From:	Liz Hegarty
To:	CA Broadband Council
Cc:	Amina Fazlullah
Subject:	Common Sense public comment for CA Broadband Plan
Date:	Wednesday, November 11, 2020 2:45:11 PM
Attachments:	Common Sense_Written Comment_California Broadband Council.pdf

Dear California Broadband Council:

Attached please find Common Sense's public comment for the California Broadband Council. This document includes an overview of key considerations as well as the latest research from Common Sense on the digital divide.

Please feel free to reach out if we can be of any further assistance moving forward.

Best,

Liz Hegarty

Liz Hegarty
Legislative Director | **Common Sense** Kids Action
[redacted]

November 11, 2020

California Broadband Council
1325 J Street
Suite 1600
Sacramento, CA 95814-2941

Subject: State Broadband Action Plan

Dear California Broadband Council,

Thank you for your work to expand broadband access in California and for your consideration of our comments. For more than 15 years, Common Sense has been a leading advocate for kids and families in the digital age. Our work has centered on helping parents, educators, and students to have a balanced, healthy and high quality digital learning and social experience. We have also led the charge to close the "Homework Gap" that has left millions of low-income children and children of color, and their families, at a disadvantage to their wealthier and whiter peers.

In California, about 25% of students and eight percent of teachers lacked access to adequate internet at home[1] before the pandemic struck and only 59% of rural California residents have access to broadband at home,[2] leaving them at a significant disadvantage as educators and families rely on the internet to access not only education but telehealth and emergency services. Currently, only half of families in the bottom 20% of household income in the state have a computer and high-speed broadband. This compares to over 90% of families in the top 20%.[3] Communities of color and rural communities are disproportionately affected by the digital divide, in California of students who lack connectivity 60% are Black, Latino, or Native American.[4] Students who cannot get online struggle to finish homework, keep up with their peers, and miss out on critical education opportunities. These same families would have limited access to telemedicine and critical public health information if they lack access to high-speed broadband.

Students, parents and teachers from around the state are already impacted by lack of access to high-speed internet. Families who previously thought their broadband connection was "enough" are now finding that to stand up remote work, learning and telemedicine they need consistent broadband speeds of at least 25 mbps symmetrical. With videoconferencing increasingly used for distance learning, coupled with other household video needs like working-from-home and telemedicine, both household download and upload speed requirements are increasing. For a single user, 25 Mbps / 3 Mbps, corresponding to download and upload speeds, respectively, is a reasonable minimum standard. However, this minimum speed benchmark corresponds only to each concurrent user's requirement. Households with multiple users—including parents and family members—will require speeds directly proportional to the number of concurrent users. Past analyses have found that some subscribers, particularly for DSL and satellite service, encounter significantly lower-than- advertised speeds, with more than 30 percent of subscribers experiencing a median download speed less than 80 percent of the advertised speed.[5]

[1] Common Sense and Boston Consulting Group. Closing the K–12 Digital Divide in the Age of Distance Learning. June 2020.
[2] PPIC, California's Digital Divide, 2017.
[3] USC Annenberg Research Network on International Communication. Mapping the distance learning gap in CA. May 2020.
[4] Common Sense and Boston Consulting Group. Closing the K–12 Digital Divide in the Age of Distance Learning. June 2020.
[5] Ibid.

While communities across the state are working together on short term fixes to address the digital divide, the need for connectivity persists and it will outlast the pandemic. School districts, such as LAUSD, have succeeded in addressing emergency connectivity needs related to school closures, but have also recognized the need for continuing support to ensure the ongoing sustainability of connectivity efforts, such as identifying and advocating for additional external sources of funding, beyond school budgets, to cover universal access and support costs.[6]

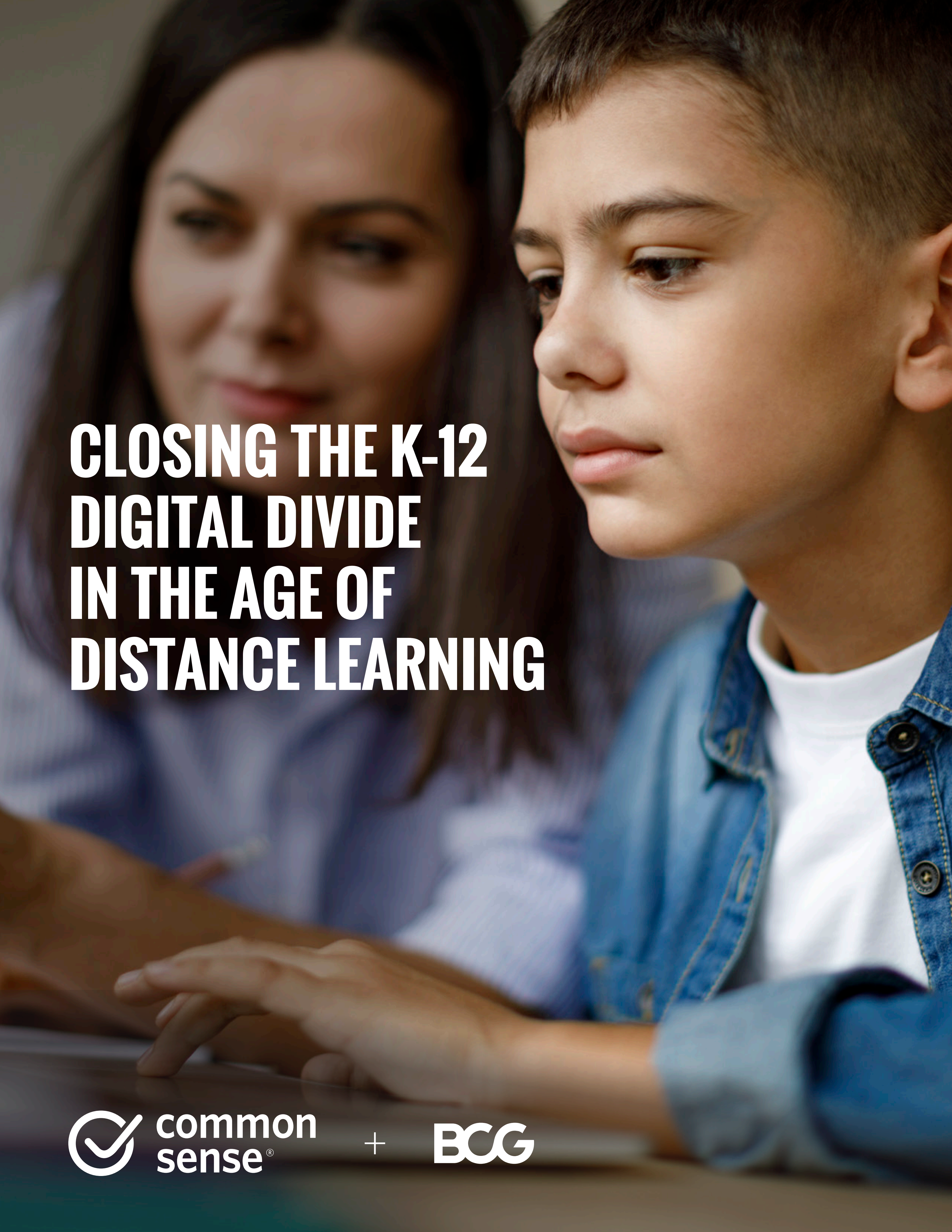
To help guide policymakers, educators, and industry grappling with increased distance learning demands during the coronavirus pandemic and over the long term, Common Sense partnered with a leading consulting firm to produce two of the most current and detailed analyses of just how big the digital divide is for California's and all of America's students and their teachers, how much would it cost to close the divide, what technical requirements should be met in doing so, and what some states and school districts are doing now that can be models for success. Attached, please find *Closing the K–12 Digital Divide in the Age of Distance Learning*, conducted with Boston Consulting Group, and *Connect All Students: How States and School Districts Can Close the Digital Divide*, on which we partnered with EducationSuperHighway as well as Boston Consulting Group. Solutions in these reports are based on evidence from states and school districts across the country and in California that have successfully addressed the divide during the pandemic.

Please feel free to contact us if we can be of any further assistance.

Sincerely,

Elizabeth Galicia
Vice President, Common Sense Advocacy

[6] Chandra, S., Fazlullah, A., Hill, H., Lynch, J., McBride, L., Weiss, D., Wu, M. (2020). Connect all students: How states and school districts can close the digital divide. San Francisco, CA: Common Sense Media.



CLOSING THE K-12 DIGITAL DIVIDE IN THE AGE OF DISTANCE LEARNING

common sense® + BCG

This report was developed by Boston Consulting Group in partnership with Common Sense.

Common Sense is the nation's leading nonprofit organization dedicated to improving the lives of all kids and families by providing the trustworthy information, education, and independent voice they need to thrive in the 21st century.

Boston Consulting Group partners with leaders in business and society to tackle their most important challenges and capture their greatest opportunities in order to unlock the potential of those who advance the world.

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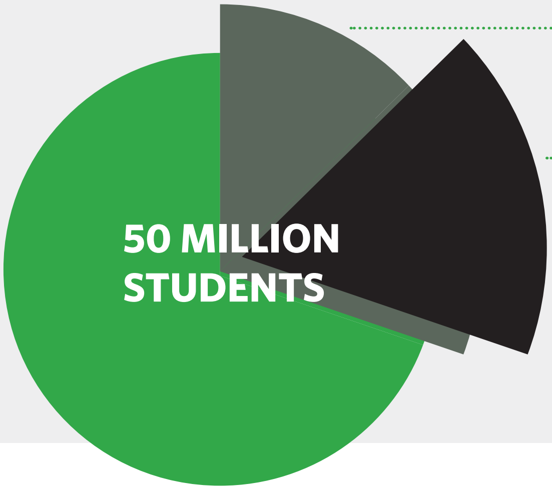
CLOSING THE K-12 DIGITAL DIVIDE IN THE AGE OF DISTANCE LEARNING

Due to COVID-19 school facility closures, 50 million K-12 public school students have had to learn remotely from home

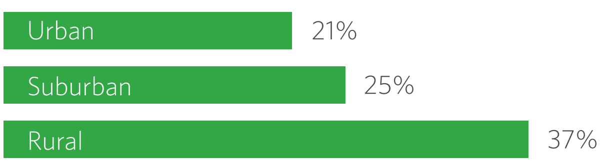


15 MILLION TO 16 MILLION (~30%)
of these students lack adequate internet or devices to sustain effective distance learning at home

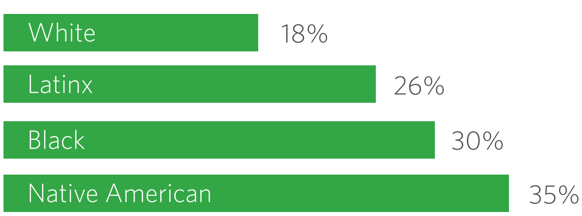
9 MILLION
of these students lack both adequate internet and devices

The digital divide is a major problem across all 50 states

% OF STUDENTS WITHOUT ADEQUATE CONNECTIVITY
by geography



by race/ethnicity



Even in states with the smallest divides, **~1 IN 4 STUDENTS** still lack adequate internet

For states with the largest divides, **~HALF OF STUDENTS** lack adequate internet

Furthermore, up to **400,000 TEACHERS** can't teach because of lack of internet

Nearly all students in the US are expected to be learning remotely in the Fall; the digital divide will prevent many students from accessing the education they deserve

Where do we go from here? How do we close the digital learning divide once and for all?

Closing the student digital divide will require action from Congress to invest $6 billion to $11 billion in the first year, and an additional $1B for teachers

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KEY FINDINGS

A new analysis by Common Sense and BCG of the digital divide for America's K-12 public school students and teachers finds that the "homework gap" is larger than previously estimated.

- Approximately 15 million to 16 million K-12 public school students, or 30% of all public K-12 students, live in households either without an internet connection or device adequate for distance learning at home, a higher number than previously recorded; and of these students, approximately nine million students live in households with neither an adequate connection nor an adequate device for distance learning.
- The homework gap isn't just about homework anymore; lack of access to the internet and a distance learning device during the COVID-19 pandemic school closures puts these students at risk of significant learning loss.
- This analysis identifies students lacking baseline technology requirements for distance learning, including reliable high-speed internet, sufficient data plans, and a computer, laptop or tablet device.
- The digital divide is a major problem for students in all 50 states and all types of communities but is most pronounced in rural communities and households with Black, Latinx, and Native American students.
- 300,000 to 400,000 K-12 teachers live in households without adequate internet connectivity, roughly 10 percent of all public school teachers, and 100,000 teachers lack adequate home computing devices.
- The cost of closing the digital divide for students is at least $6 billion and as much as $11 billion in the first 12 months, and it would cost an additional $1 billion to close the divide for teachers.
- The novel coronavirus pandemic has changed the nature of the homework gap, exacerbated existing inequities in education, and heightened the urgent need for Congress and the states to provide emergency funding to ensure all students have equal access to distance learning.
- The private sector, districts, and education support organizations also have important roles to play in this challenge to identify the right technology that meets the unique needs of their students and teachers today while fitting their long-term digital aspirations, and that are delivered systematically and equitably to districts across the United States.

INTRODUCTION

Across the United States, even before the onset of the novel coronavirus pandemic, there was a significant digital divide between K-12 students with and without access to high speed internet and computing devices at home, known as the "homework gap."[1] A new analysis by Common Sense and BCG finds that the nature of the homework gap has changed in this period of distance learning caused by the pandemic, and that the gap is larger than previously understood. The analysis puts a first-year price tag on closing the gap, and for the first time estimates the digital divide for public school teachers. This report provides a detailed assessment of the digital divide's interrelated components of internet connection and devices, and their respective technical requirements, which are needed to ensure adequate distance learning for today's K-12 students and teachers.

This analysis, combining the most recent 2018 data from the U.S. Census Bureau and the National Center for Education Statistics, shows that before the pandemic an estimated **15 million to 16 million K-12 public school students lived in households without either an internet connection or a device adequate for distance learning at home**,[2] representing 30% of all public K-12 students. **Of these students, approximately nine million students live in households with neither an adequate connection nor an adequate device for distance learning**.

Our new interactive map[3] shows this student digital divide is a major problem across all 50 states. The **digital divide affects every state and every type of community, but it is more pronounced in rural communities and for Black, Latinx, and Native American households**; while 18 percent of White households lack broadband, 26 percent of Latinx, 30 percent of Black, and 35 percent of Native American student households lack adequate home internet access.[4] In rural communities, 37 percent of students are without a home broadband connection compared to 25 percent in suburban households and 21 percent in urban areas.[5]

Distance learning that offers real-time interaction with teachers and classmates and allows for effective engagement with curriculum and assignments requires reliable high-speed internet, sufficient data plans, and a computer, laptop, or tablet device; this analysis estimates the number of students in households who lack these distance learning requirements, including students that only have access to internet via a cellular connection on a mobile device. This is an important distinction in the context of today's distance learning environment, to ensure equitable access to technology resources.

Teachers are also affected by lack of home internet and devices; based on this new analysis, our report shows that **approximately 300,000 to 400,000 public school teachers (8 percent) lack access to adequate connectivity and 100,000 (3 percent) lack devices**, limiting the distance learning potential for entire classrooms of students.

In addition to revealing a new and larger estimate of the size of the student digital divide, and an assessment of the digital divide for teachers, our report estimates that **the cost of closing the digital divide for K-12 public school students ranges from $6 billion to $11 billion in the first year, and up to an additional $1 billion for teachers**. This estimate covers the costs of an adequate internet plan, related connectivity expenses, and a computer, laptop, or tablet for all students and teachers that are "digitally divided."

This student digital divide has long been a challenge for many, fueling economic inequality and lost opportunity—with some students and families unable to complete homework assignments or gain experience with the tools essential for professional success later in life. Yet, the COVID-19 pandemic has exacerbated this problem, causing an unprecedented disruption in the U.S. educational system. Nearly all U.S. public schools closed early this year, driving more than 50 million students to transition to full-time distance learning from home. While nationwide, 99% of public schools have high-speed broadband access,[6] distance learning from home presents many challenges, with the potential for significant inequities given internet and device gaps. Digital platforms are often the only option for educators to stay safely and deeply connected to their students' development at this time.

1. FCC Commissioner Jessica Rosenworcel is credited with first using the term "homework gap" which sheds light on this critical problem for K-12 students. In this report, we expand the definition of the "homework gap"to refer to students who cannot complete homework that requires internet and computing devices at home.
2. Did not account for effects of COVID-19 pandemic. Adequate internet connection is defined as fixed, high-speed broadband, and cellular or satellite networks when combined with sufficient data plans for distance learning and the necessary hardware to connect to a distance learning-appropriate device (e.g., hot spot device to connect to laptop, LTE-enabled device); adequate internet connection excludes dial-up as well as cellular networks with connection through mobile phones only. 2018 National Center for Education Statistics (NCES) data.
3. Please follow this link to explore Common Sense Media's interactive map of the digital divide: https://www.commonsensemedia.org/digital-divide-stories#/state
4. U.S. Congress Joint Economic Committee. (2017, September). *America's digital divide*. Retrieved from https://www.jec.senate.gov/public/_cache/files/ff7b3d0b-bc00-4498-9f9d-3e56ef95088f/the-digital-divide-.pdf.
5. Perrin, A. *Digital Gap between Rural and Nonrural America Persists*. Pew Research Center. 31 May 2019. Retrieved from www.pewresearch.org/fact-tank/2019/05/31/digital-gap-between-rural-and-nonrural-america-persists/.
6. EducationSuperHighway. (2019). *2019 State of the States*. Retrieved from https://s3-us-west-1.amazonaws.com/esh-sots-pdfs/2019%20State%20of%20the%20States.pdf.

The "homework gap" is no longer just about homework; it's about access to education. In this new environment, with the prospect of extended distance learning this summer and into the fall, lack of technology access will significantly impact students' ability to learn and engage, accelerating learning loss for students cut off from teachers and peer resources. One study projects that **by the start of the next school year, the average student may have lost up to a third of their expected progress from the prior year in reading and half of their expected progress in math due to recent school closures from COVID-19**.[7]

In this crisis, closing the digital divide is more critical than ever. Given the uncertain prospects of both virus progression and availability of appropriate vaccines and treatment, some states have already announced fully distance learning or blended instructional models for the upcoming academic year.[8] As this crisis extends into the long term, schools will need support preparing for distance delivery in the upcoming academic year. **Addressing COVID-19 learning disruptions with internet and learning devices will serve an urgent need to enable effective distance learning and mitigate learning loss; it will also position communities that have long struggled with the digital divide with equitable technology resources to better succeed in the future.**

Schools and school districts; local, state and federal governments; the private sector; and philanthropies are rapidly working to address the digital divide. Yet, data limitations and a wide range of national-level estimates available have hampered efforts to create a structured, systematic approach to the problem schools face today. Our analysis builds state-level granularity, leverages the most recent Census data available reflecting household technology adoption, and builds a methodology that aligns to technical specifications required for learning from home.[9] **Our study builds a fact base around the size, nature, and scope of the digital divide in the context of the COVID-19 pandemic and how to systematically take action to address it**. **This new analysis also adds urgency to the call for Congress and the states to provide direct emergency funding to close the student digital divide before the gap between those who can learn from home and those who cannot further drives inequality in America.**

In order to support a better understanding of the K-12 digital divide, we assess:

1. **The size of the distance learning digital divide for K-12 public school students and teachers on a state-by-state basis**. We triangulate public Census data with public and private sector benchmarks and perspectives to characterize the problem by geography (rural, suburban, and urban), income, and race/ethnicity, and identify respective technology needs of key student segments.
2. **Requirements for distance learning to ensure equitable technology access for all students**. This includes technological specifications for connectivity and devices, as well as non-technological supports for successful activation, such as instructional content and ancillary services (e.g., maintenance, teacher professional development, digital literacy for families), which are necessary for successful distance learning.
3. **Estimated cost to bridge the digital divide.** Our estimate is based on the cost of key technology requirements (e.g., monthly internet costs, installation, home computing devices) to meet the needs of different student segments, the size of each segment, and scenarios for various distance learning objectives for schools/districts.

Our analysis is based on reviewing the existing literature; merging and leveraging granular federal data sets in new ways; and conducting interviews with private sector stakeholders (broadband and cellular network providers, device manufacturers), school districts, and other public and social sector stakeholders to understand the landscape, validate the methodology, and provide benchmarks for triangulation.

All K-12 students deserve equal access to modern technology at home required for their education; this is more important now than ever with mass closures of school facilities. To reduce learning loss and continue education gains for K-12 public school students in the upcoming school year due to the pandemic, **policymakers, the private sector, districts, and other education organizations must take action**. In particular, Congress has the clear opportunity to **use the upcoming stimulus to invest between $6 billion and $11 billion in direct appropriations to provide connectivity and devices to students at home who are without it today**. In the long term, Congress, in partnerships with the states and the private sector, can take steps to close the digital divide once and for all with infrastructure investments where they are needed.

High-speed internet connection at home is not a luxury. It is as essential as electricity and running water to be fully engaged in American society and to ensure equal opportunity at desired educational, economic, health, public safety, and social outcomes.

7. Kuhfeld, M., Soland, J., Tarawasa, B., Johnson, A., Ruzek, E., & Liu, J. (2020, May). *Projecting the potential impacts of COVID-19 school closures on academic achievement*. (EdWorkingPaper: 20-226). Retrieved from Annenberg Institute at Brown University: https://doi.org/10.26300/cdrv-yw05.
8. Bernstein, L. *Back-to-school plans include big changes for K-12 students, educators*. https://wjla.com/news/nation-world/back-to-school-plans-include-big-changes-for-k-12-students-teachers.
9. See appendix for more details on analysis methodology and data limitations as a result of limited national and granular-level data.

SIZE OF THE DISTANCE LEARNING DIGITAL DIVIDE

The fact that some students can do their schoolwork remotely with reliable, fast internet on their own device while others cannot is one more way in which education inequities and achievement gaps are exacerbated in the United States. Without a detailed understanding of the size and characteristics of the distance learning digital divide, policymakers, districts, education agencies, private sector actors, and others cannot determine actionable approaches to address the issue and what is required for their implementation. To date, a range of estimates exist that examine different components of the problem—the connectivity gap or device gap, for students or teachers—though they lack a structured, systematic characterization of the distance learning digital divide in the context of COVID-19. This analysis examines key segments at the intersection of adequate internet connection and devices for students, and overall technology gaps for teachers.

How do we define the distance learning digital divide?

Effective distance learning requires both adequate devices and internet connection so that students may engage with curriculum, teachers, and classmates. Because of this intersection, these elements must be examined together, not independently of one another. To understand the size of the digital divide for students, this analysis builds a segmentation based on both the number of students with access to a device and those with adequate internet connection.

Students are considered to have an adequate distance learning device if they have a desktop computer, laptop, or tablet[10] in their household. While this analysis does not account for 1-to-1 access to a device for students given data limitations, it is important to provide students with their own device, as sharing a device with a sibling or parent can cause distance learning disruptions.

While it is possible to engage in distance learning via a mobile device, there are several notable challenges, including: (1) incompatibility with existing homework and learning applications with mobile operating systems, (2) difficulty in using small screens to read and digest information, as well as typing and producing assignments, and (3) higher likelihood of distraction on a mobile versus other device. Given these challenges, **students with only a cellular device (mobile phone) are not considered to have an adequate distance learning device**.

Adequate internet connection is defined as internet with sufficient speeds for distance learning, of 25/3 Mbps (download/upload speeds), at a minimum. These connection speeds can be provided through a fixed broadband network, including digital subscriber line (DSL), cable, or fiber. Adequate internet connection excludes dial-up, which has connection speeds that are too slow (40 Kbps – 60 Kbps) for distance learning.

Cellular or satellite networks can provide baseline internet speeds but also require sufficient data plans to maintain distance learning and the necessary hardware to connect to a distance learning-appropriate device (e.g., hotspot device to connect to laptop, LTE-enabled laptop or tablet). A household that reports having access to the internet through cellular on their mobile device is considered inadequate due to the challenges students face with distance learning engagement on a mobile device alone, as described above.[11]

We recognize that **cellular connection is adequate if distance learning devices are tethered to the mobile device or are using a hotspot, coupled with sufficient data caps and speed**.[12] Given data limitations from the survey results, households with hotspot or LTE-enabled devices are not explicitly accounted for, and thus the households with inadequate internet connectivity may be somewhat overstated in this analysis.

With internet speeds of 25/3 Mbps, it would take ~3 minutes to load a half-hour video at 720p resolution, compared to ~9 minutes with 10/3Mbps internet.

> Technology access has been a huge challenge for the high schools. We have students in town and many in the country. Despite having local ISPs giving free temporary access to students, it doesn't reach everywhere and is quite slow. One of my students said it might take 30 minutes to watch a 2-minute Khan Academy lesson because the streaming freezes often while loading more content.
>
> **- Brooke, high school teacher, Galt, California[13]**

10. Tablets include, but are not limited to, Apple iPads.
11. For more detail on internet speed, please refer to "Internet speed requirements" on page 16.
12. This analysis is based on responses from the American Community Survey (ACS). Survey questions related to internet connectivity presume that if the respondent selects access via cellular connection, that they are accessing the internet solely through a mobile phone. Given that many education platforms and content are not optimized for a mobile phone, and make it difficult to complete student assignments, for the purposes of this analysis we do not consider respondents with cellular internet only to have adequate connectivity for distance learning. However, cellular hotspots and LTE devices, which are solutions many districts are currently seeking for their students, do provide adequate connectivity, though this segment of internet users is not accounted for in this analysis given survey limitations.
13. Common Sense Media, Connect All Students teacher survey, spring 2020

Figure 1: Three types of connectivity can support distance learning

	Wired broadband	Wireless (Cellular)	Satellite	Dial-up
Download / Upload speed[1]	5-35 Mbps/1-10 Mbps (DSL) 10-500 Mbps/5-50 Mbps (cable) 250-1,000 Mbps (fiber)[2]	50 Kbps-2 Mbps (3G) 5 Mpbs-50 Mbps (4G)	500 Kbps-25 Mbps	40 Kbps-60 Kbps
Definition	Connects **fixed locations** with wired tech[3] DSL/ADSL, cable, fiber	Provides **mobile connectivity** that does not require a fixed receiver[3]	Connects **fixed locations**[3] with communications satellite	Connects **fixed locations** using public access telephone network
Connection characteristics	**Stable** connection, high infrastructure req'mts; occasional speed variation throughout day	**Mobile** but less stable connection; more limited speeds	**Easily disrupted** with high latency	**Slow**, with limited quality of connection
Use case	Areas with **access** to corresponding infrastructure	**Unwired**, but access to cellular network	**Rural / distance** geographies with no wired or wireless service	Areas with phone infrastructure only
Cost	**Ongoing:** Service: $10-$40 / mo Model/router5 : $0-$10 / mo **One-time:** $0-$100 (installation)	**Ongoing:** Service: $15-$40 / mo **One-time:** $60-$80 (hotspot device)	**Ongoing:** Service: $60-$70 / mo Equipment: $10-$15 / mo **One-time:** $0-$100 (installation)	**Ongoing:** $0-$20 / mo (free trials available)
	Sources of adequate internet connections when coupled with appropriate hardware and data usage			

1. Varies by provider but typical speeds included here. 2. Symmetrical, so range refers to upload and download speed. 3. Fixed is defined here as serving a localized area, such as a residence or business location

Why is there a digital divide?

There are three key reasons explaining this divide: infrastructure affordability, access challenges, and other barriers to adoption.

Affordability is a significant driver of households without internet or devices. According to the 2017 Current Population Survey, **34% of households with children aged 3-18 and no internet cite affordability as the major reason for no connection**.

At least 18 million individuals across the United States, including urban, rural, and tribal communities, have limited or no access to high-speed broadband infrastructure, according to the Federal Communications Commission (FCC).[14] Additionally, many geographies have limited cellular signal (for hot-spot or device tethering) in their homes, particularly in rural areas.[15] In these instances, satellite is an option, though it is much more expensive on average and with a frequently spotty signal resulting in intermittent connectivity. Access is also an issue in urban areas. For example, internet access is a significant challenge for unhoused and highly mobile families; urban districts such as New York have as many as 114,000 unhoused and highly mobile students, representing ~10% of the students[16] who are unable to access consistent broadband internet due to a lack of permanent address.

14. Based on 2020 FCC Broadband Report and FCC Form 477 data – see Methodology section for further detail; note that some estimates show that the number of households without broadband infrastructure access to be up to 42M.
15. According to the Federal Broadband Report, https://docs.fcc.gov/public/attachments/FCC-20-50A1.pdf (table 2a), nearly 99.9% of the population (and 99.4% of rural areas) are covered by 5/1 LTE Mbps.
16. Shapiro, E., & Brittainy Newman. (2019, Nov. 19). 114,000 Students in N.Y.C. Are Homeless. These Two Let U.S. into Their Lives. *The New York Times*. Retrieved from www.nytimes.com/interactive/2019/11/19/nyregion/student-homelessness-nyc.html.

Public housing and homeless shelters often lack internet infrastructure; an investment to update internal networks would allow for more efficient connectivity support to students and their families.

Several broader barriers to adoption also play a role in this challenge. Ability to navigate the fixed broadband application process is cited as a challenge for those unfamiliar with the process, who are overwhelmed with options, or who are hesitant to share their personal information. According to some districts interviewed, families calling providers to access broadband receive inconsistent and conflicting information on eligibility about discounted/free offerings available to lower-income families. Stipulations related to unpaid balances, credit checks, or offerings made available to only new customers have acted as barriers for some families who are otherwise eligible for the program in terms of income level and qualification for free and reduced lunch. Further, most discounted broadband connectivity offerings are not offered via schools, but direct to households, making it difficult for schools to supply fixed broadband in a streamlined way (e.g., buying in "bulk") for their students, families, and teachers. School districts must also consider families' ability to cover fees, including one-time hardware fees and installation for establishing fixed broadband connections. Fixed broadband installation often requires entry of a technician into individual homes, which some families are uncomfortable allowing, though some fixed broadband providers are beginning to offer self-installation. These access hurdles are well within the purview of the network provider industry to address, and we look to public policy and the private sector to play a role to alleviate these challenges.

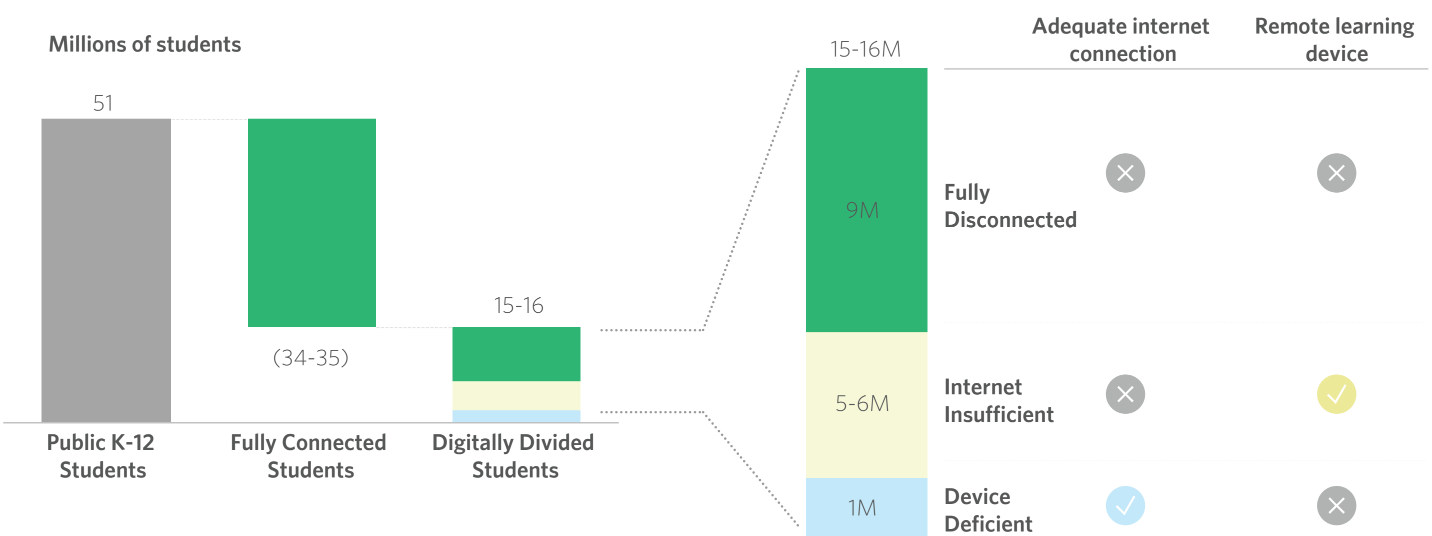
Digitally divided student segments

To understand how internet connection and device access intersect, this analysis groups students into four segments with differing technology needs. Each segment requires a different set of solutions to fulfill their distance learning technological needs, which will vary depending on the distance learning objectives of their respective schools/districts.

Figure 2 illustrates the size of each segment in millions of students. Approximately 15 million to 16 million students lack adequate internet connection, a distance learning device, or both. These 15 million to 16 million digitally divided students fall into three segments[17] with different sets of characteristics:

(Continued on next page)

Figure 2: 15-16M digitally divided students make up ~30% of K-12 public school students



Note: Distance learning devices are considered to be laptops and tablets (excludes a cellular device alone). Adequate connectivity is defined as DSL/ADSL, cable, fiber, or satellite. Cellular connection alone is not considered adequate, but can be with the right supplements.
Source: ACS 1-year survey compiled by US Census Bureau – aggregated at household level, NCES, BCG analysis

17. Our estimates are calculated using the number of students in a given area using NCES data and the % of individuals with or without at least one device in their household using the ACS. Therefore, the number of students without access to their own device is likely higher and our cost estimates likely represent the low end if our goal is a single device per student. Any attempt to estimate the number of students without 1-to-1 devices will be imprecise and heavily assumption-based, given no such data exist. Note that our cost estimates for connectivity likely represent the high end as multiple students may be in the same household and can share a single fixed broadband connection.

1. **Fully disconnected (9M students).** *Students with neither distance learning devices nor adequate connectivity*. The segment of least connected students is also the largest segment to address, which includes students who that have no high-speed internet and no device in their household. 10%-20% of this group is made up of students who do not have access to broadband infrastructure.[18] The average income for this group is ~1.9x the poverty line, compared to the national average of 3.1x the poverty line, and 20%-30% of this group qualifies for food stamps, indicating affordability as a significant reason for lack of connection or device. 30%-40% of this segment is Black, Hispanic, or Native American – the three groups with the highest proportion of individuals without connection.

2. **Internet insufficient (5M-6M students).** *Students with distance learning devices and without adequate connectivity*. In this segment, 10%-15% of students do not have access to broadband infrastructure, restricting accessibility and representing one driver of disconnection despite having a device; 10%-15% of households in this segment qualify for food stamps through SNAP which is a proportion similar to the broader U.S. population, indicating a balance of access and affordability challenges, along with presumed connectivity adoption barriers due to a variety of factors. Of this segment, 70% of students have access to internet through a cellular connection on a mobile phone; however, this is not adequate for online learning; the other 30% of students do not have a high-speed connection.

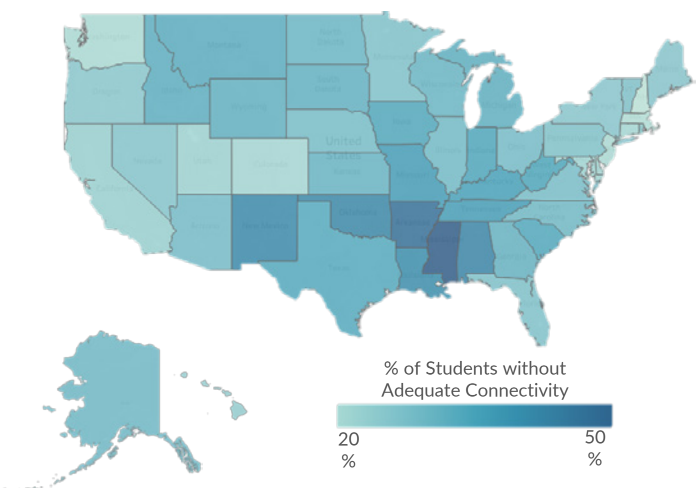
3. **Device deficient (1M students).** *Students without distance learning devices but with adequate connectivity*. Students in this segment likely have a cell phone or other device (e.g., smart TV) to access the internet but do not have devices adequate for distance learning (i.e., laptop, computer, or tablet). 20%-30% of this segment were recipients in 2018 of SNAP food stamps.

18. Figures triangulated using 2017 Community Population Survey - Computer and Internet Use supplement and 2020 FCC Broadband Report.

State-level analysis

The digital divide is a major problem across all 50 states, with an average of 30% of public K-12 students without access to either adequate (high-speed) internet or devices. States along the East Coast and West Coast tend to have higher penetrations of adequate connectivity, in terms of the percentage of public K-12 students with internet. Students across the South, including Mississippi, Arkansas, Oklahoma, and New Mexico, have among the lowest internet penetration rates. While generally making up a smaller absolute number of students, the prevalence is much higher in these states, which are made up of largely rural and tribal communities and have more limited infrastructure. The states with the highest rates of penetration, such as New Hampshire, are still experiencing up to 20% of students without adequate internet connection for distance learning. The top 10 states with the largest absolute number of disconnected students comprise approximately 50% of the overall need, with Texas, California, and Florida having the largest population of students without internet connectivity. (See table for all 50 states included in the appendix.)

Figure 3: **States with highest proportion of students lacking adequate internet connection are primarily in the South**

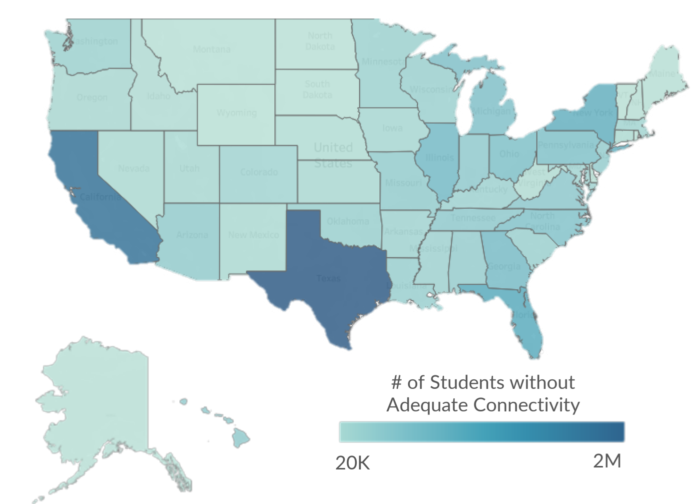


By proportion: 10 states with the highest proportion of K-12 students without adequate internet connection

State	Without adequate connection	% Without adequate connection	Without adequate device	% Without adequate device
Mississippi	234,207	50%	167,875	36%
Arkansas	225,926	46%	157,252	32%
Alabama	304,964	41%	231,999	31%
Oklahoma	285,444	41%	198,833	28%
Louisiana	281,391	40%	227,315	32%
New Mexico	133,623	40%	94,858	28%
Tennessee	363,553	36%	277,261	28%
Kentucky	240,673	36%	186,148	27%
Missouri	333,212	36%	224,772	25%
West Virginia	92,323	34%	83,450	31%

Source: American Community Survey compiled at household level – 1 year aggregation, NCES, BCG analysis

Figure 4: **Texas, California, and Florida have the largest population of students without adequate connection**



By population: 10 states with the largest population of K-12 students without adequate internet connection

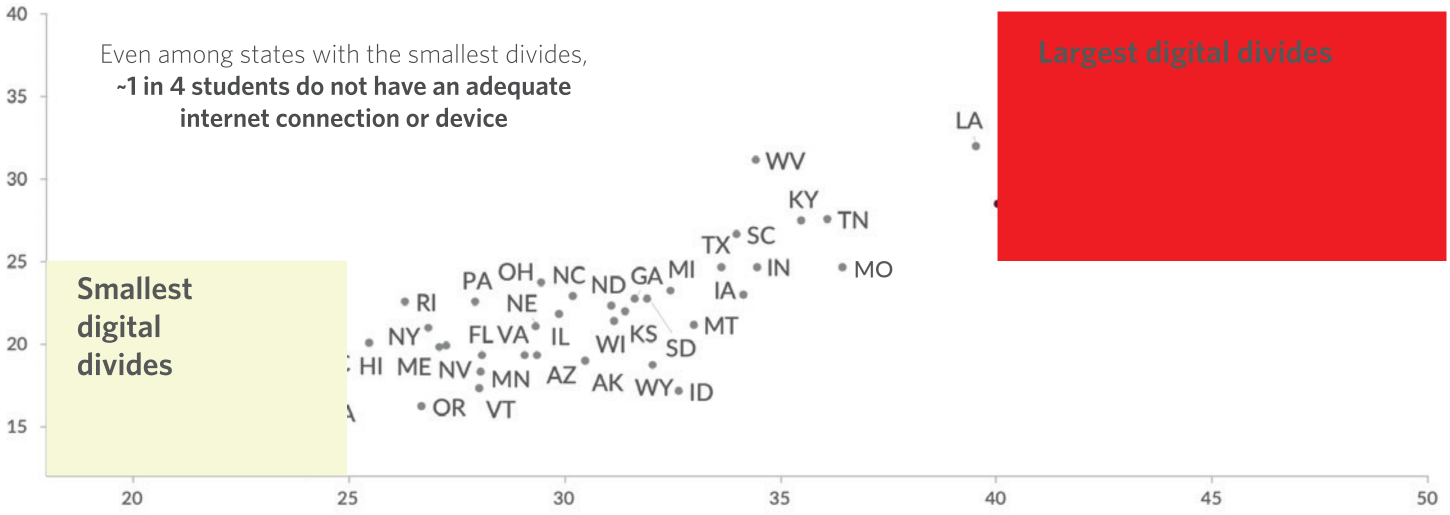
State	Without adequate connection	% Without adequate connection	Without adequate device	% Without adequate device
Texas	1,829,000	34%	1,339,000	25%
California	1,529,000	25%	1,063,000	17%
Florida	801,000	28%	549,000	19%
New York	726,000	27%	567,000	21%
Illinois	589,000	30%	430,000	22%
Georgia	560,000	32%	401,000	23%
Ohio	500,000	29%	402,000	24%
Michigan	488,000	32%	350,000	23%
Pennsylvania	484,000	28%	390,000	23%
N. Carolina	469,000	30%	355,000	23%

Top 10 states represent ~53% of total students without adequate connection

Source: American Community Survey compiled at household level – 1 year aggregation, NCES, BCG analysis

Figure 5: A major digital divide persists in all 50 states

Percent of students in households without devices and adequate internet connectivity, by state



Select state challenges and efforts in closing the digital divide

Mississippi: Ranked among highest states with lowest fixed broadband access in 2015 FCC/ Mississippi State University study – many districts opting for paper packet learning versus online options due to poor access

New Mexico: Ranked 49th in broadband access, with only 11% of population with access to fiber-optic; high proportion of Native American communities with poor access

New Hampshire: NH School Connectivity Initiative established to gain sponsors and enhance access to high-speed broadband connectivity for K-12 students

Utah: 2015 Senate bill 222 established digital teaching and learning program, allocating funding to e-learning; ranked #2 in 'Best internet access' due to high access and fast speed, according to *US News* ranking

"I use Google Classroom to deliver assignments[...] For those students that do not have internet accessibility or computers[...] I provide the hard copies [...]. It is harder to track what they are doing or don't understand because they can only give me the work packets back on the distribution days and it takes longer to give feedback.

- Karen, middle school teacher, Gulfport, Mississippi

"During this time of school closing many students live in remote places (reservation lands) where cell towers do not exist. Cell phone connection is a challenge as well as internet access. Those lack of resources pose more concerns for safety as well as equitable education opportunities in these remote areas.

- Susan, high school teacher, Cuba, New Mexico

Washington: State legislature established broadband office in 2019 - ~$22M in state budget to improve rural connectivity – currently has 95% broadband coverage

New York: 60%+ fiber coverage + top-5 states in education funding deployed per student. 2013 Beyond High School initiative aimed to tackle digital divide – little state-wide coordination since that time

Texas: Recent state-wide coordinated effort Operation Connectivity to provide K-12 connectivity across the state. Highest number of fiber providers (166), although small fiber blueprint (32% served)

Public school teacher technology gap

With school closures in place, the burden of internet cost is now pushed to teachers to enable distance learning, rather than a cost borne by schools. Yet, teachers are not without connectivity and device challenges themselves. Estimates show that between **300,000 and 400,000 teachers lack an adequate connection required for distance teaching**, representing 8% of all teachers as opposed to nearly 30% of public school students. Of this group without adequate internet connection, two-thirds subscribe to cellular internet on an enabled device only and one-third have no internet connection in their homes.

Teachers are generally equipped with proper devices, though estimates show that **2%-4%, or 100,000 public school K-12 teachers, lack at least one laptop or tablet device in their home** to administer distance teaching. Qualitatively, many teachers are sharing devices with their own families, making fully synchronous teaching difficult.

Overall, while technology gaps impact teachers at a lesser rate than the overall population (i.e., 8% of teachers lacking high-speed internet compared with 30% of public school students), that impact is magnified, by ~16x on average, based on the number of students in their classroom.[19]

Trends impacting the distance learning digital divide in 2020

The figures used in this report to characterize the distance learning digital divide draw from data captured prior to the COVID-19 pandemic. It is necessary to acknowledge in this report the underlying trends and shifts across America's households since March 2020, for which there is limited comprehensive data. Based on qualitative interviews of network providers, school districts, and others, as well as literature reviews, we find that three key trends will impact these size estimates at the beginning of the 2020-2021 school year. First, there have been significant, swift efforts by districts, governments, private sector, and philanthropy across the United States to provide devices and connectivity to students since March 2020. Yet, the data on these efforts is intermittent and inconsistently measured (though several organizations are working to track this data across the country). These efforts have certainly reduced the existing gaps in pockets, particularly for large urban districts. Smaller school districts face more hurdles to access technology, with smaller scale and smaller budgets while competing for supply with other large and small districts. In addition, Congress included distance learning as an allowable expense for K-12 schools in its March stimulus bill. While some school districts will use funds for this purpose, the limited appropriations for pubic schools must compete among multiple priorities at a time of reduced budgets and have only recently reached states for distribution.

Urgent supply challenges facing many smaller school districts

> It feels like there's not a Chromebook to be found ... the upheaval has happened in the supply chain overnight.
> **-Todd, school district Chief Technology Officer, Indiana**

> If the demand is great and if a large urban area eats up a bunch of the stock, then how far behind do you think the rural areas are going to be?
> **- David, elementary school principal, Montana**

Second, unprecedented unemployment rates are forcing many families that were previously in the middle class (i.e., not qualified for free and reduced lunch) to require services and support to meet basic needs, including food security.[20] Based on connectivity provider interviews, it is expected that when the Keep Americans Connected Pledge[21] expires on June 30, many families will need to make difficult financial trade-offs, including becoming delinquent on or opting out of household internet service as a result of these economic challenges.

Third, social distancing measures under COVID-19 make internet connectivity an essential to safely stay in touch with friends and family, work from home, apply for jobs, and keep up with critical developments. Families who had previously relied on public libraries and public Wi-Fi in cafés and restaurants that are now closed or limiting patrons are finding that having access to the internet at home has become increasingly critical.

These supply and demand trends will undoubtedly have different and opposing impacts on the size of the K-12 digital divide in 2020, and it is too early to understand how they will change the size and nature of the divide. Thus, they are not quantitatively accounted for in this report due to the lack of available data. However, they are critical to observe and analyze moving forward to gain a deeper understanding of the drivers and size of this gap for the next school year.

19. In 2020, the national average student to teacher ratio in public schools is 16 to 1, according to Educationdata.org; this does not account for high school teachers who have 100+ students across multiple classes.
20. *'People are looking at me': For many who lost jobs in the coronavirus epidemic, hunger comes with shame*. June 4, 2020. Washington Post.
21. Keep Americans Connected is an FCC initiative to ensure that Americans do not lose their broadband or telephone connectivity as a result of COVID-19's exceptional circumstances; 800 companies and associates have signed the pledge.

For example, at the time of this report's publishing, private sector vendors are still providing short-term discounts/free connectivity and devices, or are just ending their discount periods. These offers may be distorting the effects of the pandemic, as they incentivize new enrollments and help to maintain previously existing customers who may not be able to afford the full price of connectivity and devices after the current discount period ends.

TECHNOLOGY REQUIREMENTS FOR DISTANCE LEARNING

For a robust distance learning experience, students and teachers need four things: **(1) high-speed internet service; (2) internet-enabled devices that allow for assignment completion (excluding cell phones); (3) distance learning instructional content; and (4) support, including digital literacy, teacher readiness, and technical support**.[22] In the section that follows, we describe key technical and nontechnical requirements to ensure a student has what he or she needs to succeed in a distance learning environment.

Broadband internet service specifications

Internet speed requirements

Though the majority of Americans have access to some form of internet service, not all services are robust enough to support distance learning. Internet service must meet certain download and upload speeds—corresponding to how quickly a connection can retrieve or send data, respectively—to be effective in a distance learning environment. Passive streaming and web browsing have historically formed the majority of internet usage, with internet service providers (ISPs) typically providing asymmetrical service favoring higher download speeds. However, **with videoconferencing increasingly used for distance learning, coupled with other household video needs like working-from-home and telemedicine, both household download and upload speed requirements are increasing.**

For a single user, 25 Mbps[23] / 3 Mbps , corresponding to download and upload speeds, respectively, is a reasonable minimum standard. Most video conferencing and virtual classroom platforms recommend 4 Mbps-8 Mbps of download speed and 1-3 Mbps of upload speed for conferencing experiences with multiple users, with requirements increasing with the number of users supported by the platform.[24] Most fixed broadband vendors have temporarily increased internet speeds to the 25 / 3 Mbps benchmark, in recognition of the unique circumstances and demands of COVID-19, though most speed increases are not expected to be maintained through or after the summer.[25]

Districts, policymakers, the private sector, and philanthropy have the opportunity to help realize many district aspirations for digital learning, and must avoid several pitfalls:

Achieve 1-to-1 student-to-device parity; account for the number of devices in the household and ensure students are not sharing laptops with each other or parents.

Account for the desired extent of synchronous learning and type of instructional content to determine technical requirements; these decisions have a direct correlation with speed and data usage requirements, and are important to assess together when building data plans and/or connectivity strategies.

Make investments in the short-term that pay-off now and in the long-term; with the urgency to provide technology support in the short-term, it is important to take time to assess appropriate requirements that meet distance learning needs, and support long-term district digital strategies and aspirations.

Evaluate not just broadband or cellular access, but also internet speeds; internet speeds vary significantly throughout the day, often well below quoted speeds making synchronous learning difficult; work with network providers to maintain high speeds, and continue building out infrastructure that improves overall speed.

Consider how families can leverage the internet beyond education; in this period of social distancing the internet helps families stay safe in their homes by enabling them to learn remotely, and stay connected while also providing essential social and professional services (e.g., telemedicine, access to job applications). All online activities should have privacy-protection for personal data.

22. Adapted from community-vetted definitions of digital inclusion, as provided by the National Digital Inclusion Alliance (NDIA), a nonprofit organization bringing together over 300 nonprofit organizations, policymakers, and academics. Retrieved from https://www.digitalinclusion.org/definitions/.
23. Download and upload speeds cited are applicable for both fixed broadband and wireless/cellular connections.
24. Assessed from review of bandwidth requirements stipulated for major virtual classroom or video conferencing platforms, including Google Classroom, Zoom, Blackboard, Schoology, Edmodo, and LearnCube.
25. The survey data informing this analysis is dated to 2019, before speed increases were taken into effect.

This minimum speed benchmark corresponds only to each concurrent user's requirement. Households with multiple users—including parents and family members—will require speeds directly proportional to the number of concurrent users. For example, if two students live in a household and rely on distance learning videoconferencing at the same time, the bandwidth required for a quality experience would be double the minimum requirement: 50 Mbps / 6 Mbps. For real-time elements of distance learning, 25 Mbps / 3 Mbps per concurrent user requirement must correspond to actual and stable speeds. Past analyses have found that some subscribers, particularly for DSL and satellite service, encounter significantly lower-than-advertised speeds, with more than 30 percent of subscribers experiencing a median download speed less than 80 percent of the advertised speed.[26]

Cellular data requirements

In some geographies, households only have access to cellular networks and lack broadband infrastructure. Though typically offering a less stable internet connection than fixed broadband, cellular networks or external mobile hotspots can connect to devices for suitable for distance learning. Mobile LTE coverage at 5/1 Mbps is available for 99.9% of the US population[27] such speeds are sufficient for 1-to-1 and group video platforms such as Zoom.[28]

> Over 30% of our families currently do not have Internet at home, 35% of students are accessing online content via parents' smartphones. That creates a whole other set of challenges: parents needing the phone for their own communication needs, parents being at work and students unable to access online work, limited data plans creating worries about paying bills or losing connectivity.
> **- Jessica, elementary school teacher, Oakland, California**

For cellular internet access, it is necessary to purchase a monthly data plan. Based on interviews with school districts, many are setting a wide range of data caps, with some selecting unlimited plans. Given the experimental nature and unclear outcomes of recent distance learning transitions, districts and network providers are still assessing actual usage data to meet distance learning needs.

Based on interviews with ISPs and districts, early estimates on usage from cellular data plans distributed as a result of COVID-19 school closures (and representing the primary source of internet for distance learning) find that students have been using between 5 GB and 30 GB of data/month for distance learning since mid-March.

Yet, this data usage depends on several factors. We find that data usage is directly dependent on both the extent to which the district or school limits internet usage beyond education resources or classroom time, and the extent to which they provide synchronous distance learning engagement. Thus the impact of data caps must be considered as each district refines its distance learning strategies. However, early results measure a period of significant uncertainty and challenges to scale distance learning quickly, and therefore may be underestimating the need once distance learning has been in place for an extended period. Further, many districts are still developing and refining distance learning strategies for their schools, as well as the remote delivery of wrap-around support services (counseling, clubs, SEL programming, etc.).

> **Synchronous learning, or real-time classroom engagement, typically requires more data usage when administered through video.**
>
> **For example, Zoom video calls range from 540MB for 1-to-1 calls to 840MB for group two-way video calls per hour.**[29]
>
> **Data caps of 10-30GB/month are typically sufficient for classrooms using ~1 hour of Zoom calls per day. However, classrooms using Zoom for 5 hours/day, may require upwards of 70-100 GB/month. These estimates do not account for other internet applications used during the school day.**

Higher data caps allow for less constrained classroom and school applications, such as synchronous learning, as well as clubs, counseling, and other supports. Data-constrained schools will have to make trade-offs on extracurriculars for students, not to mention the amount of synchronous learning time in the classroom.

26. FCC. (2018). *Eighth Measuring Broadband America Fixed Broadband Report*. https://www.fcc.gov/reports-research/reports/measuring-broadband-america/measuring-fixed-broadband-eighth-report.
27. FCC (2020). *Broadband Deployment Report*. https://docs.fcc.gov/public/attachments/FCC-20-50A1.pdf.
28. *Zoom support and system requirements*. https://support.zoom.us/hc/en-us/articles/201362023-System-requirements-for-Windows-macOS-and-Linux.
29. Zoom help center, https://support.zoom.us/hc/en-us/articles/201362023-System-Requirements-for-PC-Mac-and-Linux.

Usage limitations imposed by the school or the district impact cellular data usage. Schools with asynchronous / low synchronous learning environments and with more constrained allowable usage (e.g., limited to sanctioned educational content) will require much less data, with estimates of 5 GB and 10 GB being sufficient in these instances. Thus, schools with fewer usage limits that place higher emphasis on synchronous learning are likely to require higher caps or unlimited cellular data plans. There are learning trade-offs for students when limiting usage; higher income families with their own internet and devices are not subject to the same constraints, meaning they have more opportunities for enrichment outside of class-time compared to their lower-income peers. Solutions must take into account the impact of these types of usage constraints on educational equity, especially when considering the additional impact of social distancing requirements on a student's overall educational environment.

Considerations influencing broadband vs. cellular decisions

There are pros and cons to each type of connectivity, and it is important for districts to understand these dynamics as they seek to support students and teachers in getting connected. Fixed broadband internet connectivity is part of many districts' long-term plans for digital sustainability, often at a lower monthly cost for sufficient speeds and unlimited access, and the ability to connect multiple devices. Yet, fixed broadband options are not without their own challenges. Many school districts indicated that when providing connectivity to students, it was challenging to simply connect families with resources, even for free or heavily discounted connectivity, because of the complexity of or discomfort some families had with navigating these resources and their enrollment processes. Internet speeds can vary throughout the day, requiring infrastructure improvements in certain geographic areas around the United States to ensure universal access to broadband internet service. As discussed previously (*see page 9*), there are several barriers to adoption that households face in their connectivity decisions for broadband.

Cellular internet has allowed for quick district response to internet connectivity, as it does not require fixed infrastructure or an application process. However, users do cite challenges with internet speed, signal, and managing data usage effectively with cellular. While it can be considered a costly option due to data usage plans, several network providers are providing discounted monthly rates for K-12 education during the COVID-19 pandemic, making it a more sustainable option. Further, for unhoused or highly mobile students and families, cellular connectivity provides internet that will remain with the student through a change of address.

Internet-enabled devices

In order to apply internet access to distance learning, students and teachers need suitable devices, including laptops and tablets. Mobile phones, while helpful learning supplements, are not appropriate sole vehicles for completing and submitting assignments, with many education platforms not optimized for mobile.

The appropriate device will depend on the connectivity solution available. For students and teachers who can be provided sufficient and reliable connectivity through **fixed broadband, suitable devices will include traditional laptops and tablets with built-in Wi-Fi**, which have no additional hardware requirements. **Where a cellular network (4G or above) is the option, students and teachers will need LTE-enabled laptops or tablets, or a traditional laptop or tablet plus a mobile hotspot device**.

Typical device features to enable quality distance learning include embedded video, touchscreen, and keyboards, particularly for middle school and high school students to complete assignments. Many districts are providing tablets for early learning in elementary, particularly grades K-2. Protective coverings/cases are also important in protecting devices from damage. Districts recognize that providing internet-enabled devices will result in some infrastructure loss due to theft, accidental damage, or other reason. It is important to administer these devices to students to avoid the risk of theft (e.g., deliver directly to home), as well as to provide insurance for parents and families in case of loss.

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> **Wide Open School**, created by Common Sense and a coalition of education and media partners, has curated a suite of instructional content for students, families, and teachers. Their content includes academic, social-emotional learning, and enrichment curriculum; digital literacy and digital citizenship training and resources; teacher readiness/professional development; and learning resources for those with special needs. These resources are available through links to education resource websites, locally housed PDFs/worksheets, connections to kid-friendly entertainment options, and live events.

Instructional content

Instructional content for distance learning is often a blend of synchronous and asynchronous learning, supported through audio/video-enabled meeting spaces, software to support digital learning content development, and a learning management system to help teachers plan and manage this content. Instructional content must be tailored to students' unique needs, including age-specific developmental requirements and students' home learning environments. Depending on internet connectivity speeds, teachers must consider alternative instructional content and tools with lower internet speed requirements.

Real-time engagement for teachers is an important tool for teachers to provide engagement with classmates, as well as 1-to-1 attention and support. Teachers cite that one of the biggest challenges in distance learning is not having the real-time feedback on whether or not students are understanding and engaging with concepts, usually provided in-classroom by visual cues and observation of students' classwork. Many are relying on applications like Zoom to engage directly with students as a substitute for the in-classroom experience. Parents are also a critical part of a successful distance learning experience; they also need sufficient resources to effectively support their children with distance learning. Many private sector vendors and nonprofit initiatives have assembled free and discount software suites enabling at-home learning, including content providers, communications software, testing platforms, and online tutoring solutions.

The type of instructional content selected, and extent to which district objectives align with synchronous learning, should have a direct impact on the required connectivity speed and data usage plans that the district seeks to offer.

Support

Teacher readiness

School districts and private sector vendors alike highlight teacher readiness as one of the primary barriers to successful distance learning, with some teachers not trained to effectively incorporate digital tools into their instruction. While a survey by Gallup and the NewSchools Venture Fund found that the majority of teachers (53 percent) say they would like to use technology more often, an even larger majority (56 percent) cited lack of training as a "significant" or "extremely significant" problem.[30] One vendor indicated walking away from procurement opportunities where school districts were not sufficiently attentive to the teacher-readiness element of device and connectivity enablement. School districts that more swiftly transitioned to distance learning held professional development trainings for teachers, with instruction on basic use of conferencing and other digital tools, as well as how best to integrate technology, pedagogy, and content.

Digital literacy training

Across all users, digital literacy skills are a necessary pathway to bridging the homework gap. Individuals need support in developing the skills to take advantage of the opportunities enabled by internet connection and devices. One component of this is information literacy, to enable individuals to find electronic information and evaluate online resources for teaching quality and privacy. Digital literacy also equips students and teachers to identify and protect themselves against online threats and limit unwanted access to and use of personal information. Importantly, digital literacy increases consumers' understanding of the potential benefits of digital technologies, and it builds motivation for mastering skills required to harness the internet for their educational and personal development. Private sector vendors are already prepared to offer this support, with many ISPs including free digital literacy training—and even requiring its use—in offerings to schools or lower-income populations.

Technical support

Quality technical support is required as users activate, build a knowledge base for, and troubleshoot issues with their connectivity, devices, and tools. Vendors indicated that the demand on customer and technical support call centers has dramatically increased during COVID-19, particularly for education-specific program offerings. School districts likewise indicated that the level of technical support offered was often a key reason districts selected certain vendors and learning platforms over others. Without technical support, users may be unable to activate or take full advantage of the resources provided to them.

Technology supply

As schools make decisions on required technology for devices and connectivity, product availability may constrain their choices. For example, many schools prioritized procurement of Chromebooks due to simplicity, cost-effectiveness and compatibility with Google Classroom and Google Docs. However, Chromebooks and low-end Windows PCs have quickly become supply constrained during the pandemic, driven by a mixture of home office demand and device manufacturers with limited excess capacity. This reality has forced schools to scramble for procurement through multiple vendors in search of inventory, purchasing products based on availability instead of preference. To continue along this example, the total Chromebook U.S. market was only ~14 million units in 2019, with nearly ~10 million units already selling into the education channel.[31] **Given the size of the digital divide, the current supply constraint will likely persist past the start of the new school year.**

30. Klein, A. (2019, Nov. 18). Digital Learning Tools Are Everywhere, But Gauging Effectiveness Remains Elusive, Survey Shows. *Education Week*. Retreived from www.edweek.org/ew/articles/2019/09/18/digital-learning-tools-are-everywhere-but-gauging.html.

31. IDC Quarterly Personal Computing Device Tracker.

> My school is over 70% low socio economic and over 50% of our students do not have Wi-Fi. Even though companies are offering free internet, most of the time they don't have enough boxes to service a neighborhood, or they don't cover that area. Please help!"
> **- Reina, high school teacher, Aubrey, Texas**

There are three ways to bridge this shortfall in the immediate timeframe. First, device manufacturers can reallocate inventory planned for consumer channels into education channels. Second, schools can extend the life of used devices, either by stalling refreshment for existing devices or purchasing refurbished devices. Third, schools can operate a portfolio of different devices (potentially across multiple operating systems) and prioritize device type depending on age groups and pedagogical objectives. In the absence of industry and government efforts to prioritize supply of low-end devices, schools and government funding will be used to pay more for high end devices.

Technology combinations by segment

As noted above, the digital divide is comprised of three key segments: **(1) fully disconnected** (no connectivity and no device); **(2) internet insufficient** (has laptop or tablet, but inadequate connectivity); and **(3) device deficient** (adequate connectivity, but no laptop or tablet). Each of these segments has a unique set of needs that must be met with a variety of options for device, connectivity, and other installation / connectivity considerations.

It is important that districts and others consider the core needs of each segment to evaluate and select the potential technology combinations most appropriate for their students, teachers, and households. Taking this approach will provide appropriate support and meet students where they are in terms of digital connection, and also will aim to optimize for cost considerations. For example, given today's environment of restricted supply, many districts are purchasing devices opportunistically, and opting for cellular connectivity due to ease of set-up, despite the fact that these options may not be best suited for student needs or meet sufficient levels of connectivity for the district's objectives.

Figure 6 outlines these potential combinations for each segment.[32]

Figure 6: Connectivity and device options are mutually dependent, resulting in bundled offerings

	Internet insufficient			Device deficient	Fully disconnected			
Bundle	1	2	3	4	5	6	7	8
Access considerations	No access to fixed or cellular	Access to cellular only	Access to fixed	Already has fixed or satellite	No access to fixed or cellular	Access to cellular only	Access to cellular only	Access to fixed
Device options	*None*	*None*	*None*	Traditional laptops/ tablets	Traditional laptops/ tablets	LTE-enabled laptops/ tablets	Traditional laptops/ tablets	Traditional laptops/ tablets
Connectivity options	Satellite broadband	Cellular data	Fixed broadband	*None*	Satellite broadband	Cellular data	Cellular data	Fixed broadband
Other hardware	Satellite dish, installation	Mobile hotspot device	Modem, router, installation	*None*	Satellite dish, installation	*None*	Mobile hotspot device	Modem, router, installation

Source: Stakeholder interviews; BCG analysis

32. Combinations do not account for build-out of additional infrastructure. Technology combinations included herein focus on existing solutions with current sets of infrastructure for broadband, cellular, and satellite.

COST AND OPPORTUNITIES TO CLOSE THE DISTANCE LEARNING DIGITAL DIVIDE

To inform public, private, and education stakeholder action, it is critical to outline the estimated cost to close the gap for students and teachers. The cost estimate in this report is based on the approximate price of different combinations of technologies that meet each segment's requirements. These combinations are assembled based on anticipated applications within and across segments, and the overall cost is estimated using previously discussed analysis of the number of students in each segment.

We estimate that the cost to provide distance devices and connectivity for students who need it is $6 billion-$11 billion in the first 12 months. This consists of $3 billion-$5.5 billion of one-time costs for installation and set-up, devices, and device warranties; and ~$2.7 billion to $5.6 billion for 12 months of recurring charges for connectivity, connectivity equipment, and mobile device management. The range of the estimate is based on several factors, including:

- Local access to fixed broadband and cellular networks
- Degree of synchronous distance learning targeted
- Degree of content filtering applied to restrict non-educational applications
- District and household preferences, often based on ease of adoption
- Short-term availability of hardware in the market
- Availability of provider discounts for education and/or households
- Eligibility of the school district, geography, and/or household for any available discounts

The precise cost will require stakeholders to evaluate the above factors as well as the divergent qualities of distance learning supported at different points along the range. Notably, connectivity options at the lower bound of the range meet the minimum requirements for distance learning but typically cannot support highly synchronous learning models, such as multiple hours of live video engagement; multiple concurrent users in a household, including non-student users; or, for cellular options, unfiltered content, constraining students' options for educational resources. Device options at the lower bound rely on availability of hardware in the market and may not be fully compatible with a school's chosen learning applications.[33] Low-cost devices are typically refurbished, with availability depending on inventory; are outdated and require earlier replacement to align with student learning needs; or involve separate household eligibility requirements. Higher-cost options are typically more flexible.

> My [...] concern is what will happen if this continues. We do not have the school budget to provide 1-to-1 devices to our students. Even if we were able to do that, large areas within our school district do not have high speed internet available. I am extremely concerned with my ability to connect with my students next year. [...] I feel that they are not afforded the same level of instruction they desperately deserve.
>
> **- Leslie, preschool, pre-K, and elementary school teacher, Ellenburg Depot, New York**

33. These estimates do not account for residual value of devices for resale.

Figure 7: Initial estimate suggests $6-$11B first-year cost to close the student digital divide

	Internet insufficient (Device, no connectivity) 5-6M			Device deficient (Connectivity, no device) 1M	Fully disconnected (No connectivity, no device) 14-15M			
Bundle	1	2	3	4	5	6	7	8
Access considerations	No access to fixed or cellular	Access to cellular only	Access to fixed	Already has fixed or satellite	No access to fixed or cellular	Access to cellular only	Access to cellular only	Access to fixed
Device options	*None*	*None*	*None*	Traditional laptops/ tablets	Traditional laptops/ tablets	LTE-enabled laptops/ tablets	Traditional laptops/ tablets	Traditional laptops/ tablets
Connectivity options	Satellite broadband	Cellular data	Fixed broadband	*None*	Satellite broad-band	Cellular data	Cellular data	Fixed broadband
Other hardware	Satellite dish, installation	Mobile hotspot device	Modem, router, installation	*None*	Satellite dish, installation	*None*	Mobile hotspot device	Modem, router, installation
Cost/ student	$850-$1,075	$250-$300	$125-$375	$225-$475	$1,075-$1,525	$550-$925	$475-$750	$350-$825
% of segment	5%	45%	50%	100%	5%	23%	23%	50%
Segment total	**$1.1B-$2.2B**			**$0.4B-$0.7B**	**$4.6B-$8.2B**			

Note: Low bound assumes a single-student household, eligibility for internet service provider discount programs, and waivers of installation and fixed broadband equipment fees. High bound assumes higher quality offerings and that these offerings support the average number of school-age children in households with children under 18 (1.93). Notably, while fixed broadband, satellite, and a hotspot with sufficient data can be fully shared by a household, service to an LTE-enabled device is often tied to the device itself and cannot be shared.
Source: ACS 1-year and 5-year surveys compiled by US Census Bureau, NCES, stakeholder interviews, BCG analysis

Figure 7 illustrates typical packages for each segment and their cost ranges. The low end of the range accounts for meeting minimum distance learning requirements, whereas the high-end of the range represents costs for more robust distance learning technology. On the following page, we include two illustrative examples demonstrating the difference in distance learning experiences for low-end versus high-end investments.

Low-end investment user experience: meeting minimum distance learning needs

Your child's class involves a blend of instruction types. The teacher asks all students in the class to turn their videos off to conserve bandwidth. The day includes several groupwork exercises with video on, but typically no more than 1-2 hours. In the afternoon, you connect to your internet, which provides speeds of 25/3 Mbps. Your child's session is undisrupted when you are browsing but you notice pixelation, and sometimes dropped connection, when you try to simultaneously stream videos.

High-end investment user experience: meeting robust distance learning needs

While your child's class yesterday was in lecture style, today's math class is highly interactive, including small virtual group exercises with all students collaborating via video. To facilitate engagement, the teacher has asked students to enter an application that allows them to show their work online. Your child's laptop is a relatively recent model that has high memory, allowing it to quickly load applications and to process your child's real-time inputs into learning tools. Meanwhile, your younger child is connected to the same 200 / 10 Mbps Wi-Fi network on a tablet, participating in similar classroom exercises.

While we take a similar approach to estimating the cost to provide teachers with connectivity and devices, teachers have higher-cost requirements for distance learning. Unlike their students, teachers must maintain their video for larger portions of the day in order to keep their classrooms engaged. Lower cost devices such as Chromebooks, a popular choice for their affordability, are typically not as effective to support teachers interfacing with different applications and learning platforms. We consequently estimate the cost to equip teachers with higher-cost distance learning devices and connectivity.

We estimate that $0.6 billion-$1 billion is required to provide distance devices and 12 months of connectivity for teachers who need it. This consists of $0.03 billion-$0.04 billion for devices and $0.5 billion-$0.9 billion for one year of connectivity, including one-time installation.

As stakeholders decide how to meet student and teacher requirements and what it will take, it will be important to understand local student and teacher needs alongside school district priorities. While students and teachers urgently need support for distance learning, financial and technological sustainability of the solutions will be critical to reducing long-term costs. In particular, stakeholders must consider how they will support the recurring costs of home connectivity, as well as device replacement and upgrade costs that occur several years after initial purchase. Though we prioritize immediate distance learning support to students and teachers, a variety of additional options, including infrastructure build-out, particularly in areas underserved by internet service providers and device manufacturers, will be a critical element of keeping the digital divide closed. These will require additional investments, which are not evaluated here.

MOVING FORWARD TO CLOSE THE DIGITAL DIVIDE

The digital divide in public K-12 education is significant, with as many as 15 million to 16 million students in households without adequate internet service or devices on which to do school work. As a result of the COVID-19 crisis, this is no longer a matter of a homework gap but of whether or not a child can participate in school. Addressing this challenge will require a deep understanding of local circumstances and needs, significant financial investment, and the ability for districts to decide what is best for their community and educational aspirations. Closing the digital divide in the short term will cost at least $6 billion, and could cost as much as $11 billion, over the next 12 months.

During the COVID-19 pandemic, schools have been in crisis mode as a result of massive school closures – scrambling and taking swift action to switch to distance, at-home learning in lieu of classroom teaching. Some schools never started distance learning because of unequal access, while others started and stopped because of access or external interference issues. Many decisions have been focused on how to provide short-term stop-gap solutions and get students connected as soon as possible, with inconsistent data to inform decisions, patch-work technology solutions, and many still waiting on supplies or unsure how to support their students, families, and teachers. Despite challenges, many districts and educators see an opportunity not just to provide a stop-gap measure during this unprecedented period, but also to realize their long-term aspirations for integrated, equitable digital learning environments.

> Equipment and access should be available to families with school children. Society must realize the digital divide is real. Access and education should not only be for some and not others, especially those from low socioeconomic backgrounds. Raising expectations for all students young and old, is especially important for a growing society if building young people to have skills and way to create a better life for them and their family.
>
> **-Brenda, middle school teacher, Seattle, Washington**

Based on our research and understanding of the digital divide, we see a significant opportunity to use this difficult moment in history to reshape the future of learning through digital education. There are important roles that various stakeholders can play to help catalyze longer-term change while closing the digital divide in the short term.

Policymakers | Take swift policy action in the short term, and invest for the long term. Closing the K-12 digital divide requires action by Congress on a short-term basis in the next COVID-19 federal stimulus bill by providing direct funding to ensure internet service and devices at home for students who lack them today. Congress must also take long-term action and invest funding to upgrade and close gaps in our nation's broadband infrastructure. These actions in combination will ensure robust universal broadband access for students and families across the nation.

Districts | Define digital education long-term aspirations and objectives. The "homework gap" has long been an issue, only exacerbated by COVID-19; many districts entered this period with existing plans to address that gap, such as providing students with 1-to-1 student-to-device accessibility. This is a critical time for districts to build out, evaluate, and scale those existing plans, while also assessing how they may need to shift in the current context, and look beyond short-term crisis response. For example, having school-based high-speed internet may no longer be enough to encompass educational connectivity needs and having connectivity in each student's household will be critical should the pandemic require longer school closures. Taking this time to clarify the longer-term vision and aspiration for distance learning, and to lay out digital objectives will drive smarter decision-making in the short-term. Decisions should also be made with a three-to-five year view in mind, so that districts can acquire technology that can be sustained over a longer time horizon. Districts should avoid making quick decisions that will need to be corrected with further investment in the future due to limited information and understanding of the requirements at the outset. For example, while many districts are selecting hotspots to provide quick, scalable internet for their students, the costs could add up quickly in the long-term compared to lower-cost broadband options. .

Districts | Identify the necessary technology, infrastructure, and capabilities to enable that vision. As described in this report, there are a significant number of technology considerations to account for to enable distance learning. It is important for districts to ensure that the technology solutions truly meet the needs of students and teachers, requiring a clear understanding of which households are in need, what their specifications need to look like, and how it aligns to the extent of distance learning the district is supporting. A district's approach to synchronous learning, for example, is a significant driver of the hardware, software, services, and connectivity needs for each student and teacher. Moving forward, we anticipate more integration of IT and pedagogy, requiring more professional development for teachers, as well as IT support and capacity. Further, with teacher readiness support and professional development on distance learning techniques, this is an opportunity for schools to fully leverage the digital tools available to them, and prepare their teachers for new, innovative learning models blending classroom and online platforms and tools. Teachers and schools should also be equipped to utilize appropriate privacy and security tools to protect students. Underscoring all of this is the continued need to build out internet infrastructure where it does not currently exist, as well as bolster existing infrastructure to increase internet speeds beyond the minimum 25/3 Mbps requirements laid out in this report. Part of this build out is not only in rural areas, but also in urban neighborhoods experiencing pockets of slower speeds. There is also a need to connect public housing and homeless shelters to support unhoused and highly mobile populations.

Private sector | Help deliver, prioritize, and support education technology needs. The private sector is critical to making effective distance learning a reality. Network providers and device manufacturers must provide transparent, discounted, and consistent prices across all districts, as many districts are navigating significant differences in price, and smaller districts lacking purchasing power face higher prices. Additionally, there are other opportunities to deliver technology needs. We see opportunities for the private sector to make a commitment to prioritize K-12 education support in their supply chains and customer service, and to evaluate and adjust offerings that meet K-12 and household needs, including reducing barriers to adoption. As noted in this report, even with affordable options, and infrastructure access, families face several other burdens to adoption such as financial hurdles (e.g., credit checks), lack of digital literacy, and being overwhelmed with options or lacking support to navigate the process. Connectivity providers can evaluate their processes to ensure they best support families to adopt their technology, while districts can also offer explicit support, guidance, and resources to help families make the best decisions for their homes. Further, they can provide products and services that are accessible through districts rather than through individual applications, and transparent, and consistent pricing to ensure equitable access for districts regardless of their purchasing power.

Education organizations/nonprofits | Build data, coordination, and support to systematically address gaps. With so many districts facing a similar issue, it is important to apply a collaborative rather than a competitive mindset. States like Texas, California, and Connecticut, for example, are developing models for cross-district collaboration to ensure all districts are getting what they need, and with greater leverage and scale for negotiation. Public, education, and nonprofit sectors have a significant potential role to support coordination. With inconsistent data collection practices on the localized need and distribution efforts, it is important to align, aggregate, and update the data regularly to systematically understand where the gaps are and proactively address them. This includes making connections across districts (e.g., aggregate localized/regional needs), and connecting with private sector providers that align to localized needs. Further, as noted throughout this report, the potential of our analysis was hindered due to data limitations in several data sets. It is important for public organizations to align on data needs, and improve data collection processes around 1-to-1 device access in homes, types of internet connectivity in households, and broadband/cellular coverage and speed maps. Furthermore, education agencies and nonprofts should work with districts to share pricing, service, and supply terms to strengthen purchasing power.

All organizations | Apply an equity lens across the board. This moment is an opportunity to provide equitable access to connectivity and technology not just for students, but also for their families. Underscoring this work is a need to understand how these challenges and issues impact students differently, and work to meet their unique needs. As districts build out a vision for digital education, this means that they will ensure those strategies reach all students. Their approach to technology and infrastructure will account not only for inequities like income, but also for digital literacy of families and other barriers to provide support for equitable access and use of those resources. Districts can also provide critical support and stability for families, including use of the internet to work from home, apply for jobs, access telehealth resources, and stay connected during the pandemic. This is an opportunity to rethink how to support students and families to weather the crisis, and level the playing field between those with full access and those without.

Closing the digital divide will require public and private sectors to come together with a sense of urgency for immediate action to ensure equitable learning opportunities during the pandemic, and a sustained commitment to secure our nation's educational future by ensuring that digital technology will benefit all students and their families..

APPENDIX

Definitions

ACS: American Community Survey – annual survey conducted by the US Census Bureau sampling approximately 3.5 million households per year.

Adequate internet connection: Refers to forms of internet connection that are suitable for online learning. Includes DSL, cable, fiber, and satellite; cellular LTE; or cellular hotspot internet where mobile tethering is feasible. Does not include dial-up or cellular-enabled mobile devices.

Adequate device: Devices suitable for online learning. Includes laptops, computers, and tablets. Does not include mobile/cellular phones.

Adequate internet speeds: Download and upload speeds suitable for online learning – consensus standard is 25/3 Mbps (download/upload) speeds though this can vary based on the number of devices connected. 5/1 LTE speeds generally sufficient for certain use cases such as virtual video conferencing.

Cable internet: Form of internet access that uses a cable model on-premise and connected to ISP's last mile infrastructure. Classified as wired broadband by the Census and considered adequate for distance learning.

Chromebook: A laptop running Chrome OS (developed by Google). Machines generally have information stored on the cloud versus in local memory and are often cheaper than traditional laptops. Can have multiple manufacturers such as Acer, HP, etc.

Dial-up internet: Form of internet access that uses public telephone networks to connect to ISP. Interferes with phone line. Considered inadequate for distance learning.

Digital divide: Students (K-12) who do not have sufficient technology (connection or device) to study, learn, and complete assignments remotely. Three segments of digitally divided audience include:

- Fully disconnected: Students with no adequate connection or adequate device for online, distance learning
- Internet insufficient: Students with an adequate device (laptop, tablet) but without adequate connectivity
- Device deficient: Students with an adequate connection (cable, DSL, fiber, satellite) but without adequate device

DSL internet: Form of internet access that uses telephone networks to connect to ISP, but utilizes a different frequency and is independent of phone line. Considered adequate for distance learning.

FCC: Federal Communications Commission – government agency that regulates communication. Publishes statistics on broadband deployment and coverage in yearly report using Form 477 data.

Fiber internet: Form of internet access characterized by fast speeds. Internet travels through fiber lines and therefore requires infrastructure build-out in coverage areas. Classified as wired broadband by the Census. Considered adequate for distance learning.

Fixed broadband: Category of internet access that includes forms of internet delivered to a fixed location. Includes all types of wired broadband and select wireless broadband options such as satellite.

GB: Gigabyte – unit of measuring data/information stores and processed in a device

Homework gap: term used to shed light on the challenge for K-12 students in completing online homework assignments because they lack adequate internet or devices at home.

ISP: Internet Service Provider – Organization that provides internet access services. Examples include Comcast, Charter. Cellular ISPs include Verizon, T-Mobile, etc. In rare cases, certain cities and nonprofits can function as ISPs.

LTE-enabled device: A device (usually cell phone or tablet) that can connect directly to a cellular LTE network without the need of a hotspot or wireless router

LTE / 4G LTE: Although different technical specifications, the terms 4G and LTE are often used interchangeably to refer to telecommunication standard signifying multiple speed, quality, and functional improvements over its 3G predecessor. 4G LTE connection is deemed adequate for at-home learning.

Mbps: Megabit per second – unit of speed measuring how fast data is transferred. Can measure either download or upload speed. 25/3 Mbps refers to 25 megabits downstream speed and 3 megabit per second upstream speed

Mobile / Cellular tethering: The practice of using a hotspot (either via a cell phone or wireless hotspot device) to allow nearby devices to connect to the cellular (often LTE) connection

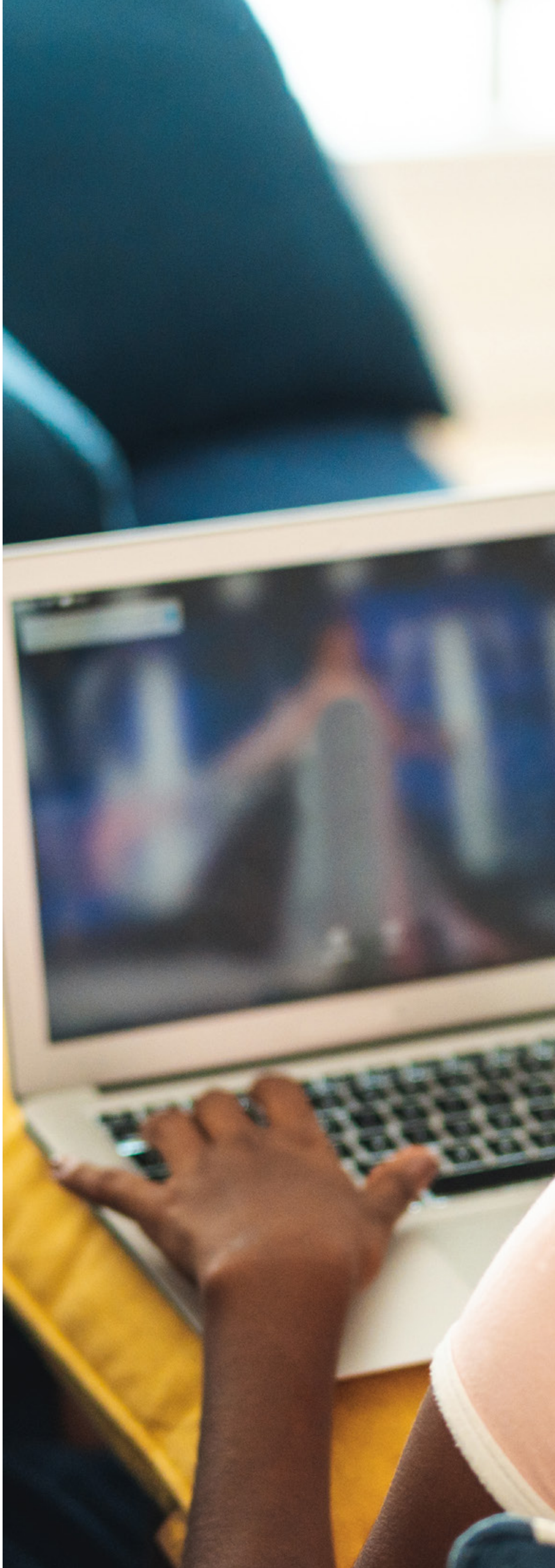
NCES: National Center for Education Statistics – division of the US Department of Education that collects and publishes select public school district information.

Operating system (OS): Software installed on devices that allow device to run, interact with user, and interact with applications. Education applications need to be configured to run on specific operating systems (e.g., iOS, Android, Windows, Chrome) – certain applications are incompatible for certain mobile operating systems.

Satellite internet: Form of internet access provided through communication satellites. Speeds are generally fast, but coverage can be spotty due to environmental conditions. Can provide access to regions that are not covered by ISPs. Considered adequate for distance learning but other forms (DSL, cable, fiber) are preferred.

Synchronous / asynchronous learning: Synchronous learning occurs in real-time and requires a live internet connection. Asynchronous learning involves online materials and requires an internet connection to initially obtain or submit materials but no continuous connection is required.

Wired broadband: Category of internet access (includes DSL, cable, fiber) where a physical connection on-premise exists. Does not include cellular or satellite forms of internet. Considered adequate for distance learning.



Methodology

Our sizing methodology consisted of two steps: (1) calculation of the number of students and teachers without access to an adequate internet connection and/or device and (2) a cost estimate of the investment necessary to provide all students and teachers with internet connection and devices adequate for distance learning.

Calculation of the number of students and teachers without access to an adequate internet connection and/or device

Calculation of the number of students and teachers without access to an adequate internet connection and/or device began with a study of what analyses have already been published on the topic and their respective shortcomings. Four common shortcomings emerged: (1) outdated underlying data, such as the 2017 Join Economic Committee report referencing 2015 1-year ACS data; (2) reliance on a survey that either has a low number of respondents (N of ~1,000 or less) or poor representation of respondents relative to U.S. population; (3) unclear definitions of what is deemed as an adequate internet connection or learning device; or (4) biased sample size due to how information was collected (e.g., information on lack of internet was collected via an online survey). Our analysis improves on these studies by using the latest government published data, documenting what is included in our statistics, and validating our findings through subject matter experts.

The U.S. Census Bureau's 2018 1-year American Community Survey (ACS), household internet and device usage rates were calculated. [34,35] The 2018 ACS had a 92% household response rate and was sent out to 3.5 million households, resulting in a significant sample size. For the purposes of this analysis, adequate internet connection is defined as high-speed broadband connection, including satellite and cable/DSL/fiber optic internet—cellular internet, as defined by the ACS,[36] is not included as an adequate internet connection as it does not specify data usage and the question presumes use on a mobile phone only, which is an inadequate device for quality distance learning. Adequate devices for home education include computers, laptops, and tablets—mobile and cellular phones are not included. Both the one-year and five-year aggregated view of the ACS survey is used, although one-year figures are the primary figures published to capture the recent trends in increased cellular internet adoption and decreased satellite internet penetration. Five-year figures likely have a lower margin of error given data collected over five years is used. with state-level student data provided by the National Center for Education Statistics (NCES) for the 2018-2019 school year to provide a view of the number of student households without internet or device access by state.[37] Using ACS public-use micro data (PUMS),[38] the number of households that fall into our four key segments (adequate device and connection, adequate device and no connection, no adequate device with connection, and no adequate device and no connection) were calculated. To estimate the number of teachers without adequate connectivity or devices, a similar methodology was used with one exception—the ACS data was filtered by Standard Occupational Classification codes to include only relevant K-12 teaching professions. Certain zip code and demographic information such as race/ethnicity, age, and gender segmentations were further calculated using NCES data and state/district-level ACS adoption rates. Finally, we estimate that 2 million to 3 million students do not have access to internet due to a lack of access or availability of a wired connection in their residential area—this figure is triangulated based off the 2020 FCC Broadband Report,[39] conversations with FCC subject matter experts, as well as the 2017 Current Population Survey (CPS)—Computer and Internet Use supplemental report.

Cost estimate of the investment necessary to provide all students and teachers with internet connection and devices adequate for distance learning

In order to estimate the cost to provide internet and devices at home to all students who need it, we consider the connectivity and device needs of the previously defined segments. Within each segment, there are multiple offerings that can meet the segment's requirement, each including complementary equipment, licenses, and support. The appropriate offering in each segment is based on connectivity network access, as well as stakeholder priorities:

34. Question 8: At this house, apartment, or mobile home – do you or any member of this household own or use any of the following types of computer?; Question 9: At this house, apartment, or mobile home – do you or any member of this household have access to the Internet?; Question 10: Do you or any member of this household have access to the Internet using a – full survey can be found at: https://www2.census.gov/programs-surveys/acs/methodology/questionnaires/2018/quest18.pdf.
35. ACS figures can be retrieved at: https://data.census.gov/cedsci/.
36. Cellular data in ACS defined as: "cellular data plan for a smartphone or other mobile device".
37. NCES figures can be found at: https://nces.ed.gov/ccd/elsi/tableGenerator.aspx.
38. PUMS dataset can be found at: https://data.census.gov/mdat/#/.
39. 2020 FCC report can be found at: https://docs.fcc.gov/public/attachments/FCC-20-50A1.pdf.

1. **Fully disconnected** (have neither connectivity nor devices). There are four potential offerings: (1) satellite, most suitable for those without fixed broadband or cellular network access; (2) cellular data plan, with an LTE-enabled device; (3) cellular data plan, with a hotspot and traditional Wi-Fi device; or (4) fixed broadband, with a traditional Wi-Fi device.

2. **Internet insufficient** (have device but no connectivity). Offerings include fixed broadband, cellular, or satellite connectivity, equipment, and installation, depending on what individuals are able to access. Satellite is primarily only suitable for those without access to either connectivity type (e.g., those in rural/remote areas).

3. **Device deficient** (have connectivity but no device). We assume only one potential offering: a traditional Wi-Fi device. This is because we define sufficient connectivity as fixed and satellite broadband only, which does not require an LTE-enabled device.

We first determined the minimum technical requirements for distance learning and then identified the price of components meeting those requirements. We conducted a series of interviews with internet service provider and device vendors to gather data and benchmarks on internet speeds offered in education or other targeted programs; student cellular data usage (number of GBs); education device models offered; educational content and other support provided; and prices and potential education and bulk pricing discounts available for each. We also gathered data from company websites and reviewed press releases on schools' digital purchases during COVID-19. Ultimately, we develop a cost range for each component by triangulating across these sources. Notably, we established component point-in-time pricing based on what can be delivered at scale, even though there may be lower prices on the market. For example, while low-cost traditional Wi-Fi devices can be offered at a $150 price point through special internet service provider programs, these devices are based on available inventory and cannot be purchased at scale.

From the component costs, we estimated a per person cost for each set of distance learning offerings. We accounted for different per person costs for offerings provided to different household sizes. Given that each segment can be served by different offerings, we also assigned percentages to each segment's solution based on what we are hearing from school districts about their priorities (total percentages for each segment sums to 100). With our per person average cost for each segment, we then used our previously sized student segments to get to the total cost to provide connectivity and devices.

While we take a similar approach to teachers, their requirements will be slightly higher than for students, given the higher demands on teachers to maintain video and support multiple learning applications to best engage their classrooms. Devices included in bundles include higher-end laptops (e.g., Dell Latitude for Education or LTE-enabled iPad with a keyboard versus Chromebook) and we assumed higher connectivity speeds are needed to allow for highly synchronous distance learning.

Data limitations and disclaimers

The majority of analyses presented in this study relies on sources of data that represent the broader US public K-12 population and that are published by reputable, largely government, organizations. We have synthesized conclusions with minimal assumptions, however there are certain elements that we have not captured as the precise data does not exist or is not representative of the overall population.

One such instance involves accounting for **multiple individuals/devices in a home**. Our data builds on the number of students who have at least one device at home. As such, our figures may underestimate the need for student devices where a student resides in a household with multiple family members and only a single device. In a scenario where each student receives his or her own learning device, we expect our device cost estimates to increase significantly. Our connectivity estimates are less likely to change in this regard as a dedicated connection line per student is less needed (except in the case of an LTE enabled device). Our connectivity figures do not adjust for the fact that some students may share a single residence (e.g. siblings) and can benefit from a single connection.

A second limitation involves **internet coverage**. Specifically, our estimation of students who do not have access to a wired connection due to a lack of infrastructure or coverage in their area may be understated. This data is published by the FCC, however this data is self-reported by ISPs and likely understated due to imprecise data collection methodologies (a single residence with wired connection access in a given area classifies the entire area connected, even if all other residences do not have the adequate infrastructure). We assume 99.9% of the population is covered by 5/1 Mbps mobile LTE as per the FCC, however these speeds may occasionally be insufficient for certain learning use cases. Tribal and rural areas make up significant portion of the 0.01%.

Other limitations include reliance on one-year ACS data which have a high margin of error for certain variables and the exclusion of group quarters, the unhoused student population, and other populations underrepresented in the ACS.

In addition to the analyses presented in this document, multiple studies exist citing the data sources listed above but face similar gaps in information. Further analyses, in the form of surveys and interviews with students, educators, and other stakeholders, can help equip student and teachers who live in multi-student homes, single device homes, areas with insufficient internet coverage, group quarters, tribal/rural areas, and face other issues not captured by the data sources listed above.

State-by-State Detail: Student digital divide

State	Students without adequate high-speed connection	% Students without adequate high-speed connection	Students without devices	% Students without devices
MISSISSIPPI	234,207	50%	167,875	36%
ARKANSAS	225,926	46%	157,252	32%
ALABAMA	304,964	41%	231,999	31%
OKLAHOMA	285,444	41%	198,833	28%
LOUISIANA	281,391	40%	227,315	32%
NEW MEXICO	133,623	40%	94,858	28%
TENNESSEE	363,553	36%	277,261	28%
KENTUCKY	240,673	36%	186,148	27%
MISSOURI	333,212	36%	224,772	25%
WEST VIRGINIA	92,323	34%	83,450	31%
SOUTH CAROLINA	265,652	34%	207,834	27%
INDIANA	363,995	34%	260,374	25%
TEXAS	1,828,917	34%	1,339,459	25%
IOWA	176,004	34%	118,309	23%
MONTANA	48,758	33%	31,259	21%
IDAHO	101,325	33%	53,153	17%
MICHIGAN	488,394	32%	349,627	23%
SOUTH DAKOTA	44,300	32%	31,563	23%
GEORGIA	559,644	32%	401,025	23%
WYOMING	30,244	32%	17,683	19%
NORTH DAKOTA	34,789	31%	24,910	22%
KANSAS	156,518	31%	109,578	22%
WISCONSIN	268,021	31%	183,892	21%
ALASKA	39,951	31%	24,894	19%
NORTH CAROLINA	468,967	30%	355,304	23%
ILLINOIS	588,917	30%	430,271	22%
OHIO	500,187	29%	402,404	24%
NEBRASKA	95,834	29%	68,888	21%
ARIZONA	335,558	29%	220,544	19%
VIRGINIA	375,097	29%	248,742	19%
PENNSYLVANIA	483,790	28%	390,265	23%
FLORIDA	800,519	28%	548,698	19%
MINNESOTA	249,845	28%	162,607	18%
VERMONT	24,415	28%	15,098	17%
NEW YORK	725,856	27%	567,116	21%
NEVADA	134,365	27%	97,843	20%
MAINE	48,936	27%	35,788	20%
OREGON	155,793	27%	94,515	16%

RHODE ISLAND	37,787	26%	32,361	23%
HAWAII	46,255	26%	36,369	20%
CALIFORNIA	1,528,536	25%	1,063,415	17%
DISTRICT OF COLUMBIA	21,301	24%	16,696	19%
MARYLAND	213,600	24%	152,389	17%
UTAH	163,108	24%	83,999	12%
DELAWARE	32,270	23%	33,325	24%
CONNECTICUT	121,776	23%	100,462	19%
COLORADO	211,425	23%	141,590	16%
NEW JERSEY	312,444	22%	245,213	18%
WASHINGTON	249,702	22%	172,897	15%
MASSACHUSETTS	204,325	21%	161,754	17%
NEW HAMPSHIRE	35,855	20%	26,139	15%

State-by-State Detail: Teacher digital divide

State	Teachers without adequate high-speed connection	% Teachers without adequate high-speed connection	Teachers without devices	% Teachers without devices
MISSISSIPPI	7,262	23%	1,634	5%
OKLAHOMA	7,284	17%	1,873	4%
ARKANSAS	6,123	16%	1,505	4%
ALABAMA	5,741	14%	1,471	3%
NEW MEXICO	3,013	14%	1,131	5%
TENNESSEE	8,794	14%	1,965	3%
WYOMING	1,055	14%	175	2%
VERMONT	1,055	14%	183	3%
LOUISIANA	5,028	13%	1,468	4%
TEXAS	48,049	13%	11,577	3%
IOWA	4,609	13%	738	2%
NORTH DAKOTA	1,140	13%	290	3%
MISSOURI	8,147	12%	1,970	3%
MICHIGAN	10,174	12%	1,749	2%
SOUTH DAKOTA	1,190	12%	375	4%
ALASKA	925	12%	112	1%
OREGON	3,473	12%	395	1%
INDIANA	6,444	11%	1,521	2%
MINNESOTA	6,379	11%	1,046	2%
IDAHO	1,769	11%	452	3%
KENTUCKY	4,336	10%	997	2%
NORTH CAROLINA	9,818	10%	3,051	3%
GEORGIA	11,695	10%	3,205	3%
KANSAS	3,582	10%	826	2%

WISCONSIN	5,759	10%	1,038	2%
ARIZONA	4,757	10%	1,497	3%
WEST VIRGINIA	1,757	9%	370	2%
SOUTH CAROLINA	4,987	9%	1,266	2%
OHIO	8,236	9%	1,958	2%
ILLINOIS	12,416	9%	3,204	2%
MONTANA	949	9%	480	5%
NEBRASKA	2,202	9%	496	2%
NEW YORK	18,035	9%	5,477	3%
MAINE	1,390	9%	406	3%
FLORIDA	14,999	9%	5,282	3%
MARYLAND	5,591	9%	1,016	2%
NEW HAMPSHIRE	1,328	9%	108	1%
UTAH	2,816	9%	352	1%
DELAWARE	735	8%	434	5%
NEVADA	1,813	8%	614	3%
VIRGINIA	6,616	8%	1,829	2%
CALIFORNIA	20,758	8%	5,485	2%
PENNSYLVANIA	8,611	7%	2,321	2%
CONNECTICUT	2,888	7%	821	2%
NEW JERSEY	8,171	7%	2,290	2%
COLORADO	3,767	7%	693	1%
WASHINGTON	4,212	7%	939	2%
RHODE ISLAND	674	6%	106	1%
HAWAII	702	6%	250	2%
MASSACHUSETTS	4,111	6%	1,311	2%
DISTRICT OF COLUMBIA	400	5%	50	1%

List of stakeholders interviewed

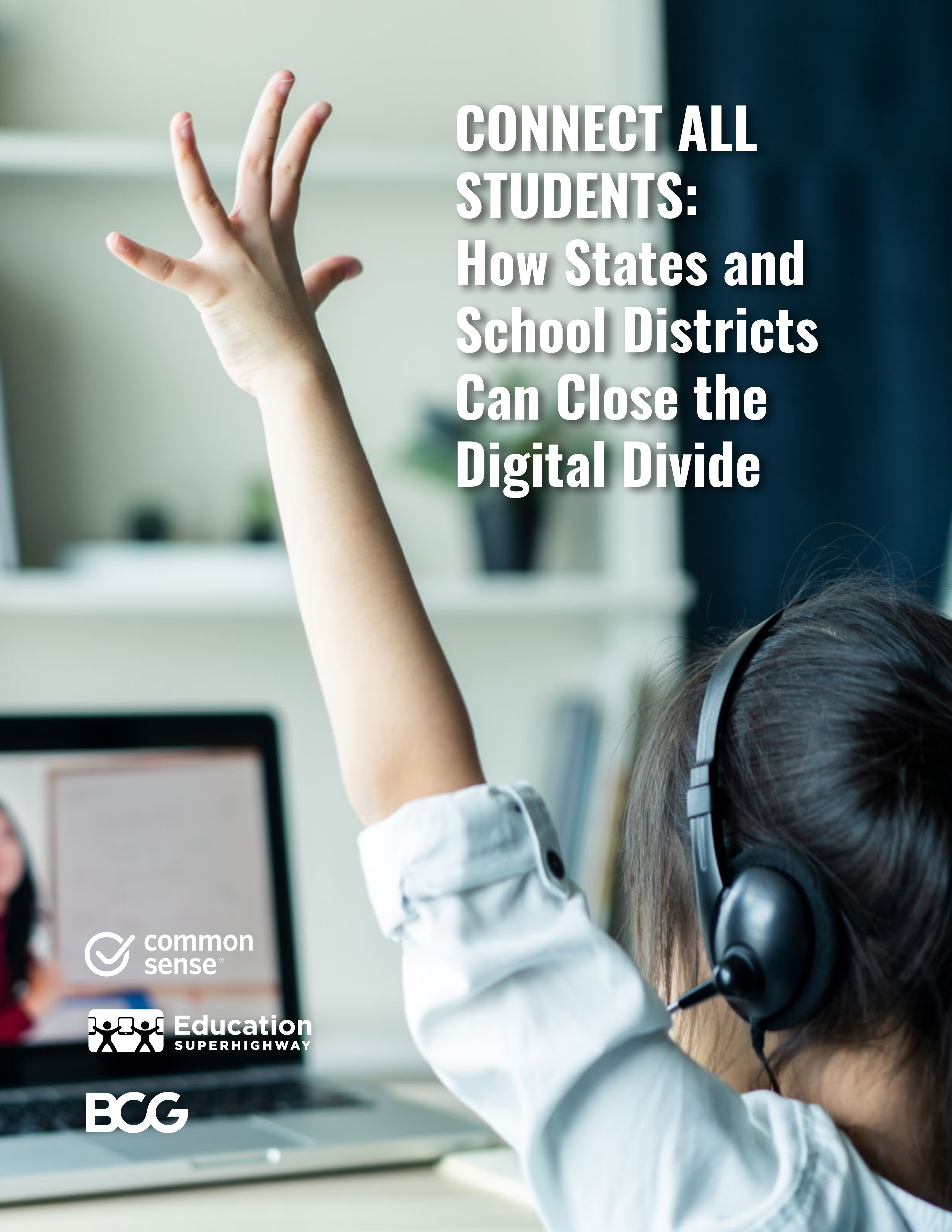
Apple
CDE Foundation
Charter Communications
Comcast
Cox
CT State Dept. of Education (CSDE)
Dallas ISD
EdNavigator
EducationSuperHighway
Emerson Collective
FCC
Kajeet
Khan Academy
Kipp DC
Kipp Delta
LAUSD
Texas Education Agency
T-Mobile
UC San Diego
Verizon
Walmart
Wide Open School
Zoom

Common Sense | San Francisco
699 8th Street, Suite C150
San Francisco, CA 94103

www.commonsense.org

BCG | Boston
200 Pier 4 Boulevard
Boston, Massachusetts 02210

www.bcg.com



CONNECT ALL STUDENTS: How States and School Districts Can Close the Digital Divide

common sense

Education SUPERHIGHWAY

BCG

This report was developed by Boston Consulting Group in partnership with Common Sense and EducationSuperHighway.

Common Sense is the nation's leading nonprofit organization dedicated to improving the lives of all kids and families by providing the trustworthy information, education, and independent voice they need to thrive in the 21st century.

EducationSuperHighway is a nonprofit organization founded in 2012 with the mission of upgrading the internet access in every public school classroom in America. The organization believes that digital learning has the potential to provide all students with equal access to educational opportunity and that every school requires high-speed broadband to make that opportunity a reality.

Boston Consulting Group partners with leaders in business and society to tackle their most important challenges and capture their greatest opportunities in order to unlock the potential of those who advance the world.

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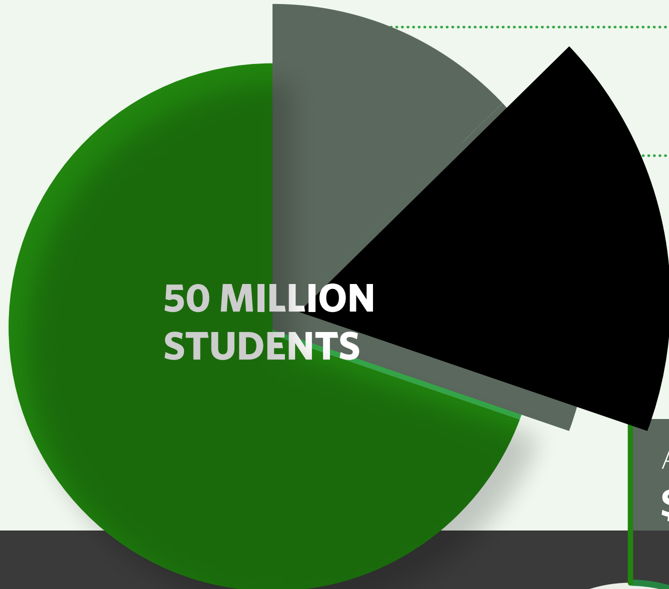
CLOSING THE K–12 DIGITAL DIVIDE IN THE AGE OF DISTANCE LEARNING

Due to pandemic-related school facility closures, 50+ million K–12 public school students had to learn remotely.



15 MILLION TO 16 MILLION (30%)
of these students lack adequate internet or devices to sustain effective remote learning.

9 MILLION
of these students lack both adequate internet and adequate devices.

At least **36 STATES** have allocated over **$1.5B IN CARES FUNDING** for K–12 digital access.

Key Steps to Closing the Digital Divide

ASSESS NEEDS

Identify

Assess who needs connectivity and devices at home and where they live.

PROCURE SOLUTIONS

Research

Determine which devices and connectivity options are desirable and available and how to distribute them.

ACCESS FUNDS

Fundraise

Find the money to pay for it all, usually through a combination of federal, state, local, private, and/or philanthropic dollars.

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EXECUTIVE SUMMARY

Across the United States, even before the onset of the coronavirus pandemic, there was a significant digital divide between K–12 students with access to high-speed internet and computing devices at home, and those without. **With the closure of school buildings for more than 50 million students in March, the "homework gap," as one part of the digital divide is known, threatened wholesale learning loss.** School districts and states scrambled to provide devices and connectivity to their students at home, and Congress responded with limited financial aid through the CARES Act.

More than six months later, there is much to be learned from the largest and most unanticipated experiment in distance learning in U.S. history. Common Sense, EducationSuperHighway, and Boston Consulting Group, each with significant experience working to address digital divide issues, joined forces to understand how stakeholders responded to this emergency and what lessons can be learned from those efforts to close the digital divide going forward.

This report highlights case studies at the state, city, and school district level and concludes that there are three key steps in the still unfinished endeavor of closing the K–12 digital divide during the pandemic.

> **First**: Assess who needs connectivity and devices and where they live.
>
> **Second**: Determine which devices and connectivity options are desirable and available and how to distribute them.
>
> **Third**: Find the money to pay for it all.

We learned that the best solutions relied on high-level communication and collaboration among all stakeholders; that states with a history of broadband investment were able to pivot more quickly to respond to school closures; and that states or districts with high-quality needs assessment were more efficient in procuring and distributing devices and connectivity.

We also learned, however, that even in the best cases, obstacles persist in closing the divide for all students, including insufficient funding, supply constraints, and limited existing infrastructure. In addition, it became clear that many efforts to date, of necessity, are short-term stop-gap measures that are not necessarily sustainable, nor would they be the optimal long-term solution. One caveat to this is that the needs assessment is a helpful step for long-term digital divide efforts.

Finally, while digital literacy is not a focus of this particular report, we found that another critical component to ensuring high-quality distance learning is a holistic digital inclusion[1] approach, including digital literacy, parent and teacher training, and tech support—all of which requires additional planning, staff, and funding.

1. Digital inclusion refers to the activities necessary to ensure that all individuals and communities, including the most marginalized, have access to and use of information and communication technologies (ICTs). These include five elements: 1). affordable, robust broadband internet service, 2). internet-enabled devices that meet the needs of the user, 3). access to digital literacy training, 4). quality technical support, and 5). applications and online content designed to enable and encourage self-sufficiency, participation, and collaboration. Digital inclusion must evolve as technology advances. It requires intentional strategies and investments to reduce and eliminate historical, institutional, and structural barriers to the access and use of technology.

INTRODUCTION

Across the United States, even before the onset of the coronavirus pandemic, there was a significant digital divide between K–12 students with access to high-speed internet and computing devices at home, and those without, historically known as the "homework gap."[2]

Before the pandemic, more than 40% of teachers in Title I schools said they would not assign homework that required digital access because students would have trouble completing it[3], and a 2017 Speak Up study found that the majority of school principals considered digital equity a major challenge.[4]

The coronavirus pandemic, which required most K–12 students to attend school from home from March through at least October, has transformed the homework gap into an even more significant problem, leading to a learning gap and raising additional concerns about learning loss in a distance learning setting.[5] And because **the digital divide disproportionately affects students from lower-income families and students of color, failure to close the digital divide risks further undermining key student groups that already face greater obstacles to educational success.**

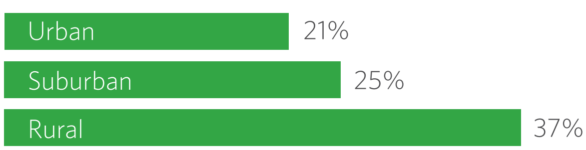
A June 2020 analysis by Common Sense and BCG on the digital divide among America's public school students and teachers found that the divide was larger than previously estimated: **About 15 million to 16 million students, or 30% of all K–12 public school students, live in households without either an internet connection or a device adequate for distance learning, or both.**[6] (The same report also found that up to 400,000 K–12 teachers—roughly 10% of all public school teachers—live in households without adequate internet connectivity, and 100,000 teachers lack adequate home computing devices.)

Closing the K–12 digital divide has multiple benefits: It is essential to ensure all students have equal access to distance learning; it enables remote working and workforce development, offering a two-generation approach to help break cycles of poverty; and it serves as a downpayment toward closing the broader digital divide.[7]

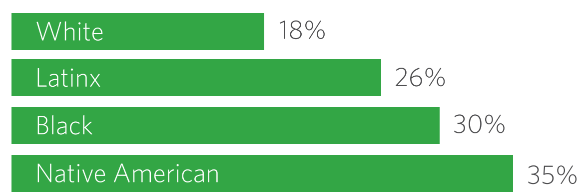
The digital divide disproportionately impacts rural communities and Black, Latinx, and Native American households

% of students without broadband

by geography



by race/ethnicity



Research by the Greenlining Institute has shown that districts subject to financial redlining practices in the 1930s face a higher digital divide today.*

*On the Wrong Side of the Divide. Source: U.S. Congress Joint Economic Committee. (2017, September). America's Digital Divide. Perrin, A. (31 May, 2019). Digital gap between rural and nonrural America persists. Pew Research Center.
Note: Asian race/ethnicity not included in bar chart.

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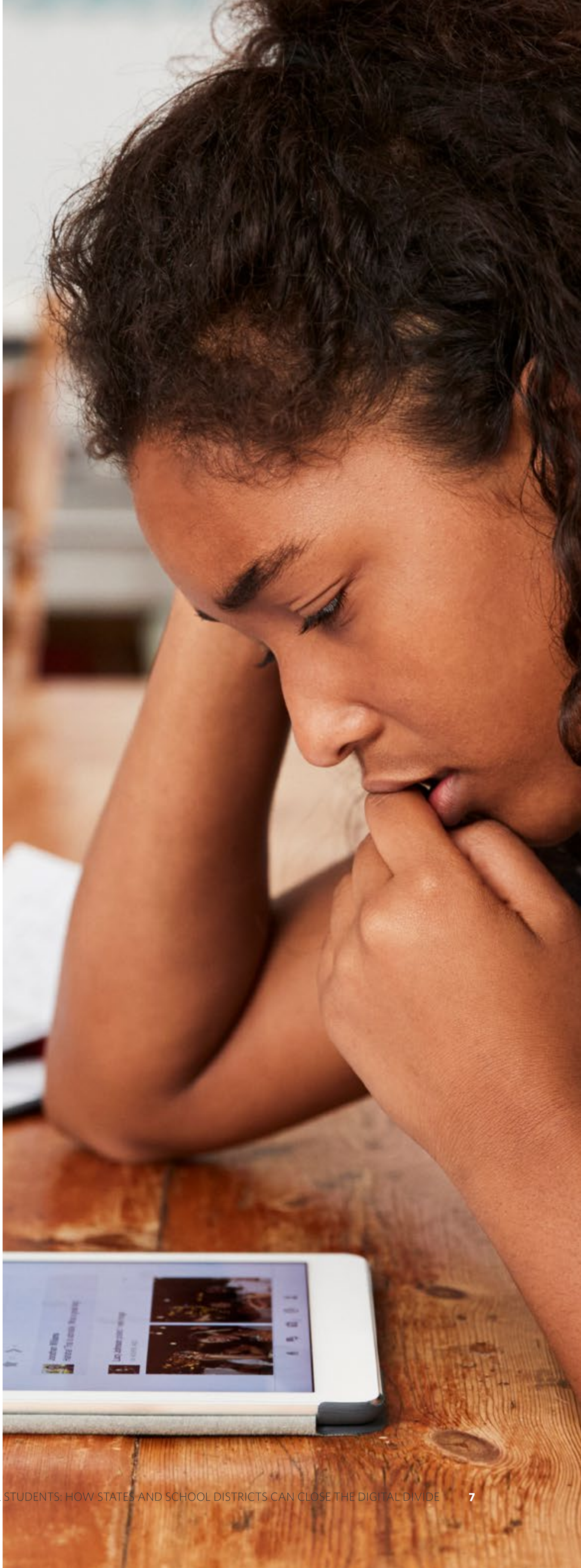
2. FCC Commissioner Jessica Rosenworcel is credited with first using the term "homework gap," which sheds light on this critical problem for K–12 students. In this report, as in our previous report *Connect all students: How states and school districts can close the digital divide* we expand the definition of "homework gap" to refer to students who cannot complete all schoolwork that requires adequate internet and computing devices at home.
3. *Infographic from The Homework Gap: Teacher Perspectives on Closing the Digital Divide*
4. *How America's Schools are Addressing the Homework Gap: Speak Up 2016 findings*
5. *The COVID-19 slide*, *COVID-19 and student learning in the United States*
6. Note: Where discrepancies exist between the digital divide figures reported in the prior Common Sense/BCG report and the figures reported in state/district spotlights, this may be due to 1). limitations in data collection and assessment, 2). varying definitions of what constitutes adequate connectivity, and/or 3). differences in methodology and scope, e.g., rural vs. state-wide, or student vs. household focus.
7. The term "digital divide" refers to the gap between individuals, households, businesses, and geographic areas at different socioeconomic levels with regard both to their opportunities to access information and communication technologies (ICTs) and to their use of the internet for a wide variety of activities (*Glossary of Statistical Terms: Digital Divide*. Organisation for Economic Co-operation and Development. Accessed July 2020).

The report estimated the **cost of closing the digital divide for K–12 students to be between $6 billion and $11 billion in the first year**, and it called on Congress to make a direct investment in student connectivity and devices as part of an emergency coronavirus response package.

In March, Congress passed the Coronavirus Aid, Relief, and Economic Security (CARES) Act, which included $13.2 billion for K–12 education (the Elementary and Secondary School Emergency Relief Fund, or ESSER) to be distributed by the U.S. Department of Education[8] to the states to use for a wide range of unmet educational needs, one of which is distance learning.

The CARES Act also included an additional $3 billion for the Governor's Emergency Education Relief Fund (GEER), designated for governors to use for either higher education or K–12 education, and which also can be used for distance learning and other purposes[9]. The ESSER and GEER funds, while helpful, did not offer a coherent approach to closing the student digital divide and were insufficient to fully close the K–12 digital divide in any single state.

> Greater direct federal investment and support is still needed to address the divide during the pandemic and to sustainably close the digital divide once and for all.



8. CARES Act Emergency Relief
9. Governor's Emergency Education Relief Fund

OBJECTIVE, SCOPE, AND GUIDEBOOK

Objective

This report provides a fact base of best practices to close the K–12 digital divide during the pandemic to enhance decision-making for all stakeholders. Without a robust and codified set of approaches, states and districts are at risk of recreating suboptimal connectivity solutions and may even end up competing against one another given supply chain constraints.

This report is intended to serve as a guide for:

States and districts: This report offers a broader view of which approaches are possible and identifies where certain approaches are best suited depending on stakeholder needs, size, and capabilities.

State and federal policymakers: This report is intended as a guidebook from which policymakers can develop more sustainable and permanent long-term solutions and funding sources.

Businesses, philanthropies, and nonprofits: This report identifies avenues where resources from these entities would be most useful and how they can support system effectiveness.

Based on our review of state, city, and school district models during the pandemic, the report concentrates on **three steps to closing the student digital divide during the pandemic**:

Who: Assess who needs connectivity and devices at home and where they live.

What: Determine which devices and connectivity options are desirable and available and how to distribute them.

How: Find the money to pay for it all, usually through a combination of federal, state, local, private, and/or philanthropic dollars.

Scope

The report is based on 18 interviews with stakeholders supporting state, city, and district efforts to close the digital divide, complemented by news media reports, existing research by education nonprofits, and previous work by Common Sense, EducationSuperHighway, and Boston Consulting Group, among other sources. The bulk of the information for this report was collected in September of 2020.

For a robust distance learning experience, students and teachers need four things:

1. High-speed internet service at home (robust: 200/10 Mbps; adequate: 25/3 Mbps[10])
2. Internet-enabled learning devices (excluding cellphones[11])
3. Distance learning instructional content
4. Support, including digital literacy resources, teacher and parent training, and social/emotional resources

This report focuses primarily on the first two elements: ensuring that all students have home access to the internet and access to devices capable of meeting the demands of distance learning. These elements intersect and must be examined together rather than independently of one another, as a student with connectivity but no device is still on the wrong side of the digital divide, and the same is true of a student with a device but no connectivity.

This report offers best practices to bridge the digital divide in the context of the coronavirus pandemic and potential approaches within the confines of what is available today. It operates under the assumption that federal action is limited, states are the primary drivers of coordinated action, and while the exact dynamic between states and districts may vary, execution is largely done at the local, district level.

10. Pg. 23, *Closing the Digital Divide in the Age of Distance Learning*
11. Given that many education platforms, and content, are not optimized for mobile phones and make it difficult to complete student assignments, individuals with only a mobile phone are not considered to have an adequate device for distance learning.

Finally, this report assumes states and districts can make use of the currently available pandemic funding, including ESSER and GEER funds as well as existing state, district, and city budgets that can be deployed to close the digital divide, although a large portion of this funding has been fully committed or already spent. As stated above, it is clear that additional federal funding is needed to close the student digital divide fully.

In the Appendix, we provide detailed "spotlights" from our interviews with state, city, and district officials to highlight effective existing models in the areas of needs assessment, procurement, and funding, representing potential approaches to reducing the divide and establishing a path to meeting longer-term connectivity goals. Excerpts from the spotlights are used throughout the report.[12]

Guidebook

The guidebook is oriented around three key steps—Who, What, and How—and additional considerations toward closing the K–12 digital divide during the pandemic.

In addition, it is important to remember that there is no one right approach to closing the divide. Efforts vary in both their context and objectives.

Context: Every community will have a slightly different slate of stakeholders. Some states have built their education system with a top-down approach, while others place more power at the local level, in the hands of districts. Engagement by additional stakeholders in a community can boost resources and potentially help share the work of closing the digital divide (e.g., public-private partnerships, community broadband organizations). Furthermore, starting points and existing circumstances will also vary, including:

- Demographics of the target population (e.g., size, urban-rural mix, family income, language(s) spoken)
- State of existing infrastructure (e.g., availability, speed, providers)
- Degree of student connectivity (e.g., robust home connection, dedicated learning device)
- Unique community needs (e.g., accessibility, usability, other barriers to adoption)

Objectives: It's important to recognize that if a state or district seeks to implement their digital divide program quickly, there are inherent trade-offs to be considered. When selecting an approach, it is important to clearly identify what constitutes adequate connectivity and the devices necessary for a distance learning program.[13]

- Maximizing speed of implementation, for example, requires streamlining negotiation processes and purchasing easily accessible connectivity options (e.g., handing out hot spots, choosing devices without supply chain constraints).
- Minimizing costs, for example, requires reducing lengthy request for proposal (RFP) processes, which may prolong the time students are without access.
- Maximizing quality, for example, may require setting up service-level contracts, narrowing selection options to those that meet stringent thresholds (e.g., upload/download speeds), or investing in long-term infrastructure.

12. The Appendix also includes a brief description of state and district examples beyond those covered in the spotlights.
13. See, for example, pg. 16, *Closing the Digital Divide in the Age of Distance Learning*

THE GUIDEBOOK

Step No. 1

Who: Conduct needs assessment to determine which students need connectivity and devices and where they live.

Conducting a needs assessment is a critical component of closing the digital divide. State and local education officials must understand which students need support to ensure home access to connectivity and devices that meet distance learning requirements. If this data is granular (down to the address level with specifics around available speeds and providers), it can ensure that state and district efforts efficiently provide resources in the short term.

However, this data will also be valuable as states and school districts seek to build long-term strategies. Assessments allow officials to gain insight into the broadband adoption needs specific to each family situation (e.g., familiarity with digital literacy, number of people sharing access). It's worth noting that if districts and states invest in a robust and recurring assessment program, the data will be valuable not only for states but also for federal policymakers and other potential private and philanthropic partners seeking to close the digital divide.

Considerations when creating a student digital divide needs assessment include:

- Crafting questions that will provide the appropriate level of detail without being overly technical or burdensome in length for the responders.
- Identifying a data repository for storing the information once it is collected, such as a student information system (SIS).
- Building an assessment program that allows robust use of the data, including the impact of digital access on learning outcomes, solutions design, and state and federal policy advocacy.
- Overlaying student digital divide data with other data sets to identify trends and possible solutions (e.g., overlaying with internet service providers, or ISPs, on coverage maps).
- Balancing timeliness of information collection with a thoughtful investment in the assessment program to repeat data collection year over year.
- Protecting student data and ensuring compliance with state and federal education privacy laws.

Protecting student privacy

Most school districts considering sharing student information with ISPs or other third parties will have to consider both federal student privacy law and newer state laws. Generally, the federal Family Educational Rights and Privacy Act (FERPA) requires written consent from parents in order to release information held in education records. In the absence of consent, federal law does permit educational institutions to disclose personal information if the disclosure fits into one of several exceptions, including directory information, a disclosure to a school official, and information for an audit or evaluation. Educational officials are advised to seek legal guidance on any transfer of student information. Sharing address information with internet service providers for the purpose of identifying unconnected households could be considered directory information so long as no additional data from education records is included. In the absence of a federal or state study or program, however, the best practice is likely to be getting written consent from parents.

Furthermore, FERPA exceptions require contractual protections. The Council of Chief State School Officers (CCSSO) has a list of best practices that districts and states should follow, including establishing a written agreement that includes restrictions on use, retention and deletion schedules, and basic data security requirements. Commercial use beyond the provisioning of internet service should be prohibited.

Following such best practices may also assist educational agencies in over 30 states who must additionally contend with state-specific laws, though again school districts are advised to consult with legal counsel.

14. FERPA Exceptions Summary
15. CCSSO Home Digital Access Data Collection Blueprint for State Leaders
16. State Student Privacy Laws. As of 9/6/2020, 34 states had passed student privacy laws that applied to either local or state educational agencies.

There are a range of approaches for assessing the size of the student digital divide, each with trade-offs in terms of speed, ease of implementation, and ability to inform long-term solutions. While estimates and surveys quickly provide a means of assessing the size of the need, school leaders should work toward more robust and sustainable assessment methodologies that integrate digital divide questions into standard processes (such as registration and enrollment) and systems (e.g., student information systems).

CCSSO has identified a set of six key questions[17] related to student device and connectivity needs whose answers should be collected in addition to key student demographic information (e.g., name, grade level, number of siblings in household, home address).[18] The student-level data will play a key role in the procurement process for connectivity and devices, as discussed in Step No. 2.

1. What device does the student most often use to complete online learning at home?
2. Is the primary learning device a personal device or school provided?
3. Is that device shared with anyone else in the household?
4. Can the student access the internet on their primary device (non-cellphone) at home?
5. What is the primary type of internet service used at the residence?
6. Can the student stream videos without connectivity interruption?

Implementation of survey-based needs assessment process

PLANNING

- Leverage teachers and school administrators in design process to **understand student context** and needs.
- Set up necessary **FERPA and data privacy protocols**, including data sharing agreements, file transfer protocol, and secure authentication.
- **Communicate upcoming assessment** to families (via text, call, email).
- Pilot with select teachers and students to **test process** for technical glitches, completion time, mobile compatibility, and language translation.
- **Set deadlines and incentives** for completion, especially for populations with lower expected response rates.
- Prepare to **guide families through process**, explaining the purpose of the needs assessment and emphasizing confidentiality.

EXECUTION

- Focus on **easing access burden** for families.
- Leverage online links shared via email, text, and auto-dialers that direct families to a **mobile- and web-friendly survey**.
- Implement **non-digital alternatives** to better reach unconnected families.
- **Use in-person avenues** for completion in line with social distancing guidelines.
- **Conduct follow-up calls** to non-respondents midway through the window to provide reminders and offer support.
- Leverage teachers, community-based organizations, and potentially ISPs to help support **data completion and accuracy**.
- **Track completion** regularly and update all stakeholders on key metrics.

FOLLOW-UP

- Analyze responses and **implement robustness checks** (e.g., weighting responses if not comprehensive, calling about non-responses).
- **Sense-check results** to protect against faulty responses (e.g., requesting unneeded laptop) by comparing estimated results to existing data, asking schools to verify if needed.
- Supplement collected data with other administrative data (e.g., performance, graduation/dropout rates) if possible to gain **understanding of the digital landscape**.
- Be transparent and **share results with all stakeholders**, including next steps and plans for immediate action.
- Reflect on the process, capture learnings, and **build infrastructure** to replicate the assessment and aggregate data going forward.

---

17. See, for example, the CCSSO's *Home Digital Access Data Collection: Blueprint for State Education Leaders*.
18. For School Districts: Registration Question Bank

K–12 Bridge to Broadband Initiative

ISPs launch programs to enable school districts to identify and purchase residential broadband service for lower-income families

In partnership with EducationSuperHighway, regional and national internet service providers (ISPs) are creating offerings tailored to meet the needs of schools looking to close the K–12 home digital divide.

Built on the recent success of partnerships between school districts and ISPs in Chicago, Atlanta, Philadelphia, and Las Vegas, the initiative promotes five core principles for ISPs working with school districts or states to identify students without broadband at home and to advance effective solutions.

- Create a **sponsored service** offering for school districts to purchase internet services for students at home.
- Provide the **data** school districts need to identify students who lack at-home broadband (i.e., provide addresses of students who are unserved and who could be provided with broadband service within 10 days).
- Agree to a baseline set of **eligibility** standards.
- Minimize the amount of information required to sign up to facilitate **enrollment** for families in need.
- Commit to protecting participating families' **privacy** by not using the supplied information for target marketing.

Participating providers offer broadband service to over 80% of U.S. homes. State and district leaders can visit K–12 Bridge to Broadband to find participating providers.

Step No. 2

What: Establish process for procuring devices and connectivity.

Efforts to ensure that every student has a dedicated learning device and home internet access have required state and local education leaders to address new procurement challenges in light of the pandemic. While some parallels in procurement strategies exist between purchasing devices and connectivity services, there are specific strategies associated with each that will be discussed separately in the following sections of the report.

Devices

The vast majority of school districts had experience purchasing devices prior to the pandemic. **However, the pandemic necessitated some school districts to quickly purchase additional devices if they were not already at a 1-to-1 student-to-device ratio, and supply chain constraints for some learning devices have added complexity to the purchasing process.** Many school districts have also had to navigate the challenges associated with sending devices home with students for the first time.[19]

When it comes to selecting the appropriate devices to purchase, school leaders typically factor in grade-level needs, compatibility with existing software and IT systems, and cost. Supply chain constraints during the pandemic have led to device availability becoming another decision-making factor in the short term.

To alleviate the administrative burden on school districts and help them better navigate supply chain challenges, some states, such as Texas and Maine, have aggregated demand and run statewide procurements for devices. It is important for states considering aggregated procurements to factor in device preferences from school districts. The state of Indiana committed CARES Act funding to learning device purchases but allowed the school districts to handle procuring the devices based on their local preference.

In addition to purchasing the physical devices, states and districts should consider service-level agreements, as seen in the Maine Learning Technology Initiative (MLTI) model.

19. For more information on how schools can manage device lending programs, see the Digital Bridge K–12 Device Toolkit.

Which device types should be selected?

	LAPTOPS	CHROMEBOOKS	TABLETS
Typical grade level	• Typically used for grades 9 through 12	• Typically used for grades 2 through 12	• Typically used for pre-K through 2 and in special education
Benefits	• Better processing power and storage capacity • No current supply chain constraints • Longer-lasting and durable • More leasing options • Useful for STEM applications	• Low cost of purchase and repairs • Cloud filtering and authentication simple for schools • Easy integration with Google Classroom and apps	• Allows for direct annotation • Touchscreen is easy to use • Can be LTE-enabled (does not require hot spot/broadband)
Limitations	• Higher cost • Difficult to administer with filtering software	• Current supply chain is back ordered, reducing distribution speed • Licensing and expiration challenges	• Higher cost • Licensing and expiration challenges • Unable to perform more complex tasks

Examples	• Dell Inspirion 14 3000
	  ▪ Cost: $294
	  ▪ Screen: 14"
	  ▪ RAM: 4GB
	  ▪ Hard drive: 128 GB
		• HP Google Chromebook 11 G5
		  ▪ Cost: $199
		  ▪ Screen: 11.6"
		  ▪ RAM: 4 GB
		  ▪ Hard drive: N/A
			• iPad
			  ▪ Cost: $429
			  ▪ Screen: 10.2"
			  ▪ RAM: 3 GB
			  ▪ Hard drive: 128 GB

These agreements integrate device purchasing with repairs and maintenance, warranty, and replacement, ensuring greater sustainability of results and a provider focus on performance (e.g., a working laptop always being available).

Device distribution

The pandemic presented a new challenge for device distribution, as districts needed to determine how to get devices to students while school buildings were closed. Many districts coordinated with food-service distribution programs to deliver devices to students. Others had manufacturers ship devices directly to students where privacy and asset logistics allowed. Other low-contact approaches to maintaining safe distribution during the pandemic have included:

1. Drive-through distribution
2. Pickup appointments at designated distribution centers
3. Rotating the distribution center to different campuses
4. "Uber"-style drop-off of devices at student homes (e.g., through teachers, administrators, or third parties)

Tech support for students, teachers, and families

In addition to ensuring all students have devices and connectivity at home, quality distance learning requires ongoing tech and digital literacy support for students and their families. School districts need to budget for additional staffing and tech requirements. Where possible, states and school districts should partner with community-based organizations (CBOs) that are well versed in providing both tech and digital literacy support to new technology users. Developing robust tech support was key to improving the success of Los Angeles Unified School District's (LAUSD) efforts to roll out a distance learning program. Even though LAUSD had an established IT support line, demand for the service pushed administrators to significantly expand capacity. Simple calls around log-ins need to be addressed quickly and separated from complex calls on technical issues related to setup, equipment, or software.

Help desks: *Should be implemented as a central digital inclusion resource* (including IT as well as digital literacy support) for parents and caregivers, with proper staffing levels and multilingual resources, and in-person appointments when feasible.

Repairs and maintenance: *Should be made available at the school or district level.* Funding should be allocated in yearly budgets for repairs, including costs of warranties and potential insurance programs.

Inventory: *Should be managed before and after distribution* through asset tagging with procedures to address student mobility, theft, and graduating classes.

Refresh cycles: *Should be updated to ensure device quality* and should occur in smaller loads to spread out costs.

Security and data privacy: *Should be implemented through school networks or prefiltered devices.* It is also important to vet online educational materials and teach cybersecurity to families to ensure compliance with the Children's Internet Protection Act (CIPA). In recent years (and especially since the pandemic), hackers have targeted school districts that handle large amounts of personal data.

School districts can take several actions to bolster their security and data privacy practices[20]:

1. Collaborate with stakeholders on guidelines for governance and use.
2. Ensure contracts meet required compliance laws (e.g., CIPA and state student privacy laws) and limit any commercial use of data.
3. Identify and train a tech security lead.
4. Perform regular audits and system tests.
5. Institute security and privacy trainings.
6. Implement technical measures that limit access to data.
7. Review and evaluate any edtech for student or teacher use.[21]

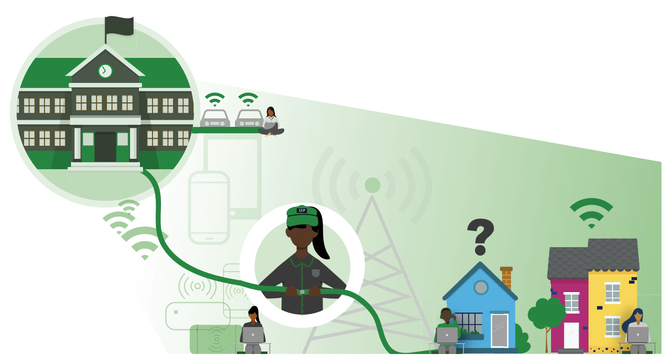
To ensure effective ongoing use of devices, states and school districts should establish robust digital inclusion programs to ensure that caregivers and students have the skills necessary to effectively participate in distance learning. When developing digital inclusion programs, school districts should consider providing materials on digital citizenship and resources to equip students, caregivers, and teachers to protect themselves against online threats and limit unwanted access to and use of personal information (e.g., through use of effective passwords). Private sector vendors and nonprofits (e.g., the National Digital Inclusion Alliance[22] and Wide Open School[23]) are already prepared to offer this support, with many offering free digital literacy resources.

Connectivity

The coronavirus pandemic has caused a dramatic shift in the way education leaders think about the role schools should play in ensuring that all students have access to the internet at home.[24] Prior to the pandemic, most schools considered home internet access to be the responsibility of the family.[25] When schools shifted to distance learning in March as the primary means for delivering instruction, attitudes about the responsibility of schools to ensure home internet access for students also shifted.[26]

The homework gap existed before COVID-19

Schools are bridging the homework gap during COVID-19



20. Framework from Trusted Learning Environment
21. The Common Sense Privacy Program has worked with a number of districts to evaluate popular edtech products.
22. The Digital Inclusion Startup Manual
23. Resources for Teachers from WideOpenSchool and Digital Citizenship resources from Common Sense Education
24. Twin Cities educators seek assurances for safe return to classroom
25. Many Districts Won't Be Ready for Remote Learning If Coronavirus Closes Schools
26. How School Districts Are Outsmarting a Microbe

Unlike with devices, schools had little to no experience procuring home connectivity services for students. The following sections cover strategies and best practices that emerged as state and local leaders worked to bridge the K–12 home connectivity gap.

Planning the procurement process

The first step in procuring connectivity services for students at home is to have a clear assessment of the need (see Step No. 1 of this report). Once the student-level need is understood, local connectivity options can be identified by overlaying ISP and LTE[27] coverage maps. Online service provider look-up tools and coverage maps, such as the ones offered at www.digitalbridgek12.org, can assist in identifying available options.

After an initial set of options has been identified, local ISPs should be engaged to get a better understanding of their service offerings. Many providers expanded their offerings during the pandemic to include programs tailored to education entities looking to purchase residential internet access on behalf of families. At the state level, these conversations can be facilitated through internet service provider associations, similar to the approach North Dakota and Connecticut took (see North Dakota and Connecticut spotlights in the Appendix). Discussions with providers should include the following topics:

- Ability to deliver desired upload/download speeds and minimum data requirements for distance learning
- How to ensure that CIPA-compliant filtering can be implemented
- Total cost of ownership, including installation fees, equipment costs, maintenance, repairs, and customer support

Many states and school districts have worked to negotiate contracts that front-load costs to take advantage of this one-time funding (e.g., higher installation costs vs. ongoing fees, and equipment purchase agreements vs. equipment rental).

The planning process should also determine whether an RFP is needed. State and local procurement law may require that an RFP process be followed, although many of these requirements have been suspended during the pandemic. There are additional pros and cons to using an RFP, namely the trade-off between optimizing the speed of purchasing and optimizing pricing through competition and negotiation. If an RFP is to be used, there are templates available at digitalbridgek12.org/toolkit/procure/internet-access-rfp/.

Evaluating connectivity options

The availability of different connectivity options depends on many factors, namely locale (urban vs. rural), geographical characteristics (i.e., terrain), and historical local investment in broadband infrastructure. Some school districts, particularly those in large urban areas, may have a variety of connectivity options available. Others in less populated locales may have limited choices.

Fixed broadband, such as cable or residential fiber, usually offers the most reliable indoor service and fastest speeds, isn't constrained by data caps, and provides some of the lowest price points for internet access. Fixed broadband has the ability to connect a majority of K–12 students based on existing network infrastructure, but many families with access to broadband networks are not connected due to barriers to adoption (e.g., affordability, sign-up requirements).[28] To overcome these barriers, states and school districts are using an innovative approach: The school district serves as a single subscriber for multiple households through what's known as a sponsored service, or a single-payer contract, with an ISP.[29] This allows school districts to relieve the burden on families around eligibility and sign-up. However, where fixed broadband options do not exist, or where adoption barriers cannot be quickly overcome, cellular hot spots provide an alternative. For example, school districts with students facing housing instability may find hot spots to be a more effective connectivity solution.

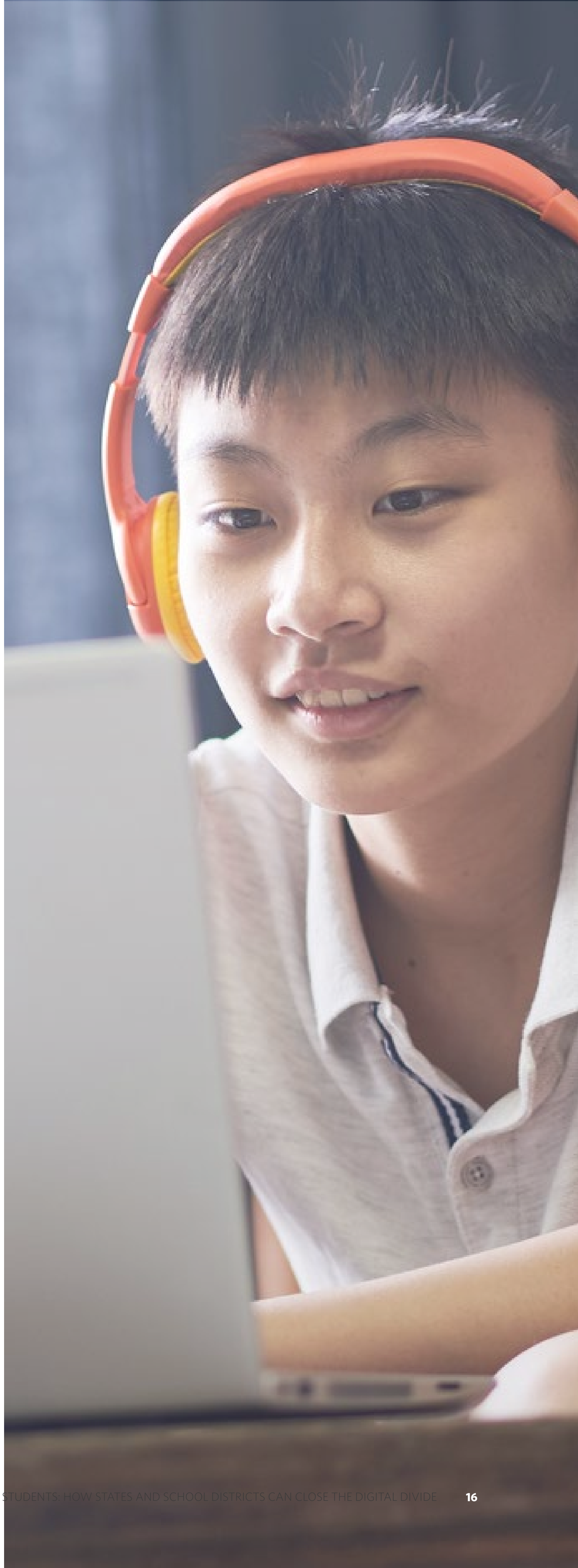
In areas where both broadband and LTE access are lacking, more creative solutions need to be employed to provide home internet. This could include satellite internet, deployment of Wi-Fi buses, and installation of mesh networks.

27. LTE stands for "long-term evolution" and is a marketing phrase that signifies progression toward true 4G.
28. The Alliance for Excellent Education found that 80% of students without adequate connectivity are in metropolitan areas vs. in nonmetropolitan, or rural, areas. The majority of metropolitan areas are connected to the fixed broadband grid. For students in these regions, lack of adequate connectivity is largely tied to affordability and other barriers to adoption
29. What Are Single Payer Agreements?

In **SAN RAFAEL, CALIFORNIA**, while higher-income neighborhoods enjoyed robust home access to broadband, the Canal neighborhood, an area populated predominantly by lower-income workers, had a lack of broadband infrastructure that would have created additional barriers to the success of distance learning efforts.[30] **Over the summer of 2020, public and private stakeholders in the community built a mesh network to connect more than 2,000 students and their families for the 2020–2021 school year.**[31]

In **CHATTANOOGA,TENNESSEE**, Hamilton County Schools quickly supported all students in need of home access through an existing partnership with municipally owned telecom provider EPB. EPB's earlier investments in a sophisticated fiber network infrastructure enabled them to quickly extend fiber infrastructure throughout the community, deploying 100 Mbps broadband for high-speed internet to more than 28,000 lower-income families. Thanks to their earlier investments, EPB was able to drive down the cost of service, extending use of the **$8.2 million raised by the district to secure a 10-year program that will offer students 100 Mbps broadband service completely free of charge**[32] (see Chattanooga spotlight before Appendix).

30. Canal Digital Access Equity Fund
31. How San Rafael, California Built a Neighborhood Mesh Network That Turned into Something More
32. Hamilton County and Chattanooga use Smart City Infrastructure to Bridge the Digital Divide for Students



What connectivity types should be selected?

	FIXED INTERNET CONNECTIONS	HOT SPOTS	SUPPLEMENTAL OPTIONS *Satellite, mesh networks, cell on wheels**
Use cases	• In areas with existing infrastructure (e.g. fiber, cable, DSL) • Where a long-term solution is a priority • When synchronous distance learning is preferred	• When rapid implementation is needed • Where no fixed option is available • For students facing housing insecurity	• Where wired or wireless service is not available
Benefits	• Stable, high-quality connection that multiple members can use concurrently	• No enrollment required by families • No installation • Can be managed centrally by districts	• Can offer connectivity where other solutions are not available
Limitations	• Gaps in infrastructure deployment • Difficulty for families with sign-up and installation	• Limitations with coverage based on location • Certain indoor settings can limit signal • Networks can become overwhelmed • Low data caps can throttle or cut service	• Typically higher-cost solution • Can be more difficult to implement • Should not be considered as a long-term solution
Cost	• **Ongoing**: Service ($10–$40/month), modem/router ($0–$10/month) • **One-time**: Installation ($0–$100)	• **Ongoing**: Service ($15–$40/month) • **One-time**: Hot spot device ($60–$80)	• Costs will vary • **Ongoing**: Service ($60–$70/month), equipment ($10–$15/month) • **One-time**: Installation ($0–$100)

*Also includes Wi-Fi buses, microcells, and other creative solutions; dial-up lacks required speed to support digital learning.

Overcoming adoption challenges

Efforts to expand residential broadband access for families of students have often run into adoption challenges, as awareness, understanding, and trust of these offerings is often low, on top of the fact that the families most in need of them often—because of this exact issue—lack access to the channels by which schools most often contact parents.

Schools and CBOs can serve as trusted intermediaries when a family wary of signing up with a provider on their own may prefer to work through the school or other organizations. This could simply mean serving as a trusted point of information for families. Outreach about school-sponsored internet offerings through community-based organizations can maximize awareness and result in greater rates of adoption of broadband service. Chicago Connected in partnership with Kids First Chicago and Chicago Public Schools is funding CBOs to support the sign-up process for free broadband service and provide continuing digital literacy support.[33] Coupling broadband-adoption resources with device pickup at schools is another way to increase the take rate of services. Finally, providers can directly increase trust and rapport with families through a dedicated "distance learning" customer service line.

Digital inclusion[34] resources are also needed to support students, teachers, and families once they have been

33. Chicago Connected
34. Digital inclusion refers to the activities necessary to ensure that all individuals and communities, including the most disadvantaged, have access to and use of information and communication technologies (ICTs). This includes five elements: affordable, robust broadband internet service; internet-enabled devices that meet the needs of the user; access to digital literacy training; quality technical support; and applications and online content designed to enable and encourage self-sufficiency, participation, and collaboration.

equipped with devices and connectivity. Dedicated training needs to be conducted for teachers so they can properly educate students in a vastly different educational environment. Digital literacy and technical support are essential for all parties engaged in the distance learning process. States and school districts should include in their efforts a plan to include professional training for social and emotional supports, resources to assist with mental health screening, and implementation of a curriculum that supports diversity, equity, and inclusion.

A note on educational online content

While the focus of this report is the provisioning of high-speed internet and devices, it is important to highlight the additional resources needed to close the digital divide, such as tech support and training, which we discussed earlier in this report (see "Tech support for students, teachers, and families," above), as well as high-quality online instructional content.

In a digital environment, it is essential to maintain quality and continuity of curriculum despite differences in available educational tools and in-person learning opportunities. A recent Common Sense Media survey[35] found that about 60% of teens feel online learning is worse than in-person learning, and about 30% of teens cite lack of access to teachers as a major academic challenge.

Once students are online, educators will need to adapt their teaching techniques and even create new methods to encourage students to focus and engage. New content is needed, including prerecorded lessons, computer-adaptive teaching, and potentially the use of gamification to increase engagement. Investing in training and effective content will empower teachers and help them thrive in a new teaching environment. Digital citizenship training for both teachers and students will support safe and responsible usage of the digital classroom.[36]

35. New Survey: Majority of Teens Say Online Learning Is Worse Than In-Person, but Only 19% Think School Should Return to Full In-Person Instruction
36. Realizing the Promise: How can education technology improve learning for all?

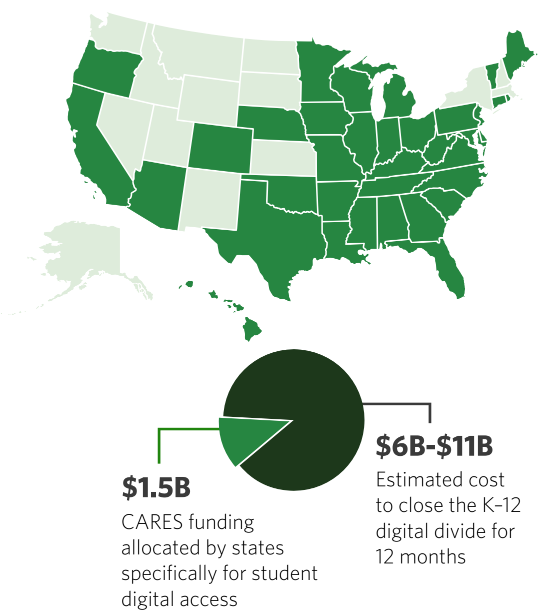
Step No. 3

How: Find the money to pay for devices, connectivity, and support.

Emergency coronavirus funds

In response to the coronavirus pandemic, Congress passed the CARES Act in March, including two funding sources to support emergency K–12 education needs. The $13.2 billion Elementary and Secondary School Emergency Relief Fund (ESSER) made distance learning an allowable expense, and allowed for a long list of other coronavirus-related needs (e.g., cleaning supplies, school-based meals, mental health services). The $3 billion Governor's Emergency Education Relief Fund (GEER) gave governors wide discretion to support K–12 education, higher education, or both, including support for distance learning. It's important to note that because CARES, ESSER, and GEER all allow for expenses other than distance learning, it's possible that while funding may be eligible to support distance learning, states may choose to prioritize other emergency uses for the funding.

CARES spending by states, specific to K–12 access*



* Based on public releases as of October 2020; may understate the number of states and amount of funding that has been allocated for K–12 access through CARES.

Several states have used these CARES funds to partially close the digital divide. At least $1.5 billion of CARES funding has been allocated by 36 states specifically to address K–12 digital access. However, these funds are still insufficient to cover first-year costs to bridge the K–12 digital divide, and additional funding is needed to support ongoing costs to close the divide (e.g., maintenance, replacements, monthly costs, training, tech support, etc.) beyond the first year.[37]

Private and philanthropic funds

In addition to government support, state and school leaders should take stock of potential private-sector and philanthropic partners who could provide funding and in-kind support. There is strong momentum to support initiatives to close the distance learning digital divide, especially now that some schools may need to be able to quickly transition back and forth between in-person and distance learning at least until the end of the 2020–2021 school year. The efforts of Citadel, Crown Family Philanthropies, and other philanthropic groups to fund Chicago's home connectivity push are one such example. Besides funders typically interested in education and connectivity issues, states and school districts should consider engaging organizations with a commitment to local economic development.[38] However, it is important to note that these funding sources are not necessarily reliable for sustained device purchasing and connectivity needs. Private companies have also made commitments to support efforts to close the digital divide: T-Mobile's Project 10Million is offering up to 10 million households free data over the next five years,[39] Comcast Internet Essentials is offering low-cost plans, Kajeet is supporting Wi-Fi buses,[40] and HP has provided $10 million worth of products and grants.[41] In particular, HP is partnering with providers to ship Windows devices and Chromebooks to districts. They have also launched the HP Refresh Program to enable communities to donate and clean unused laptops and redistribute them to schools.

To maximize the use of available private or philanthropic support, state and school districts should build comprehensive plans based on their needs assessments that lay out the special role private or philanthropic partners can play and how students will be affected in the absence of that support. Ultimately, only public funding offers the kind of reliable and comprehensive investments needed to close the digital divide.

37. See, for example, pp. 21–23, *Closing the Digital Divide in the Age of Distance Learning*
38. Learning loss due to coronavirus-related disruptions in education could exacerbate existing disparities in achievement and have a long-term impact on children's economic well-being as well as the U.S. economy.
39. Project 10Million
40. Kajeet SmartBus
41. As the digital divide widens, tech companies help fill the gap

Making the case for additional public funding

Accessing reliable and comprehensive funding from state and federal policymakers requires analysis and data to make a compelling case. For example, states and school districts should provide comprehensive numbers of students in need of support, necessary components of the program (e.g., broadband service, devices, tech support, digital literacy, professional development, etc.), coupled with estimated costs and a specific plan to procure and distribute to ensure that policymakers understand the full scope of the program. This detailed planning backed by granular assessments will help bolster the case that, with public funding, states and districts are well positioned to close the digital divide. **At the federal level, Congress and the administration have been presented with numerous analyses and have shown an increasing willingness to make the student digital divide a priority, but as of this writing they have not yet provided the level of support that is needed.**

States and districts can also use their assessments to help close gaps in infrastructure deployment. Data showing the costs and trade-offs of delivering distance learning to students with poor infrastructure access helps policymakers understand where there are gaps in this critical infrastructure and how an investment in a "future-proof" network (capable of at least 100/100 Mbps) could help ensure universal access to high-quality distance learning.

Since Congress passed the CARES Act in March, it has had under consideration further proposals for emergency coronavirus response legislation, including provisions for direct funding for distance learning during the pandemic. In September, the House of Representatives approved a package that included $12 billion through the E-rate program to provide connectivity and devices for students at home during the pandemic. The Senate has not yet considered the House legislation. In addition to funding through emergency pandemic response legislation, at the federal level there are existing programs that, with support from policymakers, could be deployed now to bridge the digital divide:

- **The FCC's Connect America Fund, the FCC's Rural Digital Opportunity Fund, and the USDA's ReConnect Loan and Grant Program** can be leveraged over time to enable significant infrastructure improvements, as seen in North Dakota, where 99.8% of rural students have home internet access as the result of more than two decades of investment.
- **E-rate**, one of the FCC's Universal Service Funds, has successfully helped to wire the vast majority of America's schools and libraries. If expanded, E-rate funds could be used to connect eligible students at home. E-rate rules requiring price transparency helped drive the cost of school broadband down by 90%.[42]
- **Lifeline**, also part of the FCC's Universal Service Funds, is the only federal program that provides people with lower incomes (at or below 135% of the federal poverty guidelines) with a cost subsidy for telecommunications service. With changes to encourage greater participation from broadband service providers and a higher subsidy level (currently set at $9.25 per month), this program could help support at-home broadband service for students from lower-income families and their caregivers nationwide.
- Other avenues to purchase devices may exist: Districts may use **Title I-A funds** to acquire laptops and tablets if use of the devices is supported by the school's comprehensive needs assessment and implemented through evidence-based instructional strategies. States may also use **IDEA Part B funds** to support the use of assistive technology devices for students with disabilities. Additionally, districts may use **Title IV-A funds** to purchase devices for students who lack them.

42. EducationSuperHighway milestones

POLICY IMPLICATIONS

Stakeholders are dependent on good policy decisions to help them close the student digital divide during the pandemic and to keep it closed for good. Federal and state policymakers should take the following actions:

Assess the K–12 digital divide

School districts need resources and guidance to continue their digital divide assessments and to ensure the data can be utilized at the local, state, and federal levels to close the digital divide.

Short-term funding: States and school districts can implement their own surveys and needs assessments quickly to locate the students caught in the digital divide. Our report provides several good examples of these needs assessments.

Long-term funding: The federal government should initiate and support a nationwide study to determine which students live in the digital divide. A federal-level assessment focused on students will complement other federal mapping efforts, and can support school district efforts to share student information consistent with privacy obligations.

Guarantee adequate funding and supply

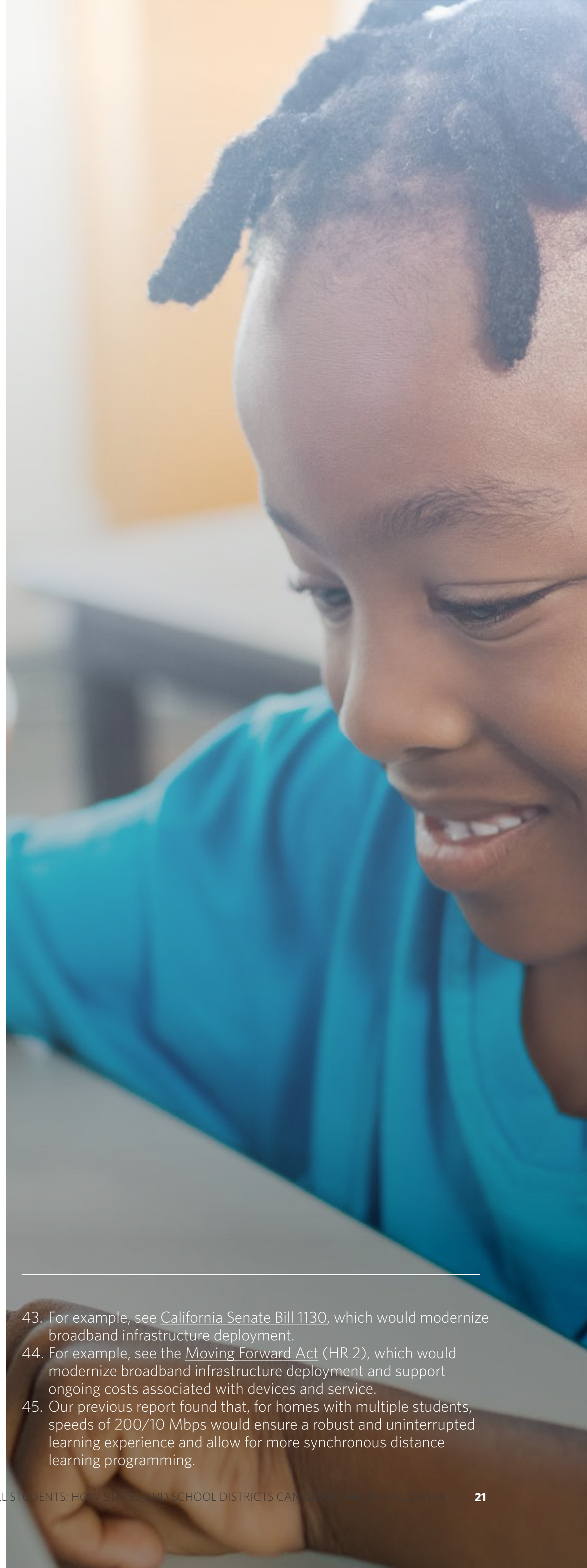
As is now clearly established, too many parts of the country, in urban and rural areas, lack adequate or any broadband connectivity. Meanwhile, funding to date is insufficient to close the K–12 digital divide.

Short-term funding: Congress should appropriate emergency "homework gap" funding sufficient to ensure all K–12 students have connectivity and devices adequate for distance learning during the pandemic.

Long-term funding: States[43] and the federal[44] government should make significant investments in broadband infrastructure and commit to continuing cost supports for both services and devices.

- Deploy new networks that are capable of high-quality distance learning.[45]
- Upgrade existing networks to ensure they are capable of high-quality distance learning.
- Support K–12 students with a subsidy support program for service and devices.

Secure the supply chain: Prioritize the supply of critical connectivity and learning devices for the educational market, and support transparent pricing.



43. For example, see California Senate Bill 1130, which would modernize broadband infrastructure deployment.
44. For example, see the Moving Forward Act (HR 2), which would modernize broadband infrastructure deployment and support ongoing costs associated with devices and service.
45. Our previous report found that, for homes with multiple students, speeds of 200/10 Mbps would ensure a robust and uninterrupted learning experience and allow for more synchronous distance learning programming.

CONCLUSION

Our review reveals **seven key takeaways** from state and local efforts to close the digital divide during the pandemic.

1. **While progress has been made, the K–12 digital divide persists.** States, cities, and school districts have made strong efforts to close the digital divide, yet the divide persists across all 50 states, and greater public investment is needed to close the divide and keep it closed.

2. **Closing the divide is a difficult, but solvable, challenge; schools cannot solve it on their own.** Permanently closing the divide requires better data, new infrastructure, greater funding, new skill sets, and enhanced digital literacy; schools are uniquely positioned, given their connection to families, but solutions must break down silos and bring together all stakeholders: states, districts, the private sector, nonprofits, teachers, and families.

3. **An effective needs assessment is the foundation for rapid action to fully close the divide.** Lack of digital divide data (or even an organization committed to compiling granular digital divide data) on students has stymied efforts to close the digital divide. States and school districts began to conduct assessments when school buildings closed to support their efforts to provide equitable access to distance learning. Quality needs assessments are essential to help states and districts obtain recurring data sets providing visibility into the quality of broadband service, broadband adoption resources in the household, and potential providers in serving an address.

4. **Closing the digital divide is an iterative process; states and districts make different decisions based on differing objectives.** Short-term solutions may result in trade-offs among speed, cost, and quality of implementation; while the lead-up to fall 2020 focused on rapid solutions, now states and school districts are seeking sustainable efforts that will more effectively meet curriculum and student needs to close the digital divide with a long-term solution.

5. **Both centralized and decentralized models can effectively close the divide.** Both state-led and district-led models can be effective: State-led models offer efficiency of scale and reduce the administrative burdens on districts, while district-led models offer flexibility, choice, and greater input from the district, schools, and families.

6. **While states and school districts are having an impact today, their solutions are not sustainable at current funding levels.** Federal CARES Act funding helped to jump-start efforts, but completely and permanently closing the divide will not be possible without greater emergency and long-term funding to invest in infrastructure, devices, and training.

7. **Further research and analysis are needed to effectively close the digital divide for K–12 students and ensure high-quality distance learning for all students.** For example, additional research will help to quantify how better connectivity at home and device distribution to homes minimize learning loss; accurately understand how much of the gap has been closed and what is required to bridge the remainder; further understand barriers to adoption and the best approaches to connect communities lacking broadband infrastructure, including creative solutions such as mesh internet, cell on wheels, or even new infrastructure builds; and better understand which educational content, supports, and digital literacy are needed to ensure high-quality distance learning for all students.

SPOTLIGHTS

Alabama

State-issued vouchers coupled with **ISP collaboration** enabled broad and rapid deployment of services.

The Alabama Department of Economic and Community Affairs (ADECA) acted quickly to set up a broadband expansion program.

- When it became apparent in July that students would not be returning to school in the fall, ADECA quickly partnered with CTC Technology & Energy, a telecommunications contractor, to devise a statewide mechanism to roll out broadband internet quickly and efficiently.
- The program was aimed at lower-income students (about 450,000 across Alabama), focusing on students for whom affordability was a barrier to adoption.
- It allocated $103 million in CARES funds to serve an expected 250,000 households.
- It focused on offering fixed broadband solutions where possible to remove adoption barriers due to one-time costs (e.g., installation fees and equipment costs).

With strong ISP participation, a voucher program was rapidly designed and distributed to lower-income families across the state.

- Contracts were negotiated and signed with 38 ISPs in just three weeks, with statewide pricing for service fees, installation, and equipment costs.
- Qualifying families were sent vouchers with a customized list of provider suggestions based on which ISPs could serve their address, but families could apply the voucher to any address; the program maximized families' ability to choose their service provider.
- Families with no ISP coverage were mailed hot spots; families who already had coverage were able to obtain service credit from providers.
- Billing contracts were set up directly with the state, eliminating the need for families to undergo credit checks or provide billing information.
- Unless families opt out, ISPs can offer them plan options to consider when CARES funding expires.

ADECA continues to push adoption as school begins, with a variety of techniques employed to engage students.

- More than 250,000 vouchers have already been sent, with about 10% adoption in the first 10 days.
- ADECA promoted the program through local nonprofits, school superintendents, robocalls, social media campaigns, ISP marketing materials (within contract confines), and an ADECA ambassador center to support families through the voucher process.

Chattanooga, Tennessee

Active community leaders and **existing fiber networks** provide high-quality, sustainably funded internet.

Cross-sector stakeholders, including the mayor and superintendent as well as leaders from the Enterprise Center and EPB, collaborated to bridge the digital divide in Hamilton County.

- Experts were brought together across the municipality, private sector, and school district to tackle the issue strategically, including collaborating with the University of Tennessee at Chattanooga on GIS data for a clearer overall picture of connectivity.
- The Enterprise Center, an economic development partner with a focus on digital equity, was well suited to support connectivity efforts.
- The telecom provider EPB leveraged its existing fiber network infrastructure to increase adoption of Wi-Fi for students, and the Enterprise Center invested in emergency public Wi-Fi access to ensure there was a connectivity option for all students.

The effort maximized impact through robust identification of student need and through outreach to increase adoption.

- All students under the free or reduced-lunch program (FRLP) were eligible (approximately two-thirds of all Chattanooga students), and schools helped identify additional underserved populations who required connectivity (e.g., unhoused, undocumented, refugee).
- Families received high-speed fiber service, which was far stronger than standard connection and better suited for the virtual learning environment.
- The adoption strategy focused on building trust, including collaborating with community partners who focus on specific demographics or geographies and using multilingual calls, texts, social media, email, and web resources to spread the word.

Through multi-stakeholder engagement, Chattanooga identified a sustainable path to funding.

- A mix of state CARES funding, city and county budgets, and philanthropic donations covered over $7 million in upfront hardware and installation costs; the district and EPB also committed more than $7.1 million to fund costs over the next 10 years.
- By centralizing connectivity through EPB, the program was able to optimize costs to just the cost of service.
- Households must requalify each year so the program can be managed.

Chicago, Illinois

A **unique partnership across stakeholders** funds internet connectivity for the next four years.

Early stakeholder engagement created urgency toward bridging the digital divide.

- The project began with authentic parent voices: Kids First Chicago partnered with the Metropolitan Planning Council on a report that elevated the voices of families directly affected by the digital divide and equipped stakeholders with concrete data, demonstrating the extent of the city's widespread connectivity gaps.
- Chicago benefits from a history of investing in public school education, an issue that continues to be a high priority for the city.
- Investments from Citadel and Crown Family Philanthropies spurred the launch of Chicago Connected, a $50 million program bringing together public, private, and philanthropic partners to serve approximately 100,000 Chicago public school students.

The Chicago Connected partnership maximized the expertise and connections of each stakeholder.

- The City of Chicago led the strategic vision and secured both public and private funding.
- Chicago Public Schools (CPS) determined eligible households and led the daily operations of the initiative.
- Comcast and RCN served as the selected broadband providers, and T-Mobile served as the major cellular hot spot provider.
- United Way of Metro Chicago and Children First Fund served as fiscal agents to ensure security and data privacy.
- Kids First Chicago and 35 CBOs led community engagement efforts by serving as critical conduits to eligible families, providing newly connected households with digital literacy training and support, and ensuring parent and community voices were infused in program design and implementation.

Chicago Connected rapidly designed and executed a sustainable, sponsored service program to provide internet to eligible families.

- They quickly determined that connectivity was the fundamental driver of the digital divide for Chicago students.
- They built a tiered eligibility model focused on the students with the most need using multiple family economic and student level factors, such as diverse learner status, and using the University of Illinois at Chicago hardship index.
- They identified the appropriate provider (for broadband or hot spot) and sent provider-specific vouchers to each eligible family.
- They organized four years of funding, with local philanthropies funding the first two years of the effort (with $5 million from CARES) and CPS funding the remaining two years.

Chicago Connected continues to promote the program through outreach to increase enrollment.

- One-third of eligible students signed up by the first day of school, with sign-ups increasing exponentially since launch.
- Program adoption has been the primary focus thus far through general marketing, informative webinars, and direct texts/calls; personal outreach from schools and CBOs has been particularly effective.

Connecticut

Collaborative state efforts with **district/ISP engagement** enables effective provisioning in smaller states.

Strong leadership and broad stakeholder engagement in Connecticut drove efforts to close the digital divide.

- Governor Ned Lamont set the vision and elevated digital divide as a statewide priority, leveraging a cross-agency leadership team from the department of education, the Commission for Educational Technology, the Connecticut Education Network (CEN), the Office of Consumer Counsel (OCC), the Department of Economic and Community Development (DECD), and Internet2.
- The department of education helped ensure alignment with statewide reopening plans and procurement.
- The Commission for Educational Technology provided digital equity resources, national benchmarks, and program design.
- CEN brought the provider perspective as the fiber backbone of the state.
- OCC helped to consider long-term access issues.
- DECD pushed the digital divide beyond educational considerations.
- The state was already about 50% 1-to-1 with strong broadband infrastructure and fewer rural areas, allowing for greater ease of implementation.

The state worked closely with districts and ISPs to deliver devices and connectivity to students.

- The state-led model fast-tracked procurement of devices and hot spots through bulk ordering organized by the state's IT department.
- Governor Lamont issued an executive order to accelerate purchasing under simplified terms of service with broadband providers to bypass the months-long RFP process.
- Districts identified the best options for their families through a series of webinars with state leaders and broadband carriers.

- The state invested $43.5 million to purchase more than 80,000 devices, 12,000 mobile hot spots, and about 40,000 broadband connections as well as 200 public hot spots.
- Chromebooks and Windows laptops were deployed with preexisting endpoint protection from CEN.
- Devices and connections were prioritized for districts and families with the greatest need.

In parallel, Connecticut drove wraparound support and enablement, including:

- A public outreach campaign and supporting website with free wraparound services (e.g., emotional/social support, mental health support).
- A five-year state strategic plan to ensure that students graduate with digital literacy and that teachers have the skills to effectively teach digitally.
- Continued advocacy for federal (E-rate) and state-level policy to enable long-term investment and connectivity.

Indiana

State-issued grants and **district-led execution** allow for a decentralized model in bridging the digital divide.

The state of Indiana deployed GEER funds to help close the digital divide through a needs-based competitive grant program.

- The program allowed districts to express their relative needs through grant applications as opposed to relying on a formula-based funding approach.
- The grant program forced districts to think strategically about how funds would be invested and gave them choice in how to bridge their divide.
- Grant money could be spent by the district to improve device availability, connectivity, and educator capacity.

Grant requests were reviewed by the state for quality and overall need, to inform the amount to be funded.

- District grant requests were rubric-evaluated across demonstration of need, quality of execution plan (including sustainability), evidence of efficient budget usage, and definition of performance benchmarks, with district equity and existing technological infrastructure also considered.
- Quality assurance was employed to ensure that districts were allocating reasonable costs per line item and requesting an appropriate number of devices based on past student survey results.
- Due to the high volume of requests, only $1 in funds was available for each $3 to $4 dollars requested.
- Stranded investment opportunities (initiatives that could not be funded) were pointed to other state departments and philanthropic funds.

Districts led the provisioning of devices and connectivity, with Indianapolis finding success through effective collaboration.

- Districts that received funding had full jurisdiction over the services they purchased and distributed to students in need.
- The City of Indianapolis, in partnership with the corporate and philanthropic communities, created a coalition of 11 districts, including Indianapolis Public Schools, and 50 charter schools (together totaling about 10% of all Indiana students) to increase purchasing power during procurement.
- A group of Indianapolis-area philanthropies raised $2.6 million to help Indianapolis schools narrow the divide with devices and hot spots.
- The group ran an RFP for connectivity, ultimately partnering with T-Mobile for two years, with districts driving procurement and distribution; requests for hot spots from schools dropped from 38,000 to just 21,000 in fall 2020.
- Through participation in the statewide grant program, the group received about 20% of available funds to continue narrowing the divide.

Los Angeles, California

Efficient procurement and the unlocking of **emergency bond funds** quickly narrowed the short-term divide.

The LAUSD superintendent took swift action to close the digital divide ahead of state-led guidance or relief funds.

- The school board gave the superintendent authority to address the crisis, centralizing leadership and accelerating the process.
- LAUSD ran a rapid procurement process and reached out quickly to vendors like Apple, recognizing that there might be supply chain constraints similar to the earlier supply chain constraints for personal protective equipment.
- LAUSD accessed their previously available voter-approved, property-tax-funded $78 million bond authorization, the outcome of a 10-year authorization effort to procure devices.

LAUSD distributed devices and hot spots to families through schools, enabling 90% of students to engage in online classes, and:

- Estimated that about 150,000 students (about 25% to 35% of the district's 470,000 K–12 students) were affected by the digital divide in 2019.
- Purchased 247,000 devices (of which 120,000 were LTE-enabled iPads) and an additional 105,000 hot spots,

largely through a Verizon partnership, supplementing existing 1-to-1 efforts.
- Streamlined the distribution process with socially distant pickups at schools and no required documentation for eligibility.
- Provided a dedicated IT help desk to assist parents and students logging on, significantly expanding support as school went online.

LAUSD recognized the need for continuing support to ensure the ongoing sustainability of device and connectivity efforts, including:

- Developing rigorous use standards to ensure that connectivity is sufficient to enable distance learning for the entire family.
- Identifying and advocating for additional external sources of funding, beyond school budgets, to cover universal access and support costs (e.g., monthly connectivity costs, administrative costs, tech support desks).
- Continuing and expanding requisite purchasing, including planning for ongoing repairs/replacements and offering devices to a broader base of students (e.g., including purchasing 31,000 devices for pre-K students).
- Addressing teachers' issues with connectivity, devices, teaching tools, and educational software, and supporting their ongoing training and pedagogy necessary to effectively teach remotely.

Maine

A **one-to-one initiative** based on **service-level contracts** accelerates Maine's digital agenda.

Governor leadership led to the 1999 founding of the Maine Learning Technology Initiative (MLTI), focused on digital access in Maine.

- In 1999, Governor Angus King took a $90 million governor surplus, which eventually was taken out of the General Purpose Aid budget, and put it toward MLTI, a 1-to-1 program equipping every seventh and eighth grade student with a device.
- The seventh and eighth grades were selected because they tended to exist in the same building, were a population with lower test scores, and were an age group that was starting to benefit from collaborative environments.
- These funds were also put toward an endowment to fund the program year over year.

MLTI was sustainably set up as a service model as opposed to a commodity purchase.

- Stakeholders agreed that no child was to go without a device for more than a day.
- Repair, warranty, and replacements were included in the contract to expedite service delivery; teacher, school leader, and technology leader training and in-school Wi-Fi were also included as part of the service.

Additional benefits were realized by having a statewide contract.

- The contract resulted in improved pricing, which districts reimbursed at the cost of usage for age groups not covered by MLTI (e.g., K–6 or 9–12 students).
- The scale of the program attracted Apple talent to the state: Eight to 15 Apple FTE positions were created in Maine to service the contract from a product management and professional development perspective, with employees meeting weekly to problem-solve and troubleshoot.
- The program aligned districts on the same digital agenda to build a sustainable digital system.
- The program allowed for a cost-effective buffer pool of devices that can be redistributed across districts.

North Dakota

Historical infrastructure and **effective coordination** lead to efficient needs assessment and rapid action.

North Dakota has a history of investing in broadband coverage, even in its most rural areas.

- In 1996, 14 rural telcos formed Dakota Carrier Network (DCN) to provide broadband at scale and invest in fiber-optic infrastructure, efficiently leveraging federal funds, including the FCC's Connect America Fund.
- In 1999, the state legislature partnered with local ISPs to develop a statewide broadband network for government and education, expanding affordable access to broadband statewide.
- In 2009, a new state policy encouraged fiber-optic investment by exempting property for telecom services from sales and use taxes to spur business development across the state.

When the pandemic hit, North Dakota was able to rapidly cross-reference student addresses and ISP coverage.

- The state had already captured student addresses through the web-based student information system PowerSchool.
- DCN served as a single point of contact to immediately build a robust statewide ISP coverage map, enabling North Dakota to set up and execute a needs assessment quickly with only a few phone calls.
- The database approach ensured that this efficient process could be easily replicated in the future.

A high-quality, rapid needs assessment enabled North Dakota to take quick action to bridge gaps as part of a sustainable solution.

- The state quickly identified 2,000 rural students without connectivity, broken down by root cause (adoption vs. access), and provided broadband access to more than 1,700.
- Mapping efforts enabled the state to identify which ISPs could provide broadband service to rural students and to delegate sign-up and installation of broadband service to the relevant ISPs.

A database approach helped to align and unlock relevant funding sources through the 2020–2021 school year.

- DCN partnered with the Broadband Association of North Dakota (BAND), covering spring 2020 fees in line with the FCC's Keep Americans Connected Pledge.
- State-directed CARES funding is being used to cover 2020–2021 school year connectivity costs.
- Efforts are underway to enact state legislation to sustainably cover the cost of service going forward or to identify available federal funding.

Texas

Strong leadership and **coordination at the state level** maximized funding and led to swift action.[46]

When the coronavirus pandemic hit, the Texas Education Agency (TEA) provided strong leadership to address the digital divide as a state.

- In May, the TEA established the Operation Connectivity Task Force in partnership with the governor's office and the Dallas Independent School District, to create a fact base on the nature and size of the gap in Texas as well as potential policy, technology, and funding solutions.
- The TEA used task force findings to help secure $200 million of CARES Act funding to close the digital divide as quickly as possible.
- The TEA also provided several tools for districts, such as a playbook on how to close the gap and sample surveys for schools to use in gathering relevant data.

To close as much of the digital divide as possible for the 2020–2021 school year, the TEA launched a bulk order on behalf of school systems.

- They recognized the benefits of a bulk order to increase the urgency for districts to act immediately, to leverage scale for improved pricing and supply chain prioritization, and to ensure that smaller districts were not ignored by suppliers.
- They negotiated pricing and prioritization by leveraging an existing Houston region procurement process with the Region 4 Educational Service Center, coordinating efforts to support negotiations and execution of the statewide bulk order.
- They unlocked greater purchasing power by matching both the funding that districts contributed to the order and the CARES Act funding that local cities and counties contributed.

Bulk order execution required close collaboration and change enablement with about 900 school systems participating.

- The TEA rapidly coordinated with participating districts to understand their needs and execute the bulk order.
- They placed the initial order while working in parallel with districts to fine-tune their needs based on provider pricing, specifications, and product availability.
- They invested in district enablement through webinars, customer service personnel, a customer relationship management (CRM) system, and 1-to-1 phone calls to help districts better understand the program, complete necessary forms, and answer questions.
- They partnered with suppliers to coordinate directly with districts on asset tagging, CIPA compliance, and shipment.

More than 1 million devices and hot spots have so far been acquired as part of Texas's Operation Connectivity.

Wisconsin

Effective surveys and **collaborative state action** identified pockets without coverage.

When the pandemic hit, Wisconsin rapidly launched an action-oriented needs assessment.

- The department of public instruction leveraged their history of assessing student technology needs.
- They partnered with EducationSuperHighway (ESH), CCSSO, and local providers to build out a data governance strategy in less than a month.
- They established a survey with six key questions to determine device and connectivity needs, ensuring data could be replicated and easily aggregated.
- They benefited from having three primary student information system (SIS) vendors (Skyward, Infinite Campus, and PowerSchool) that cover 98% of schools to coordinate data collection.
- They implemented a voluntary survey through these SIS vendors and the existing Ed-Fi API data-collection

46. The full set of materials that TEA made publicly available as part of Operation Connectivity is available here.

protocol known as WISEdata. DPI also increased opt-in through ongoing communications.

DPI coordinated with ISPs to streamline and automate the serviceability assessment process.

- They married FCC maps for ISP coverage with student data from surveys.
- They established data-sharing agreements between the state and districts and between the state and ISPs to effectively match coverage.
- They are now creating maps that show the overlay of ISP coverage and address-level student-needs data, which can be accessed via a secure authentication portal.

DPI is continuing to work closely with ISPs to build a suite of low-cost offerings and to unlock sustainable pricing.

- In a state largely composed of small districts (the average grade size is 60 kids), Wisconsin school districts lacked the resources to do it on their own—only the state had the scale and vantage point to coordinate and negotiate with ISPs.
- Wisconsin's regional education network partners negotiated from a state-level scale to drive down costs (e.g., lower to no installation fees).
- The state created a "digital bridge" website for districts containing product offering specifications and statewide pricing.

APPENDIX

Publicly available resources

Alliance for Excellent Education (All4Ed) and Future Ready Schools (FRS): A national policy and advocacy organization and associated project that offers district and school leaders tools and resources to advance evidence-based practices and create rigorous and engaging student-centered learning environments, including the technology necessary to enable these new systems to perform efficiently with equity for every child.

Common Sense Media: Including an interactive map of coverage with state details and teacher and parent stories on the digital divide.

CoSN (the Consortium for School Networking) is a professional association for school system technology leaders. CoSN provides thought leadership resources, community, best practices and advocacy tools to help leaders succeed in the digital transformation of K-12 education.

Council of Chief State School Officers (CCSSO): A nonpartisan, nationwide, nonprofit organization of public officials who head departments of elementary and secondary education in the states and offer education-related resources, including Restart & Recovery, a coronavirus-related framework and tools.

Digital Bridge K–12: A playbook by EducationSuperHighway to support every public school in America to increase connectivity outside the classroom and connect students to high-speed internet.

Education Week: An independent news organization that covers K–12 education, providing both news and analysis along with explanatory and investigative journalism across a range of digital, print, and broadcast platforms as well as through live and virtual events.

Funds for Learning: A professional organization offering high-quality consulting and support services for the needs of E-rate program participants, including preparing and submitting paperwork, and helping clients to understand and maintain compliance with E-rate rules and regulations.

human-IT: A nonprofit organization that repairs and repurposes old electronics, offers high-speed internet capability for recipient homes and agencies for free or at a heavily discounted cost, and provides digital literacy training (including free online learning courses and other relevant local programs) to recipients.

ISTE (International Society for Technology in Education): A nonprofit organization that serves educators interested in the use of technology in education by providing practical guidance, evidence-based professional learning, virtual networks, and thought-provoking events.

NDIA (National Digital Inclusion Alliance): A nonprofit organization bringing together more than 300 nonprofit organizations, policymakers, and academics to advocate for national access to broadband and end the digital divide.

SETDA (State Educational Technology Directors Association): A not-for-profit membership association launched by state education agency leaders to serve, support, and represent their emerging interests and needs with respect to the use of technology for teaching, learning, and school operations.

Tech Goes Home: A nonprofit organization that brings computers, internet, and training to those who need them, so students can do homework, adults can find jobs and manage finances, and seniors can connect with loved ones and lead healthy lives.

Wide Open School: A curated suite of instructional content created by Common Sense and a coalition of education and media partners for students, families, and teachers. The content includes academic, social and emotional learning, and enrichment curricula; digital literacy and digital citizenship training and resources; teacher-readiness/professional development; and learning resources for students with learning and thinking differences. These resources are available through links to education resource websites, locally housed PDFs/worksheets, connections to kid-friendly entertainment options, and live events.

List of interviews conducted

a. City of Chicago
b. City of Indianapolis
c. Los Angeles Unified School District
d. New York City Department of Education (former)
e. Connecticut Commission for Educational Technology
f. Indiana Department of Education
g. North Dakota Information Technology Department (ITD)
h. Texas Education Agency
i. Wisconsin Department of Public Instruction
j. Professor Brian Whiteacre, Oklahoma State University

Continued on next page...

k. CTC Technology & Energy
l. Edmoxie and the former Maine Learning Technology Initiative (MLTI)
m. Kids First Chicago
n. State Educational Technology Directors Association (SETDA)
o. Enterprise Center
p. HP Education Solutions
q. T-Mobile
r. National Digital Inclusion Alliance

State and district examples

Below are brief descriptions of some of the many state and local efforts to close the K–12 digital divide during the pandemic as of September 2020.

State or district example	Effort to close the digital divide during the pandemic
Alabama	The Alabama Department of Economic and Community Affairs provided families that qualified for free or reduced-price lunch with vouchers to cover broadband installation and service fees through the calendar year. (See spotlight.)
Arizona	The state provided substantial funding for districts to put toward improving distance learning and expanding rural broadband.
Arkansas	The department of education partnered with AT&T and T-Mobile to provide students with devices and two years of high-speed internet with unlimited data.
Atlanta	Atlanta Public Schools leveraged a robust communications plan with Comcast to identify the needs of students who missed class and partner to provide a year of free service.
Boulder, Colo.	The district conducted phone outreach to identify students who lacked internet access and then partnered with LiveWireNet to sustainably provide those households with broadband.
Chattanooga, Tenn.	Chattanooga leveraged existing fiber network infrastructure; brought together experts from the municipality, school district, and private sector; and raised the requisite funds to help bridge the connectivity divide over the next 10 years. (See spotlight.)
Chicago	Chicago Connected, a unique public, private, and philanthropic partnership, was formed to provide families with internet access through sustainable funding sources. (See spotlight.)
Connecticut	Governor Lamont's office brought many stakeholders together to provide devices and connectivity for its districts. (See spotlight.)

Delaware	The state accelerated progress to connect families by deploying a statewide speed survey, building out broadband infrastructure across the state, and acquiring equipment for families in financial need.
Georgia	The state allocated funds to support connectivity initiatives like broadband signal extenders (extending from school buildings) and mobile Wi-Fi for students who live in multifamily housing.
Greenville, Tenn.	Greenville City Schools leveraged their previously implemented registration questionnaire that included a question on home internet to quickly identify and provide internet access to students.
Hawaii	The state department of education allocated funding for devices and connectivity as well as summer learning, special education, training, and support initiatives.
Illinois	The governor administered federal GEER funding to districts to purchase devices such as laptops, tablets, and hot spots, alongside broader statewide initiatives, such as Connect Illinois, that focus on expanding and repairing broadband coverage in communities and schools across the state.
Indiana	The state set up a competitive grant program to distribute CARES funding to districts that then led procurement and in some cases accessed additional philanthropic funding. (See spotlight.)
Iowa	The Iowa Department of Education worked with the state's Office of the Chief Information Officer to conduct a statewide assessment of students' remote learning needs before distributing GEER funding to districts to supply students with devices and hot spots.
Lockhart, Texas	Lockhart teachers and staff led calling campaigns to identify students in need and are providing devices and building a private wide area network (a series of telecommunications towers) throughout the community to support families.
Los Angeles	The Los Angeles United School District procured devices and partnered with Verizon to provide hot spots to students by using emergency district funding. (See spotlight.)
Louisiana	The state of Louisiana conducted a statewide survey of student technology and then distributed federal funding to districts with guidance for using funds to purchase digital devices for disconnected students.
Maine	The state of Maine provided devices and internet to its students, relying on a long-standing statewide 1-to-1 initiative that leveraged a robust service contract. (See spotlight.)

Maryland	Districts in Maryland applied for grant funding to expand access to broadband service, with funding delivered in coordination with the Maryland Department of Housing and Community Development and the Governor's Office of Rural Broadband; additional funding is being used to conduct feasibility studies for a statewide fixed wireless network to further expand access for rural students.
Mississippi	The department of education administered CARES funding to districts to purchase and be reimbursed for devices and hardware, and also ran a grant application for additional funding to expand broadband availability in underserved areas, with schools responsible for negotiating with service providers.
Missouri	The Missouri Department of Elementary and Secondary Education requested that districts submit applications to be reimbursed (using ESSER and GEER funding) for purchasing learning and connectivity devices for students.
New Jersey	The state of New Jersey used CARES funding alongside other emergency, philanthropic, and corporate funding to administer grants to districts that applied for support in purchasing device and connectivity solutions.
New York, New York	The department of education distributed internet-enabled iPads, loaned additional school devices, and announced plans to build out broadband for lower-income residents.
North Dakota	The Dakota Carrier Network had invested in broadband infrastructure across the rural areas of the state for the previous two decades and were able to rapidly identify and provide broadband to rural students. (See spotlight.)
Ohio	The state of Ohio launched a noncompetitive grant program for school districts to apply for CARES funding to be used for Wi-Fi hot spots and internet-enabled devices, with a focus on connecting rural districts and students.
Texas	The Texas Education Agency ran a statewide RFP for devices and hot spots while providing matching CARES funds to enable districts to purchase devices and connectivity. (See spotlight.)
Virginia	The state used a survey to identify students and provide them with Chromebooks and connectivity, using creative solutions like meal distribution sites and Wireless on Wheels.
West Virginia	The state, in collaboration with the West Virginia Department of Education and Higher Education Policy Commission, installed wireless access points at more than 1,000 sites in all counties, including nearly 700 K–12 schools; the state also distributed CARES funding and administered a grant program for counties for additional assistance in closing the digital divide.
Wisconsin	The department of public instruction set up a replicable and sustainable survey through the districts' student information systems, and partnered with ISPs to provide districts with maps that showed the connectivity options of their students. (See spotlight.)

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