019)	Low-income, Seniors	Digital literacy training, Digital navigators	Health outcomes	2015-2016
MacPherson (2021)	Low-income, Indigenous communities	Subsidized service, Subsidized device	General experiences	2021
Manlove & Whitacre (2019)	-	Digital literacy training	Broadband adoption	2008 - 2016
Mendez et al. (2021)	Low-income	Subsidized service	Broadband adoption	2012-2015
Moore & Hancock (2022)	Seniors	Digital literacy training	Digital literacy skills	2020
Ngiam et al. (2022)	Low-income seniors	Subsidized service, Subsidized device, Digital literacy training, Digital navigators	Health outcomes, Digital literacy, Social connectedness; quality of life; loneliness; overall well-being	2020 - 2021
Ogbo (2022)	Low-income K-12 families	Subsidized infrastructure, Subsidized service	Program participation	2019 - 2020
Ollerenshaw et al. (2021)	SMEs	Digital literacy training	Digital literacy skills	2015
Pender et al. (2022)	Rural residents	Subsidized infrastructure, Digital navigators, Broadband in rural libraries and tech support	Broadband adoption, Economic outcomes, Remote work	2013-2016; 2014-2018
Quialheiro et al. (2023)	Seniors	Digital literacy training	Health outcomes, Digital literacy	2021 - 2022
Rosston & Wallsten (2020)	Low-income	Subsidized service	Broadband adoption	2011-2015
Rupasingha et al. (2023)	Rural residents	Subsidized infrastructure	Economic outcomes	2010-2019
Valentín-Sívico et al. (2023)	Rural residents	Subsidized infrastructure	Broadband adoption, Health outcomes, Economic outcomes, Education outcomes	2021-2022
Vicentin et al. (2020)	Seniors	Digital literacy training	Health outcomes	2016
Wedlake, Ramirez, et al. (2021)	Low-income, job seekers	Subsidized service, Subsidized device, Digital navigators	Broadband adoption, Economic outcomes, Digital literacy, General experiences	2020
Zuo (2021)	Low-income	Subsidized service	Economic outcomes	2009-2015
Zuo & Powell (2023)	Low-income, people with disabilities	Subsidized service	Economic outcomes	2009-2019