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Digital Equity in the time of COVID-19: The Access Issue

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DIGITAL EQUITY IN THE TIME OF COVID: THE ACCESS ISSUE

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A report by the Metropolitan Educational Research Consortium (MERC)
Virginia Commonwealth University School of Education

ABOUT THIS REPORT

This report is a part of a series of reports on digital equity in the time of COVID-19 written by members of the MERC SY20 study team. MERC launched the SY20 project to provide rapid response, iterative research to help address immediate and enduring needs by school divisions in metropolitan Richmond. The project has the following goals: (1) To convene conversations between scholars and practitioners on critical topics in public education relevant to the moment, (2) To share examples of local efforts that illustrate innovation and best practice, (3) To encourage community engagement and dialogue on our work through broad dissemination.

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Established in 1991, the Metropolitan Educational Research Consortium (MERC) is a research alliance between the School of Education at Virginia Commonwealth University and school divisions in metropolitan Richmond: Chesterfield, Goochland, Hanover, Henrico, Petersburg, Powhatan, and Richmond. Through our Policy and Planning Council, MERC division Superintendents and other division leaders identify issues facing their students and educators and MERC designs and executes research studies to explore them, ultimately making recommendations for policy and practice. MERC has five core principles that guide its work: Relevance, Impact, Rigor, Multiple Perspectives, and Relationships.

MERC Metropolitan Educational Research Consortium

VCU School of Education

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WHO HAS ACCESS AND WHERE?

The International Society for Technology in Education (ISTE) established the 14 Essential Conditions which are "...critical elements necessary to effectively leverage technology for learning." One of those conditions is equitable access, which is defined as

> *Robust and reliable access to current and emerging technologies and digital resources, with connectivity for all students, including those with special needs, teachers, staff and school leaders.*[1]

Thus, equitable access is, at the very least, about access to the internet and to educational computing devices.

Which students have access to reliable internet and computing devices for engagement in remote learning? The answer to this question has implications for the social and financial capital that students will accumulate over time,[2] and the inequities that students experience is often referred to as "the digital divide."[3] While the digital divide also includes how students use and ultimately build skills in working with technology, it is important to first understand discrepancies in access to technology.[4] Like many opportunity gaps in public education, these discrepancies tend to fall along racial and socioeconomic lines, with low-income and racial minority students being less likely to have access to reliable internet or devices.[5]

Using the framework developed in the first part of this multi-part report, we consider access issues at home and in school as well as policy efforts to address disparities in access to computers and the internet. Subsequent reports will be focused on issues of equity in use of and outcomes related to technology in education.

[1] International Association for Technology in Education (n.d.)
[2] Hohlfeld et al. (2017)
[3] Campos-Castillo (2015); Middleton & Chambers (2010)
[4] Tichavakunda et al. (2018); Ritzhaupt et al. (2013)
[5] Ritzhaupt et al. (2013)

Internet Access at Home and In the Community

> *From 2010 to 2020, Americans with access to broadband internet increased from an estimated 74.5 percent to 93.5 percent…*[6]

Overall, broadband internet access has improved over the last decade, but there are still significant disparities for some school-aged children. According to Common Sense Media, "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."[7] Furthermore, nearly nine million students live in homes that have connections and devices that are inadequate for online learning.

The following table illustrates access to the internet nationally and in Virginia measured in megabits per second (mbps) based on 2019 data.

Table 1. Internet Access Nationally and in Virginia

	Percentage of population with access to at least one internet provider offering this speed[8]	
Speed (mbps)[9]	**National**	**Virginia**
25 "Basic" - *supports 1-2 users*	99.9%	100%
100 "Average" - *supports 3-4 users*	90.8%	90%
250 "Fast" - *supports 4-5 users*	85.9%	83.9%
1000 "Gigabit" - *supports 5 or more users*	22.0%	2.24%

While nearly all of the population nationally and in Virginia has access to an internet provider offering at least basic internet speeds, approximately 10% of the population does not have access to average internet, and 15% does not have access to fast internet. Importantly, simply having providers available does not necessarily translate into students being able to afford internet access or the costs that are often associated with faster speeds.

[6] Cooper, T. (2020, January 15)
[7] Chandra et al. (2020, p. 5)
[8] Federal Communications Commission. (n.d.)
[9] Cooper, T. (2020, October 28)

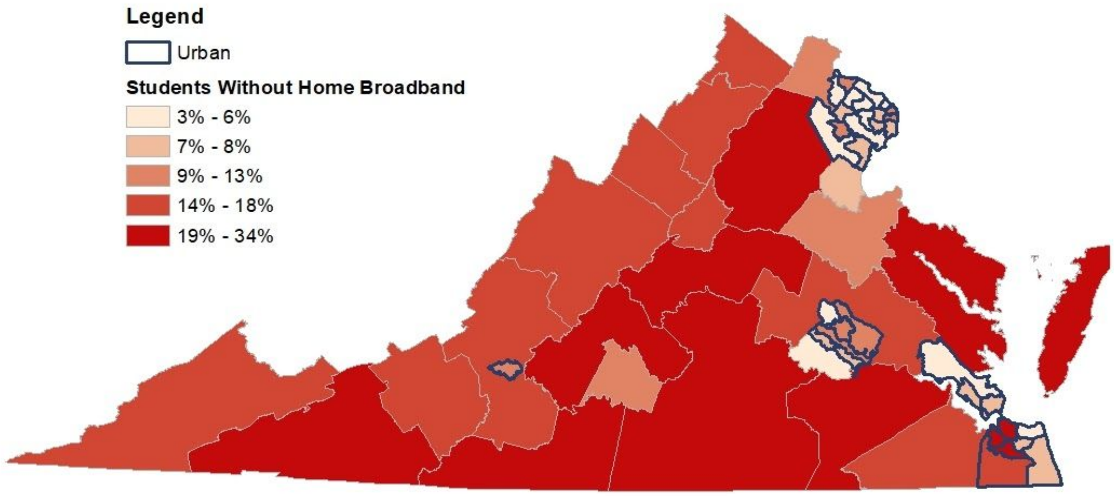
Using the terminology of broadband internet access, a recent report from the State Council of Higher Education in Virginia (SCHEV) shows that 12% of students across the Commonwealth do not have broadband access; nine percent of students have no computer.

Table 2. Virginia Students Without Broadband and Computer by Student Type[10]

	No Broadband (High Speed) Internet Service		No Laptop, Desktop, Or Notebook Computer	
Student Type	**Number**	**Percent**	**Number**	**Percent**
K-12 student	202,622	14%	173,039	12%
College student	62,363	10%	22,828	4%
All Students	264,985	12%	195,867	9%

Per that same report, broadband access in Virginia also varies geographically as demonstrated in Figure 1 below.

Figure 1. Geographic Distribution of Broadband Internet Access in Virginia[11]



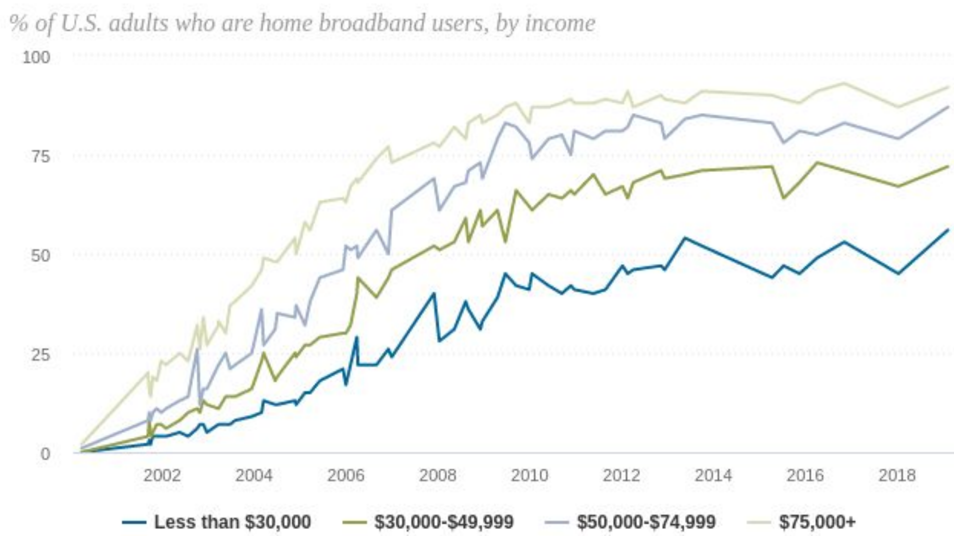
Because students may lack internet access, assigning work to be completed and submitted electronically outside of the classroom, even if the device is provided by a school, may prove inequitable if students are unable to access reliable internet in order to finish the assignment.[12]

[10] Allison (2020, p. 2)
[11] Ibid. (p. 3)
[12] Dornisch (2013)

Socioeconomic disparities in internet access

Socioeconomic disparities in internet access are well-documented by research. Hohlfeld et al. described socioeconomic disparities as the "primary domain of inequality" in terms of the digital divide because of the direct connection between family financial resources and the ability to afford sufficient internet access and devices to complete online school work.[13] According to analysis from the Pew Research Center,[14] 92% of US adults making more than $75,000 per year had broadband internet at home in 2019, compared to just 56% of those making less than $30,000 per year. Students from more affluent homes tend to have more consistent internet access, own their own computers, and have sufficient time to engage with ICT, and at the same time tend to demonstrate higher digital fluency than their less affluent peers.

Figure 2. Home Broadband Use by Income[15]



[13] Hohlfeld et al. (2017, p. 135)
[14] Pew Research Center (2019, June 12)
[15] Ibid.

The following table depicts internet access in the MERC region compared to the percentage of students qualifying as economically disadvantaged.[16]

Table 3. Internet Access in the MERC Region by Student SES

	Percentage of population with access to at least "average" (100 mbps) internet	Percentage of students qualifying as economically disadvantaged
Chesterfield	97.4%	39.6%
Goochland	65.9%	26.2%
Hanover	80.2%	23.3%
Henrico	98.2%	41.0%
Petersburg	98.6%	76.3%
Powhatan	81.6%	22.8%
Richmond	94.8%	55.0%

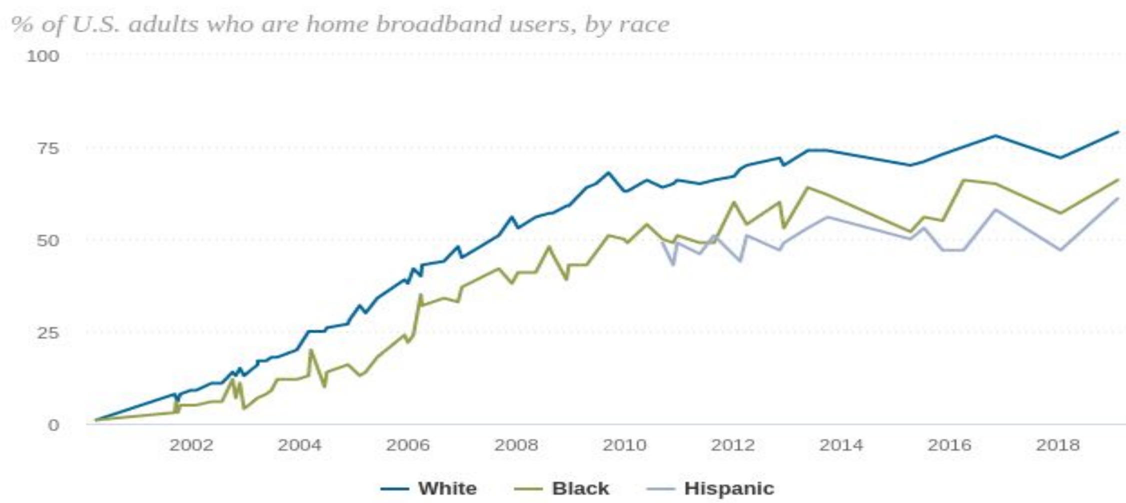
These data tell a complex story about internet access in our region. While urban areas like Petersburg, Richmond, and parts of Henrico have high percentages of the population with access to average internet speeds (97.2% on average), they also have higher percentages of students qualifying as economically disadvantaged (57.4% on average). This suggests that although they may have internet providers in their area, they may be less likely to be able to afford access. Conversely, rural areas like Goochland, Powhatan, and parts of Hanover may have fewer students qualifying as economically disadvantaged (24.1% on average), but their total populations are also less likely to have access to average internet speeds (75.9% on average). Chesterfield, which serves a mix of urban, rural, and suburban student populations, tends to have internet access and an economic disadvantage distribution more comparable to urban than rural school divisions in the area. This suggests the digital divide manifests differently throughout our region, with more rural areas primarily experiencing an issue of physical access and urban areas primarily experiencing an issue of financial access. While access disparities in urban areas may primarily be addressed through providing free access to existing internet (e.g. through mobile hotspot distribution), this may be more challenging to ameliorate in rural areas due to their remoteness and even some hesitancy by their inhabitants to use the internet due to unfamiliarity.[17]

[16] Based on 2019-2020 fall membership reports from the VDOE
[17] Townsend et al. (2013)

Racial disparities in internet access

Although broadband internet usage in racial and ethnic minority communities has been increasing rapidly,[18] they still experience disparities in access. According to the Pew Research Center,[19] 92% of White US adults used the internet in 2019, compared to 86% of Latinx and 85% of Black adults. Yet, 79% of White US adults used broadband internet at home that year, compared to 66% of Black and 61% of Latinx adults. This suggests that high-speed internet access at home varies by race and ethnicity just as it varies by socioeconomic status. Census data from 2017 showed that Black households were most likely to report having no broadband access and no computer at home (36.4%) compared to 21.2% of White households.[20]

Figure 3. Home Broadband Use by Race[21]



Racial disparities in ICT tend to persist even after controlling for socioeconomic status.[22] This tends to manifest in White students outperforming their racial minority peers in ICT related tasks.[23] Revisiting broadband access data in the MERC region, it appears that similar patterns emerge based on the racial composition of the student body.

[18] Middleton & Chambers (2010)
[19] Pew Research Center (2019, June 12)
[20] United States Census Bureau (2017, September 11).
[21] Pew Research Center (2019, June 12)
[22] Campos-Castillo (2015); Tichavakunda et al. (2018)
[23] Ritzhaupt et al. (2013)

Table 4. Internet Access in the MERC Region by Student Race and SES[24]

	% Population with access to at least "average" (100 mbps) internet	% Black	% White	%Latinx	% ED[25]
Chesterfield	97.4%	25.4%	48.3%	17.6%	39.6%
Goochland	65.9%	13.6%	72.9%	7.40%	26.2%
Hanover	80.2%	9.35%	77.6%	5.70%	23.3%
Henrico	98.2%	35.8%	36.7%	10.7%	41.0%
Petersburg	98.6%	88.9%	2.60%	6.50%	76.3%
Powhatan	81.6%	5.20%	85.8%	4.00%	22.8%
Richmond	94.8%	62.9%	14.2%	19.3%	55.0%

In divisions with the highest percentage of Black students (Petersburg and Richmond), more than 94% of the population had access to at least average speed internet. However, as previously discussed, students and their families in these divisions may struggle to afford to pay for the internet according to the high percentages of students qualifying as economically disadvantaged (65.7% on average). In school divisions with the highest percentage of White students (Powhatan, Hanover, and Goochland), an average of 75.9% of the population had internet access and 24.1% of students qualified as economically disadvantaged. Thus, it appears that in our region, White students are more likely to live in rural areas where physical access to reliable internet is an issue while Black students are more likely to live in urban areas where financial access is an issue.

[24] Based on 2019-2020 fall membership reports from the VDOE
[25] Economically Disadvantaged

English Language Learner disparities in internet access

Schools and teachers nationwide have reported that the resources required for virtual learning are often less readily available in the homes of English learners (ELs) than in those of native English-speakers (Zehler et al., 2019). Data from a 2016 survey by the U.S. Census Bureau showed that only 62.5% of multilingual[26] households reported broadband internet at home, compared with 82.3% of all other households[27]. In this case, cellular data plans were included under broadband internet, so it is possible that the number of multilingual households with high-speed internet service running directly to their homes was even lower. While certain cellular subscriptions may provide reliable internet access, a data plan would likely be insufficient and/or inconvenient for virtual learning. These multilingual households were also significantly less likely to possess an internet-capable device, such as a computer or tablet, at home. For example, just over half of multilingual households reported having a desktop or laptop computer, compared to over three-quarters of other households[28]. These statistics demonstrate a clear gap in access to both computing hardware and network connectivity, which likely persists in 2020, although the exact extent is unknown.

Since multilingual households were less likely to own the tools required for virtual learning before the COVID-19 pandemic, members of multilingual households may also be less familiar with using those tools, such as laptops and WiFi hotspots. Evidence shows students without an adult English speaker at home are more likely to fail to complete schoolwork due to a lack of support and familiarity with these tools.[29] Therefore, not only students but also parents and guardians of ELs who are less experienced with virtual learning tools may need more fundamental instruction on and support with computers and the internet.

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[26] Multilingual refers to households in which all members over 14 years of age are most proficient in language(s) other than English.
[27] Ryan (2018)
[28] Ibid.
[29] Blagg et al. (2020).

Internet Access at School

One area where broadband connectivity has greatly improved over the last decade is in public schools. A 2018 report by EducationSuperHighway declares that "the classroom connectivity gap has been closed."[30] Some highlights from that report include:

- 99% of schools nationwide have fiber-optic or similar quality connections. That is, they have a clear path to delivering enough bandwidth for digital learning in every classroom, every day.
- 99% of school districts have internet access at the minimum 100 kbps goal.
- The FCC recommends 1Mpbs connections to support digital learning in the schools. 38% of school districts are meeting the 1 Mbps per student standard.

There are still inequities in access in schools, though. There are approximately 750,000 students who still do not have access to the internet at a rate of 100 kpbs. Also, only 23% of the nation's largest school districts, which are disproportionately urban districts, have 1 Mbps access, compared to 57% of the smallest districts.

According to that same report, in Virginia, 100% of students can access the internet at a speed of 100 kbps, and 12% of students have 1 Mbps access, compared to 24% nationally.

Computing Devices at Home and in the Community

Moore, Vitale & Stawinoga (2018) surveyed a random sample of students who took the ACT in 2017, and asked them about their access to and use of computers at home and in school. Of that population, 14% reported having access to only one device and 1% reported having no computing devices.

Of the students who only had access to one device, 56% indicated that the device was a smartphone. Furthermore, 85% were classified as underserved, meaning they were one of the following: low-income, first generation in college, or a racial minority.

The Pew Research Center conducted a survey of adults in the U.S. in February of 2019 and found that access to technology at home varies by income level.

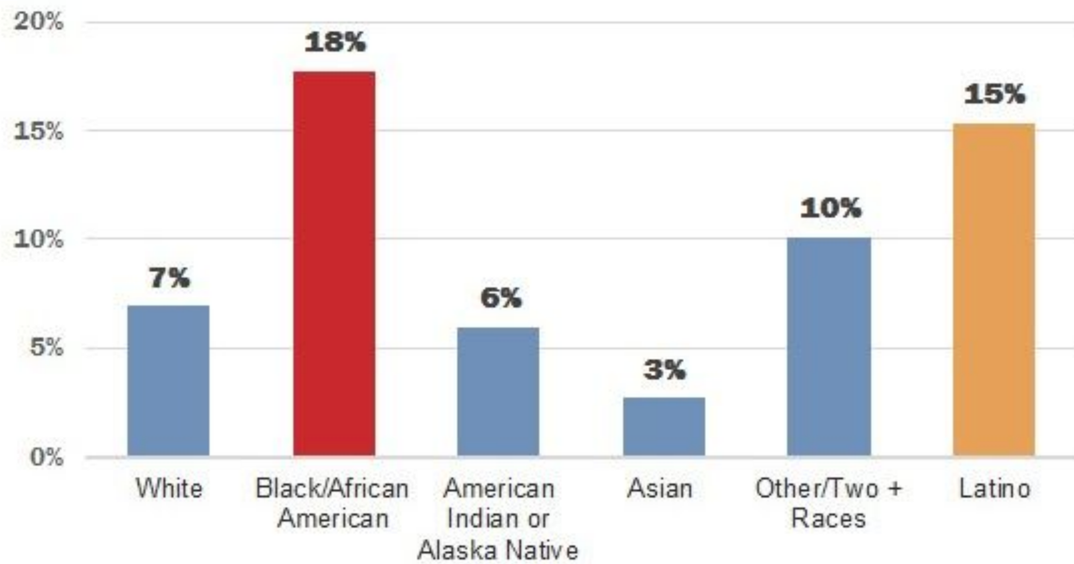
> *Higher-income Americans are… more likely to have multiple devices that enable them to go online. Roughly two-thirds of adults living in high-earning households (64%) have home broadband services, a smartphone, a desktop or laptop computer and a tablet, compared with 18% of those living in lower-income households.*[31]

SCHEV examined data from the American Community Survey to see the differences in computer access at homes in Virginia. While only 7% of White households were without a computer, 18% and 15% of Black and Latino households, respectively, had no computer.[32]

[30] Education Superhighway (2019, p. 1)
[31] Anderson & Kumar (2019, May 7)
[32] Allison (2020)

The picture that emerges from all of this data and information is that the vast majority of households have at least one computing device in the home, but for too many Americans, particularly those with lower incomes, that access is limited to just a smartphone. This may be sufficient for basic communications purposes, but for students who need to engage in school-related work at home, a smartphone is an insufficient device.

Figure 4. Virginia Students Without a Computer in the Home by Race[33]



Computing technology is constantly evolving, but it can also be quite expensive, and students from lower-income families are less likely to be able to afford it.[34] Thus, while lower-income students may technically have access to devices, this may actually manifest in the form of computers provided at a local library or community center,[35] or the use of cheaper cell phones with limited functionality for completing school work.[36] In these circumstances, while students technically have the opportunity to engage with ICT, they need to put forth considerable effort to do so in comparison to their more affluent peers.

Computing Devices at School

While there are still significant disparities in access to computers in homes, over the last couple of decades, schools have been providing more and more access to computers, both within the schools and as take-home devices. Based on data from the 2015 National Assessment of Educational Progress (NAEP) survey, using National School Lunch Program (NSLP) eligibility as an indicator of socioeconomic status, we see this situation fairly clearly. That is, for 4th grade students at least, there were socioeconomic differences in students' access to computers at home (76% of students eligible for the NSLP did not have computer

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[33] Allison (2020, p. 4)
[34] Lei & Zhou (2012)
[35] Tichavakunda et al. (2018)
[36] Collins et al. (2016)

access at home, compared to 91% of students not eligible). However, lower income students had similar rates of computer access (91%) at school compared to middle-to-higher income students (92%).[37]

Well before the Covid-19 pandemic, schools and school districts were increasingly providing students with laptops or tablets that they could use in school and at home. These efforts are commonly referred to as "one to one initiatives," referring to a central goal of the programs to provide each student with his or her own internet connected device. Studies have shown that students participating in one to one programs tend to spend more time writing and engaging with feedback from peers and teachers.[38] Studies have also shown a moderate positive association with school attendance and student achievement.[39] Such programs are increasingly popular across the country.[40]

The Consortium for School Networking (CoSN) has been tracking the growth of computer access and 1:1 initiatives for a number of years. In their 2020 report called "The State of Ed Tech Leadership in 2020," they asked school district technology leaders about computing device-to-student ratios. Nearly one-half of districts surveyed reported one device per student, and another 38% of districts envisioned such a ratio within three years. This is a significant jump from 2014, when just 23% of districts surveyed reported 1:1 computing access. Only 4% of districts reported offering less than one device per every five students. On the other end of the spectrum, 28% of respondents said they offered more than one device per student.[41]

One-to-one computing programs are concentrated in secondary schools. When looking at 1:1 by grade level, two-thirds (66%) of high schools and more than two-thirds (69%) of middle schools are fully 1:1. Only 43% of elementary schools have implemented 1:1 programs.

A few of the MERC school divisions have implemented 1:1 programs. Henrico County has one of the longest-standing programs in the country, having started giving every high school student a laptop in 2001. Middle school students began receiving laptops the next year in 2002. Chesterfield County Public Schools and Goochland County Public Schools also currently have 1:1 programs. And, during the pandemic, other MERC school divisions have had to ensure that all students with need have access to a sufficient educational computing device. The result is likely to be that by 2021, the vast majority of students in the MERC divisions will have access to a school-issued laptop or tablet.

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[37] National Association of Educational Progress. (n.d.)
[38] Warschauer et al. (2014)
[39] Thieman & Cevallos (2017)
[40] National Science Foundation (2018)
[41] Consortium for School Networking (2020)

ESTABLISHING EQUITY OF ACCESS

In this section, we look at ways to address the internet and computer access issues through a multi-pronged effort across all layers of government and in partnership with industry and community partners.

Internet Access

The role of the federal government

There have been a number of federal efforts to ensure internet access to schools; primary among them is the program commonly known as E-rate. This Federal Communication Commission's (FCC) Universal Service for Schools and Libraries Program is one of four Universal Service Fund (USF) programs. Authorized under the Telecommunications Act of 1996, and funded by fees collected by telecommunications providers, E-rate's authors focused the program on connecting all schools and libraries to the internet. E-rate is essentially a "discount" program, as it offers schools and libraries subsidies on telecommunications and internet access services based on their level of need (based on the percentage of local students qualifying for free or reduced lunch under the National School Lunch Program (NSLP)). In 1998, the first round of E-rate funding was capped at $1.69 billion per year. Today, that cap stands at $3.9 billion per year.

The E-rate program has gone through a number of changes, including a major reform effort in 2014. While there is no question that the E-rate program has helped in terms of equity of access to the internet in schools, some research points to some less than ideal outcomes. For example, Hudson showed that a disproportionate amount of the funds flowed to more prosperous states[42], while Jayakar and Park demonstrated that wealthier school districts got a disproportionately higher share of funds.[43] Also, the Government Accountability Office has been critical of the E-rate program. "Four GAO reports have recommended that the FCC establish a long term strategic vision and performance outcomes and measures for the E-rate program."[44] Overall, though, while the E-Rate program is incredibly complex and time-consuming for schools and districts, it provides great benefit.

The E-rate program is one way the federal government has supported schools directly in their efforts to ensure equitable access to the internet. Beyond E-rate the federal government provides additional grant funding that could be used for education-related projects or programs. For example, the U.S. Department of Agriculture supports the Distance Learning and Telemedicine program that helps rural communities use telecommunications to "connect to each other and to the world, overcoming the effects of remoteness and low population density."[45] Under this program, as one example, teachers and medical service providers in one area can be linked to students and patients in another. Additionally, through Broadband USA, the U.S. Department of Education identifies

[42] Hudson (2004)
[43] Jayakar & Park (2009)
[44] Holt and Galligan (2012, p. 307)
[45] USDA (n.d.)

12 federal programs that provide funding that can support broadband infrastructure and adoption in schools and/or communities.

There is more that the federal government can do to ensure equitable access. In April 2019, U.S. Senator Patty Murray (WA) introduced the Digital Equity Act, which proposed to authorize over $1 billion in federal grant funds over five years to support digital inclusion in the United States. The Digital Equity Act would create two major Federal grant programs, operated by the U.S. Department of Commerce's National Telecommunications and Information Administration (NTIA), to promote digital equity nationwide. The proposed funding for each program is $125 million per year for five years — a total of up to $1.25 billion. One program would be carried out through state governments, with funding allocated by formula, and would incorporate state-by-state digital equity planning followed by implementation grants to qualifying programs. The other would be an annual national competitive grant program, run by the NTIA, to support digital equity projects undertaken by individual groups, coalitions, and/or communities of interest anywhere in the United States.

The role of state government

A 2019 report by the State Educational Technology Directors Association (SETDA), called State *K-12 Broadband Leadership 2019: Driving Connectivity, Access and Student Success* documents how state education agencies and policymakers have worked hard to ensure equitable internet access for all students.

> *Students deserve these equitable opportunities both on and off campus. States demonstrate leadership through legislation, initiatives, partnerships, statewide broadband networks, regional networks, and/or statewide purchasing consortia to facilitate reliable, cost-effective internet access for districts. States are also developing strategies to help ensure all students have adequate internet access both on and off campus. (p. 1)*

The report shows how state-level leadership around broadband necessarily varies across the states. "No two states are exactly alike as multiple considerations including geography, state education agency practices and state procurement laws all impact decisions regarding broadband support and implementation" (SEDTA, 2019, p. 3). There are some statewide networks, and some networks are partnerships between states and/or non-profit organizations. Also, across the states, there are partnerships with regional networks, community-based groups, and other external organizations. However state policy is arranged and governed, "...the overall goal is to expand high-quality connectivity to all K-12 public schools to provide robust access for students to further teaching and learning" (p. 3).

In Virginia, there are a number of state-level policies, programs, and activities aimed at ensuring equitable access to technology. In 2015, the Virginia Department of Education launched the K-12 Learning Infrastructure Plan (KLIP) which has the following strategic priorities:

1. Provide resources and tools to assist schools with network infrastructure and broadband technologies

2. Assist schools with the E-rate process to get the discounts they need for internet access and internal Wi-Fi connections
3. Build the capacity of school division technology directors to lead and implement digital equity strategies and solutions in their division and community
4. Provide resources, technical assistance, and professional development on information security and student data privacy issues
5. Develop partnerships with cloud providers to offer ongoing education, training, resources, and strategy assistance for school cloud migration.
6. Create greater communication and collaboration among division technology leaders through conference participation at the Leading Ed Forum, regional technology meetings, and the MS Teams channel- Technology Directors-VA school divisions[46]

The KLIP Work Group has produced Broadband Connectivity Capability Reports which document the results of a survey the group conducted across the state as well as data that school divisions are now required by state law to report to VDOE on the status of broadband connectivity capabilities of schools in the division. VDOE and KLIP have partnered with an non-profit organization called EducationSuperHighway (ESH) that was founded in 2012 with the mission of upgrading internet access in every public school classroom in America.

Commonwealth Connect (CC) is the Commonwealth of Virginia's comprehensive effort to achieve universal broadband access, a goal set by Governor Ralph Northam in July 2018. CC works toward universal broadband access in Virginia through four main tracks:

1. Increased state grants to public/private partnerships to "make the math work" and build broadband to unserved communities
2. Policy changes to accelerate universal broadband
3. Better support and resources for local broadband planning
4. Convening over 100 broadband stakeholders in the Commonwealth Connect Coalition

Finally, in July 2019, VDOE held its first Digital Equity Summit. This was a pre-conference to the larger *Virginia is for All Learners: Education Equity Summer Institute*. The purpose of the Digital Equity Summit was to bring K-12 education leaders together to learn more about the factors that contribute to digital equity and potential solutions to the problem.

The role of local government

There are also policies and programs that can take place at a more local level, either regionally or at the school district level. The Consortium on School Networking (CoSN) released a Digital Equity Toolkit in 2018 that "provides background context for the Homework Gap, addresses broader implications of household connectivity, suggests resources for scoping the problem, and details five strategies districts are currently using to address these challenges."[47] For each of the five strategies, the table below lists the pros and cons.

[46] VA Department of Education (n.d)
[47] Consortium for School Networking (2018, p. 1)

Table 5. Strategies for Local Governments to Address Digital Equity in Education Issues.

Strategy	Pros	Cons
Partner with Community Organizations to Create "Homework Hotspots"	• Minimal school district costs • Increased community engagement in digital equity	• Business hours, student schedules may not be aligned • Lack of transportation to/from public Wi-Fi access locations • Public Wi-Fi networks rarely provide any security or age appropriate filtering
Promote Low Cost Broadband Offerings	• No cost to school/district	• Duration of offerings may be uncertain • Research shows that few families sign up for this type of service • May not be a feasible option for families who move frequently • Family will be responsible for security and filtering
Deploy Mobile Hotspot Programs	• Provides internet access anytime, anywhere • Particularly relevant for students spending time in multiple households or who move frequently • With school-provided access, educators can often gain visibility into student activity that can inform academic strategies and help evaluate the use of digital resources	• May have data caps • Not all vendors provide coverage in some areas Filtering may be a consideration
Install Wifi on School Buses	• Leverages existing school district assets • Students use travel time for learning and homework • Improved school bus discipline • Filtered bus Wi-Fi provides a safer online environment for students doing homework	• Additional cost • Motion sickness may be a challenge for some students
Build Private LTE Networks	• Leverages an existing, underutilized resource • No data caps/overages	• Start-up costs may be significant • Setup and maintenance requires technical sophistication

The report highlights spotlight school districts, including a couple in Virginia:

- **Fairfax County Public Schools (VA).** As part of the Access4All program, Fairfax County Public Schools (FCPS) in Virginia mapped free Wi-Fi locations for students. Their Community internet Access maps list sites in neighborhoods within the district, including libraries, community, family, and other resource centers where students can access Wi-Fi to complete their homework[48].
- **Albemarle County Public Schools (VA)** is leveraging Educational Broadcast Spectrum (EBS) licenses to provide home connectivity for underserved students through a private 4G LTE network. Spanning 726 square miles at the foothills of the Blue Ridge Mountains, the district is both geographically and socioeconomically diverse, comprising both urban and rural communities with pockets of poverty and low levels of both broadband adoption and access. According to the National Digital Inclusion Alliance, broadband is not available through either cable or commercial 4G cellular service in many of the district's rural areas. Following an initial pilot which included partnerships with local police and fire agencies and began with mounting antennas on school buildings, the district is expanding the EBS service to cover additional areas. With an eye towards sustainability, their strategy includes partnering with a commercial firm to install towers on school campuses, allowing the district to broadcast signals to Wi-Fi devices while also leasing space to commercial carriers, generating revenue to support system upkeep.[49]

Computer Access

Unlike ensuring equitable access to the internet, making sure that K-12 students have access to sufficient computing devices has become less of a federal and state issue as the burden has fallen to schools and districts. This was not always the case.

The influential 1983 report "A Nation at Risk" recommended that computer science become one of the "Five New Basics" to be covered in public education. Also in 1983, the National Commission on Excellence in Education (NCEE) concluded that high school graduates should:

> *...understand the computer as an information, computation and communication device; [be able to] use the computer in the study of the other Basics and for personal and work-related purposes; and understand the world of computers, electronics, and related technologies.*[50]

In the late 1980s and early 1990s, the federal government issued a number of reports that emphasized the development of infrastructure and the installation of hardware in schools. In the latter part of the 20th century, the federal government made a serious commitment to building up the computing infrastructure of America's schools. In 1993, the U. S. Department of Education created the Office of Educational Technology (OET), and the first

[48] Consortium for School Networking (2018, p. 6)
[49] Ibid (p. 13)
[50] (p. 26)

National Educational Technology Plan (NETP), titled "Getting American Students Ready for the 21st Century: Meeting the Technology Literacy Challenge," was published in 1996.

Two of the four pillars of the first national technology plan directly addressed the need for equal access to technology. Furthermore, along with the first NETP, the federal government's Technology Literacy Challenge Fund (TLCF) grant program was focused on infrastructure and professional development. That is, in the first years of the program, TLCF monies were specifically to be spent on developing technological infrastructures in schools.

Even before the first NETP was issued, some states began to use their own funds and/or funds from philanthropic partners to build up the computing infrastructure of schools. West Virginia's "Basic Skills/Computer Education" program was a unique early effort. The BS/CE program was authorized in 1989-90 and hardware and software were installed in schools and teacher training began. The program had three main components: (1) software that focuses on the State's basic skills goals in reading, language arts and mathematics; (2) enough computers in the schools so that all students will be able to have easy and regular access to the basic skills software; and professional development for teachers in the use of the software and the use of computers in general, and (3) each year from 1990-91 onward and beginning with kindergarten, at a cost of about $7 million per year, the State of West Virginia provided every elementary school with enough equipment so that each classroom serving the grade cohort of children targeted that year might have three or four computers, a printer and a school-wide, networked file server. Schools were able to choose to deploy the computers in labs and centers or distribute them directly to classrooms. As the 1990-91 kindergarten class went up the grades, so did the successive waves of new computer installations coupled with intensive professional development for teachers and software chosen from either IBM or Jostens Learning.[51]

Other states tried to implement similar initiatives as the 20th century concluded, but with the turn of the century came the first statewide 1:1 computing initiative. In 2002, Maine became the first state to provide a personal computer to each 7th and 8th grade student and teacher. The Maine Learning Technology Initiative (MLTI) program, still in existence today, expanded to high school students and teachers in 2009. That expansion into high schools was not fully funded by the state, so school districts had to find the funding to participate in the MLTI. As a result, only half of high schools in Maine were participating in the program. MLTI came under scrutiny when state leadership changed in 2013, but the governor was ultimately convinced to keep the program in place, with some changes. One such change was that in 2013, MLTI moved away from exclusive use of Apple computers and incorporated Windows-based computers.

Around the same time that the MLTI was getting underway in Maine, the Henrico County Public Schools (HCPS) in Virginia became one of the first school districts in the United States to distribute laptops to students. The initiative began in 2001 and was initially slated to be a four-year, $18.6 million project. The first year focused on high schools, and the middle school program began in 2002. For the first few years of the program, Apple computers were used exclusively. In 2005, however, Dell was awarded a contract with HCPS. The program continues to this day, though HCPS's offerings have expanded to iPads and other forms of technology.

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[51] Mann et al. (1999)

Maine, at the state level, and Henrico, at the district level, were the early trendsetters. It is difficult, if not impossible, to ascertain how many schools and districts now issue computing devices to students. In 2019, CoSN conducted a survey of 335 school district IT leaders. According to those data, 42% of elementary schools have implemented 1:1 programs, as compared with 60% in High Schools and 63% in Middle Schools. That same survey showed that schools and districts are moving away from Bring Your Own Device (BYOD) programs where students are expected to purchase their own computing device to be used for schoolwork in and out of schools. Furthermore, more and more schools and districts are banning student use of personal devices, especially mobile phones, "Districts banning devices increased from 10% in 2018 to 15% this year."[52]

As the coronavirus pandemic pummeled the United States, most school districts that had not already been 1:1 began issuing computing devices to students so that they could engage in emergency remote learning programs. Funding for those devices came from a number of sources, including the federal CARES Act, transportation and energy cost savings, community organizations, and philanthropic efforts. In March and April 2020, the Richmond Public Schools (VA) distributed about 8,000 laptops already owned by the schools (and, to that point, kept in the schools) as well as up to 10,000 laptops that the division purchased at a cost of around $3.5 million.

While the cost for implementing technology programs like 1:1 initiatives is a consideration for all school divisions, this may be particularly challenging in divisions with higher concentrations of lower SES students whose resources may be allocated elsewhere.[53] High-poverty schools and divisions tend to illustrate not only socioeconomic but also racial inequities in digital access, as Black students in particular are much more likely than their White or Asian peers to attend them.[54] An illustration of how they are under-resourced, high-poverty schools tend to have lower computer to student ratios than low-poverty schools, which means that Black students are more likely to attend schools with fewer computers available for them to use.[55] Even when these schools do have similar numbers of computers as lower-poverty schools, they are less likely to be modern, have the same software packages, or have reliable internet access.[56] Thus, schools with high concentrations of low-income students, which are also more likely to have high concentrations of racial minority students, often experience a confluence of inequities in digital access.[57]

[52] CoSN (2019, p. 12)
[53] Warschauer et al. (2014)
[54] Tichavakunda et al. (2018)
[55] Hohlfeld et al. (2017)
[56] Ibid.
[57] Hohlfeld et al. (2017); Warschauer et al. (2014)

CONCLUSION

The effort to ensure equitable access to technology for teaching and learning in the United States has been multi-pronged, across federal, state, and local governments, and occasionally in partnership with industry and community partners. As the earlier section on access to technology indicates, there is still significant opportunity for growth towards equity; perhaps there always will be. But, if we are to become more equitable, the kinds of efforts that have been undertaken need to continue and need to be expanded. Additionally, we will need new and significant efforts, including perhaps a move towards broadband as a public utility, if not a free service.

In 2011, Frank LaRue, then the United Nations' Special Rapporteur on the promotion and protection of the right to freedom of opinion and expression, issued a report which stated that the internet enables a range of human rights:

> *Indeed, the internet has become a key means by which individuals can exercise their right to freedom of opinion and expression, as guaranteed by article 19 of the Universal Declaration of Human Rights and the International Covenant on Civil and Political Right.*[58]

Additionally, LaRue wrote, the internet enables "economic, social and cultural rights…the right to education and the right to take part in cultural life and to enjoy the benefits of scientific progress and its applications, as well as civil and political rights, such as the rights to freedom of association and assembly"[59].

In 2016, the United Nations Human Rights Council passed a non-binding resolution condemning countries that intentionally disrupt citizens' internet access. That resolution made an addition to Article 19 of the Universal Declaration of Human Rights. Article 19 states that "Everyone has the right to freedom of opinion and expression; this right includes freedom to hold opinions without interference and to seek, receive and impart information and ideas through any media and regardless of frontiers."[60] The new section adds to that "the promotion, protection and enjoyment of human rights on the internet."[61] Additionally, another 15 recommendations were added that cover the rights of those who work in and rely on internet access. The resolution also applies to women, girls, and those heavily impacted by the digital divide.

Reglitz argues that the UN should have gone further:

> *I argue instead that internet access is itself a moral human right that requires that everyone has unmonitored and uncensored access to this global medium, which should be publicly provided free of charge for those unable to afford it.*[62]

This argument is based on three justifications: First, Reglitz says that "without such access many individuals lack a *meaningful* way to hold accountable supranational rule-makers and

[58] LaRue (2011, p. 7)
[59] Ibid.
[60] United Nations. (n.d.).
[61] United Nations General Assembly (2016, June 30, p. 1)
[62] Reglitz (2019, p. 314)

to influence supranational institutions."[63] Second, internet access "...is necessary for exercising some of our basic political rights (e.g. free expression and assembly)".[64] Finally, "...properly realised and protected – internet access would be an extremely powerful instrument for protecting a range of core human rights, such as those to life, liberty, freedom from torture, and bodily integrity".[65] Reglitz does concede that free internet access would have to come with some regulation to protect against abuses.

Reglitz's argument can be boiled down, in part, to the idea that, increasingly, the internet is entangled with citizenship. That is, more and more, to be a productive member of a deliberative democratic society requires access to the internet. Similarly, education, and formal schooling have always been necessary to participate meaningfully in a deliberative democracy; internet access and education, therefore, go hand in hand.

We can and should tinker towards more digitally equitable schools. As we do so, though, it is incredibly important to consider that the "digital divide" is not just a distributive justice problem. That is, it is not just a problem of exclusion or non-consumption. Simply providing internet access for free will not necessarily level the playing field. The "digital divide" is part of a larger set of complex societal problems. In fact, Bach, Wolfson and Crowell argue that the digital divide is not the problem:

> *...rather it is a symptom of social and economic marginalization that has been exacerbated by policies and practices that further disenfranchise poor and working people. Initiatives that aspire to lift people out of poverty by providing them broadband access and training in digital literacy fail because they misunderstand the nature of poverty today by aiming to solve a symptom of a much larger and more complicated problem, rather than the problem itself.*[66]

Furthermore, access to technology should not be thought of as static. Naturalistic research that gets beyond raw numbers and statistics show that households, particularly low-income households, see fluctuations between connectivity and cancellation due to financial hardships. Also, technical and technological issues can impact the quality of access on a day-to-day basis. In other words, access is fluid.

> *Neither digital education nor broadband access alone can promote a more equitable society. Rather, it is the critical engagement by and with individuals and groups on issues of social importance and worth... and the role of new information technologies in fostering this critical engagement and mobilization that can lead to concrete changes that improve the lives and working conditions of marginalized individuals and communities.*[67]

That is, until we can treat these symptoms of marginalization, then, the perception that technology can "level the playing field" and increase transparency and governmental accountability will remain more of a myth than reality.

That said, this report shows that there are clear steps that can be taken at multiple levels of government to address the disparities in access to computers and the internet. The federal

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[63] Reglitz (2019, p. 318)
[64] Ibid (p. 319)
[65] Ibid (p. 321)
[66] Bach et al. (2018, p. 36)
[67] Ibid (p. 37)

government can strengthen and improve upon the E-rate program and pass the Digital Equity Act into law. State governments can put more resources behind programs like Commonwealth Connect in Virginia in order to complement the federal government's efforts around broadband access Also, the Covid-19 pandemic has made it clear that 1:1 computing is the present and future state for our students. Therefore, state governments should also consider statewide educational computing programs like Maine undertook over a decade ago. There are no doubt economies of scale to be achieved when this is done at the state level instead of each individual school district going through procurement processes. Finally, local governments can partner with industry and community partners to implement the kinds of programs listed in Table 5. In sum, we can and should do more to address the access aspect of digital equity in education.

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