Recognizing the Rural Digital Divide

Online connectivity obstacles for households in Wattsburg Area School District

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Table Of Contents

Introduction

"About 7 in 10 teachers assign homework that requires broadband access, but nearly 1 in 3 households don't have it."[1] Nationally, at least 15% of all households are without high-speed services, and that number can jump to nearly 33% amongst low-income households.[2] This discrepancy in service availability is often referred to as the digital divide. The digital divide is more formally defined as the economic, educational, and social inequalities between those who have computers and online access and those who do not[3]. In other words, the lack of access to the internet, and subsequent online resources, can place citizens at a disadvantage in several aspects of daily life.

The digital divide is most prominent in two distinct socioeconomic areas - inner city and rural communities. Though unique in many ways, both groups face the same challenges including a limited number of available service options, overall affordability of services, and below-average digital literacy. In this case, digital literacy is important because it impacts one's capacity to evaluate the online service market and to then utilize the purchased services properly. In rural areas, the price per mile for the necessary infrastructure construction often prohibits broadband service offerings from reaching geographically sparse customer bases. A Department of Transportation report from 2017 estimates the cost of laying fiber at $27,000/mile[4].

The "homework gap", or the ability for K-12 students to successfully access source materials from home[5], is a negative byproduct of the digital divide. Source materials can include online blackboard programs, teacher-generated syllabi or project outlines, digital libraries, and search engines. Throughout 2020, the global COVID-19 pandemic made this gap even more apparent. By mid-March 2020[6], most educational institutions had eliminated in-classroom learning, companies sent workers home to

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[1] ("Nearly one-in-five teens can't always finish their homework because of the digital divide")
[2] ("Nearly one-in-five teens can't always finish their homework because of the digital divide")
[3] ("Digital divide Definition & Meaning")
[4] (Aman)
[5] (St. George)
[6] ("A Timeline of COVID-19 Developments in 2020.")

telework, and small businesses had to develop new methods of service. Almost all the hospitality, food service, and entertainment industries were forced to temporarily close as well, with some of those businesses never reopening. Today, almost two full years later, governments continue to evaluate various pandemic safety initiatives, including masks, social distancing guidelines, rules for non-essential businesses, and restrictions on public gatherings. At the same time, schools had to balance the challenges of student health and safety with the many inconveniences of moving to online/remote learning with little notice or preparation.

Wattsburg Area School District

Wattsburg Area School District, located in the eastern part of Erie County, Pennsylvania, is a small, rural school district serving approximately 1,300 students[7]. The district covers 143 square miles[8] and includes five municipalities: Amity Township, Greene Township, Greenfield Township, Venango Township, and Wattsburg Borough. Out of 500 school districts in Pennsylvania, WASD ranks 92nd in total geographic coverage, and 98th in population density[9] . What makes WASD a unique case study is that two of the five municipalities are serviced by wired broadband providers, while the other three municipalities are only served by traditional rural access methods.

Traditional rural access connections are no longer considered sufficient for the dynamic and media-rich content that is in widespread use on the internet today. This is due to their low speeds and less-than-desirable reliability. These methods include dial-up satellite, DSL, and cellular hotspots. It should be noted that traditional high-orbit satellite has been able to increase speed thresholds to *just* meet the Federal Communications Commission definition of broadband, but its reliability, as well as significant data caps, remain an issue. Some cellular service can also reach speeds that meet the FCC definition of broadband, but the reliability, data caps, and the unpredictability of the service are often

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[7] ("About Our District")
[8] ("Pennsylvania Land Area School District Rank")
[9] ("Pennsylvania Land Area School District Rank")

problematic in rural areas. For example, cellular providers do not necessarily guarantee indoor service. Low-orbit satellite services, still relatively new and unavailable to all areas, may provide enough speed to compensate for reliability issues, but the initial up-front costs may be a financial deterrent.

Internet Connectivity for Online Learning

What differentiates broadband or "high speed" internet access from traditional rural access methods? Quite simply, it is the speed of data transmission. Reliability is also an important factor in the overall experience a student has when learning in an online environment. For context, the longstanding definition of broadband used by the FCC was "high-speed internet access that is always on and faster than traditional dial-up access."[10] However, this was amended in 2018 to include download speeds of greater than or equal to 25 Megabits per second (Mbps) and upload speeds of 3Mbps[11]. In other words, download speeds are important for retrieving content, and upload speeds are important for delivering content. For example, the ability to download materials for use in a research paper, or watch educational videos, would be directly impacted by the available download speed. The ability to submit that research paper would be directly impacted by the available upload speed. A video call, or conference, requires both high upload and high download speeds. Classroom-style online learning, the traditional method that the majority of current teachers practice, utilizes interactive two-way communication and subsequently requires high upload and download speeds.

Even though speed is important, the corresponding reliability is just as important as the speed itself. If downloads are interrupted, video conferences distorted, or uploads are timing out, then the service cannot be considered reliable. At times sufficient speed can mask reliability issues, depending on the type of content being requested. This is often because transmission methods (or protocols) are often smart enough to repeatedly retry to retrieve and submit lost transmission data. For example, someone with poor reliability could still stream online content due to built-in quality-of-service protocols such as

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[10] (Cooper)
[11] ("Broadband Speed Guide")

buffering, error checking, and retransmission requests. Appendix A is a chart of various connection options, their reported speeds, factors in their speed and reliability, and other notes about the service.

Poor digital literacy, including an inability to seek out, evaluate, and differentiate online service providers and their respective service offerings[12], can cause households to inadvertently lock themselves into the wrong side of the digital divide. For example, a household may choose a slower or less reliable service based solely on familiarity or affordability. Even though faster upload speeds tend to drive prices higher, once the infrastructure is in place most wired broadband services are offered to customers at a lower price than other current rural access methods.[13]

WASD Case Study Opportunity

The Wattsburg Area School District, like all Pennsylvania school districts, was required to send students home beginning March 12, 2020. On March 19th, Governor Tom Wolf ordered nonessential businesses to close as well. When able, businesses attempted to provide remote work options. This unique set of circumstances forced all household members under the same roof, which subsequently strained household infrastructure in ways previously not seen during daylight hours. These unique circumstances also provided an opportunity to assess if the online access methods available to households in WASD were sufficient to support online learning and help identify if there is evidence of the digital divide within the district.

The intention of this paper is to provide qualitative data that assesses the ability of WASD households to provide an effective online learning environment for their student(s). To gather this data a survey was distributed to all K-12 households with children enrolled in WASD. The survey was designed to look for key indicators of the digital divide when it came to service offerings, service speed, reliability, overall digital literacy, and what, if any, reported effect these indicators had on the online learning

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[12] (Loewus et al.)
[13] (McNally)

experience. This paper does not intend to assess if the digital divide had any impact on the academic performance of WASD students.

Questions that were included in the survey focused on the type of access WASD households had pre-pandemic and subsequently what access methods were available during the height of the pandemic for online learning, if a households' online access method impacted the ability of students to learn online, if district-provided cellular hotspots were able to provide adequate online access, and if households were able to increase speed and reliability methods if or when a need was recognized. The survey also attempted to determine if parental assistance was needed during online schooling and if simultaneous work-from-home and online-learning sessions could successfully take place.

WASD Household Survey

After survey questions were reviewed and approved by the WASD Superintendent and School Board, the survey was distributed to all households of the WASD on March 18th, 2021. The distribution took place via email from the WASD community portal. A brief explanation of the survey and a link to the live survey was included in the communication. The survey was distributed to all 1,166 households of WASD students. The survey was closed for responses on March 29th, 2021. A total of 417 households responded to the survey, which equals a response rate of approximately 36%. Appendix B includes the survey email and subsequent SMS notifications. Appendix C includes a copy of the survey in its entirety.

The survey intentionally excluded questions pertaining to student identification, household location, household income, and "speed test" results. The first three questions were avoided to encourage survey participation. The last question, an actual "test" of internet speed, was deemed to be unreliable as will be explained below. The overall focus were the barriers each WASD household potentially faces when attempting to provide adequate connectivity to participate in online learning.

Actual street addresses were not necessary to draw conclusions around reliability and connectivity assessments for internet services. Attempting to cross-reference street address data with

various forms of throughput (connectivity) and consistency (reliability) would vary drastically with each type of service consumed. The variances in DSL service (line length, line quality, line interference), satellite (weather), and cellular (tower distance, tower height, building construction, geography, interference) are vast enough that aggregating the overall experience per service should provide a relatively clear measure of service reliability. In contrast, wired broadband performance is much more consistent.

Though potentially beneficial, accurately assessing the speed of each service offering presented quite a few challenges. Measuring speed is often done "at the modem." In other words, the speed of the service offering as it enters the household, not necessarily the actual speed distributed throughout the household. This is where digital literacy plays a key factor as being able to successfully distribute a connection to household members so they can consistently and reliably utilize the service often takes an above-average amount of technical acumen. Again, reliability can change drastically within the household in comparison to "at the modem."

The service most often affected by connectivity and reliability issues is cellular hotspots, which are dependent on physical locations within the household more often than any other device. Factors like building construction, building materials, public utility-line construction, local weather patterns, and even topographical factors can heavily interfere with open-air transmission. Line-of-site dependent transmissions, such as satellite, are more likely influenced by weather than anything else, however, flora and fauna can have negative impacts as well.

All commodity service providers are selling connectivity, so it is in their best interest to "over-subscribe" the service and let the consumers adjust their consumption patterns accordingly. This ensures a steady consumption rate of the service and helps maximize the utilization of the distribution methods providing higher return on investment for the provider. High-orbit satellites, cellular carriers, and even some wired broadband providers will often distinguish between peak and non-peak hours for

their service offerings. Additionally, it is possible to oversubscribe the household consumption of the service "after the modem." In this case, the digital literacy required to "right size" the connection (where possible) and adequately allocate enough bandwidth for online learning amongst other competing content requests can be challenging, given the growing number of connected appliances and devices in each household.

WASD Survey Results

A complete report of all survey questions with raw data can be found in Appendix E. The following section details some of the observations within that data, specifically around services consumed, service experience, household options regarding service level and service provider, and digital literacy around overall household options.

The current internet service options available to K-12 households in the WASD exacerbate aspects of the digital divide, specifically around the speed and reliability of available services, thus making it more difficult for WASD students to access online learning. The survey data indicates that nearly half of district households can identify as being part of the digital divide based solely on the options available to them to access online content. While approximately 59% of our survey respondents have access to broadband capable services, the other 41% are using traditional rural access methods that fall below the current FCC definition for broadband.

If WASD follows national averages, data indicates that on average over 61% of households within the district have more than one student enrolled in WASD[14]. Student density in the WASD footprint is just over eight students per square mile. Those eight students, when assigned to proportionate households across the district's geographic footprint, equal about five households per square mile. For any provider looking to install necessary fiber optic cabling this translates to a cost of approximately $5,400 per K-12 household.

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[14] ("PA Facts 2020")

By definition, any household that is unable to achieve the 25Mbps down/3Mbps up thresholds falls outside the FCC definition. Current provider service capacities limit WASD households to just two available broadband services: satellite and wired (cable or fiber). When other mitigating factors are considered, for example the reliability of wired broadband at several WASD households and the overall unreliability of satellite service, that number falls even further. That also leaves the households using DSL, dial-up, or cellular hotspots automatically outside the speed thresholds as set forth by the FCC definition. It should be noted that the Starlink (low-orbit) satellite service was still in beta testing at the time of this survey. Additionally, a traditional (high-orbit) satellite customer would need to be on the latest hardware/software/package version from their provider to meet the FCC broadband definition (often at additional expense to the consumer).

The broadband household data from the survey suggest overall reliability is well below the thresholds one needs for a successful online learning experience. Only 12% of households using satellite internet reported that the service was "always reliable." Additionally, 77% of satellite respondents said they've had to delay schoolwork due to internet reliability issues. Only 32% of households with satellite access reported less than three significant outages a month. Wired broadband access (cable or fiber) households reported a 70% "always reliable" score with only 21% of respondents saying they've had to delay schoolwork. 68.5% of households with broadband access reported less than three significant outages a month. It should also be noted that 21 households (5%) that participated in this survey requested a school provided hotspot despite also consuming a broadband service, including four households supplementing their wired broadband access with personal cellular hotspots.

Satellite data reliability has always been problematic. Data caps, customer over-subscriptions, and line-of-site/weather-influenced service conditions have made the experience for traditional high-orbit providers problematic. Additionally, the high latency, or lag, found in the data transmission, particularly for data upload, makes this method insufficient for any aspect of interactive online learning.

In comparison, wired broadband has traditionally been fast and reliable, particularly for bidirectional communication. Some of the survey results indicated problems with the existing broadband service level in WASD households. Various survey data points show a surprising number of broadband-related issues including; service reliability (in regards to outages) with 31.5% of household facing issues, the ability for broadband to support shared connections between parents and students with 28.5% of households reporting parental intervention required to help students reconnect while sharing a connection, and 21.5% of broadband equipped households reporting that schoolwork had to be deferred due to broadband service issues. While these issues were still the lowest of all the online services being consumed by WASD households, the numbers were still higher than expected.

How do traditional rural access methods compare versus broadband capable services? Every key metric measured by the survey indicated traditional rural internet access was worse than the access provided by broadband providers. The survey observations around service levels provided by traditional methods can be found in Appendix E. One key observation indicated that the service scoring highest as being "always reliable" was cellular hotspots (both school and private) at only 17%. DSL had the lowest score regarding percentage of households that had to reconnect access, with 73% of all households reporting they had to help students reconnect at some point. And finally, the lowest number of significant outages per month was also cellular hotspots, with only 20% of households reporting no more than three significant outages per month.

Additional data on the service levels provided indicate that when a parent and student(s) are at home sharing a commodity connection the number of times the parent needs to help the students reconnect are 26% for broadband households and 68% for non-broadband households. If two or more students are sharing the same connection, the breakdown for parental intervention for broadband is significant at 34% (28% for fiber/cable only) of households, and for non-broadband services that number jumps to 75% of households requiring parental interventions.

Other evidence of the digital divide can be found in the type of access methods in use prior to general stay at home guidelines. Over 20% of survey respondents in the WASD did not have internet access prior to the general stay-at-home directives issued in March 2020. Additionally, there are fourteen households (approximately 3%) that currently do not have any internet access at all. Finally, only 29% of survey respondents indicated there are not any barriers to desired online access methods for the household. In other words, a desired service is available, and at a price the household can afford.

Survey results also indicate that there are some inconsistencies in digital literacy within WASD households. Some examples include only 46% of wired broadband households knowing speed increases are available, as well as a handful of households incorrectly believing DSL and satellite increases are available (which may be true in very rare instances, but in general these services cannot be increased). Fifty-six households indicated that they were not aware of any other online services they could purchase had the school provided wireless hotspots not been available. Finally, the number of broadband users reporting reliability issues for online learning connectivity was just under 30%, which could suggest a possible "after the modem" issue, though there are no observable examples within the data. This is an assumption based solely on personal experience with wired broadband services and common provider metrics as measured in national customer reliability scores for broadband[15].

WASD was able to mitigate the digital divide with cellular hotspots to a degree. That is, WASD was able to provide access to online learning material with school provided cellular hotspots but the service carriers were not able to provide adequate broadband speeds and reliability for K-12 households consistent with FCC guidelines. Given the service options available for the majority of WASD school students, cellular hotspots were the most logical solution due to being portable, not requiring additional hardware or "lines," and their ability to be reprovisioned to accommodate future students. The survey indicated that 129 households (31%) are currently using the school hotspots for some type of online

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[15] (Cooper and Tanberk)

learning connectivity, including the 56 households that were using the hotspots in conjunction with their commodity service.

As the survey data indicates, the only true way to solve the digital divide in rural areas like the WASD is to run high speed broadband infrastructure to each household. High speed broadband has established itself as the fastest and most reliable method of connectivity. Additionally, most high-speed broadband providers have different tiers to increase potential bandwidth (for additional cost) and provide mesh-network routing components for better utilization of the service inside the home.

Next Steps for WASD Households

The WASD and the municipalities within its footprint face significant obstacles to providing wired, high speed broadband service to all households. However, there are funds being made available at both the state and national level to support future broadband infrastructure projects. The below section details various action items individuals can take to help bring broadband infrastructure programs to rural areas like those in the WASD.

As an important aside, one of the simplest, yet most effective ways to increase overall funding in each municipality is to fill out the census form. Federal and state allocations for infrastructure development are often based on census data. This is one reason why it is incredibly important to provide an accurate representation of the citizens that could consume any given service. Each household that fills out the Census accounts for about $2100 per person in annual federal funding.[16]

As a first step to closing the rural digital divide, residents can contact local/municipal officials and encourage planning efforts on scoping broadband deployments to specific areas of the municipalities, or in the best of possible cases, the entire municipality. Broadband service providers are better able to evaluate the ROI and feasibility of specific project requests, than they are with those based on generalizations or assumptions, thus improving the likelihood of the plan being seriously considered

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[16] (Wolman)

and/or being put into effect. Additionally, it's effective to contact local officials prior to their planning of

other municipal service expansions (sewer, water, power, etc..) to see if the "open ditch" can include

running broadband infrastructure concurrently/simultaneously.

At the state level, residents can contact Pennsylvania state officials to request that they update

Act 183 of Chapter 30 of the Pennsylvania Public Utility Code. It is in this legislation/policy language

where "broadband" is officially defined as 1.544Mbps download speed and 128Kbps in upload speed.

This definition, which was last updated in 2004, is about 25 times slower than the current FCC/federal

definition for broadband. This outdated definition allows telecommunications companies and internet

service providers to legally claim that they are providing broadband to Pennsylvanians even when using

the significantly lower thresholds. Additionally, it allows larger telecom companies (like Verizon) to forgo

investments in fiber and to continue to provide DSL service because it "meets" the PA definition.

Pennsylvania is one of only eighteen states with restrictive legislation against municipal

broadband networks in the United States[17]. Title 66 S3014 of the PA Utility Code prohibits municipalities

from providing high-speed broadband services to residents for a fee, unless no such services are offered

by private telecom companies, and no private telecom companies are willing to provide such services

within 14 months of being requested to do so. Because telecom providers can lean on the lower speeds

as allowed in Act183, their "broadband" continues to under-serve and hamper the learning and earning

potential of Pennsylvania residents. It is critical that rural residents support legislators that advocate for

effective change. Recently passed legislation in Pennsylvania is making progress toward improving rural

access to high-speed broadband services. House Bill 2438 (Act 98) allows rural electric cooperatives to

use their existing poles to deploy fiber cables, and Senate Bill 835 establishes grant programs for

high-speed broadband infrastructure projects for municipalities and public institutions.

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[17] (Cooper)

Today parents should contact their Erie County Council and the Erie County Executive to inquire as to what they have already done to take advantage of the PA COVID-19 County Relief Block Grant, as remaining funds can be utilized for broadband expansion. In one recent example, Wayne County has officially allocated $1.2 million from its portion of the CARES Act to fund six different broadband-related projects[18].

PA residents also need to encourage state leaders to develop a method for coordinating broadband infrastructure funds and projects within the state of Pennsylvania. An example would be adopting a similar model to that of the PA Department of Education's E-Rate Office. E-Rate is a federal funding program for schools and libraries, but it comes with an ever-changing and very complicated set of rules, regulations, and eligibility requirements. A similar office for broadband infrastructure could analyze and provide advice on procuring money from federal and state funding, act as matchmaker for providers with capacity and municipalities with plans and funding, schedule broadband rollouts at the state level (including multi-provider efforts), and be available to answer questions for municipalities, providers, and citizens. This would help alleviate the current issue of funding becoming available (at any level) with uncertainty on how to spend it and who is eligible to use it and even, how to apply for it.

Utilizing the FCC's new speed test app supplies valuable provider speed data to the FCC[19]. The app is named "FCC Speed Test", is free to use, and is available for iPhone and Android. Speed Test can identify the provider and the speed that is actually available in any given location. This crowdsourced effort will accurately document provider speed (as the provider self-reported speeds as mentioned above are often inaccurate) and provide more data to measure "real" broadband availability.

Residents should contact their local (municipal) officials and encourage them to partner with broadband providers to replace their existing cable and telecom providers. Additionally, encourage those same officials to include broadband access on their road map as a core municipal service. The more

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[18] (Wolman)
[19] (Hendrickson)

details a municipality has on the internet services available to its residents, the more future needs and requests can be accurately quantified. Examples of the consumer data a broadband provider needs to run service include: Where are you? Where are the maps? Are there any "open ditches"? What and where are the households? What are your existing contracts? This type of data doesn't change often but once the effort is taken to collect it, the data can be used to scope projects, explore service offerings, and more accurately represent the municipality in grant and funding requests.

Finally, the two primary funding pools in the American Rescue Plan (ARP) provide very different criteria for acquiring additional funding for broadband infrastructure. The Coronavirus State and Local Fiscal Recovery Plans allocation is specifically set aside to replace lost public sector revenue, respond to far-reaching public health, and negative economic impacts of the pandemic, provide premium pay for essential workers, and invest in water/sewer/broadband infrastructure[20]. The criteria for these projects can be found in the "Final Rule" documentation but in summary the FCC requires a municipality to partner with a service provider and: Identify an eligible area of investment, Design a [broadband] project to meet high-speed technical standards, and Require enrollment in a low-income subsidy program[21]. The Capital Projects Fund, which closed funding requests on December 27, 2021[22], is a prime example of why it is critical for states and municipalities to have infrastructure plans ready to submit during funding windows. Both sections of the American Rescue Plan have options to sign-up for "email updates" concerning deadlines, updates, etc. They can be found in the "useful links" section below.

In the meantime, households may currently be able to purchase low-orbit satellite for better speed and reliability. This newer technology promises low-latency, high-speed transmissions with plenty of coverage and a current promise of no data caps[23]. Consumer perceptions about former satellite providers should be placed aside as this is a new and very different service offering. Satellite service will

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[20] ("Coronavirus State & Local Fiscal Recovery Funds | US Department of the Treasury.")
[21] ("Coronavirus State & Local Fiscal Recovery Funds: Overview of the Final Rule")
[22] ("Capital Projects Fund | US Department of the Treasury.")
[23] (Tung)

never be as reliable as fiber optic (wired) service but should enough speed and reliability to meet the

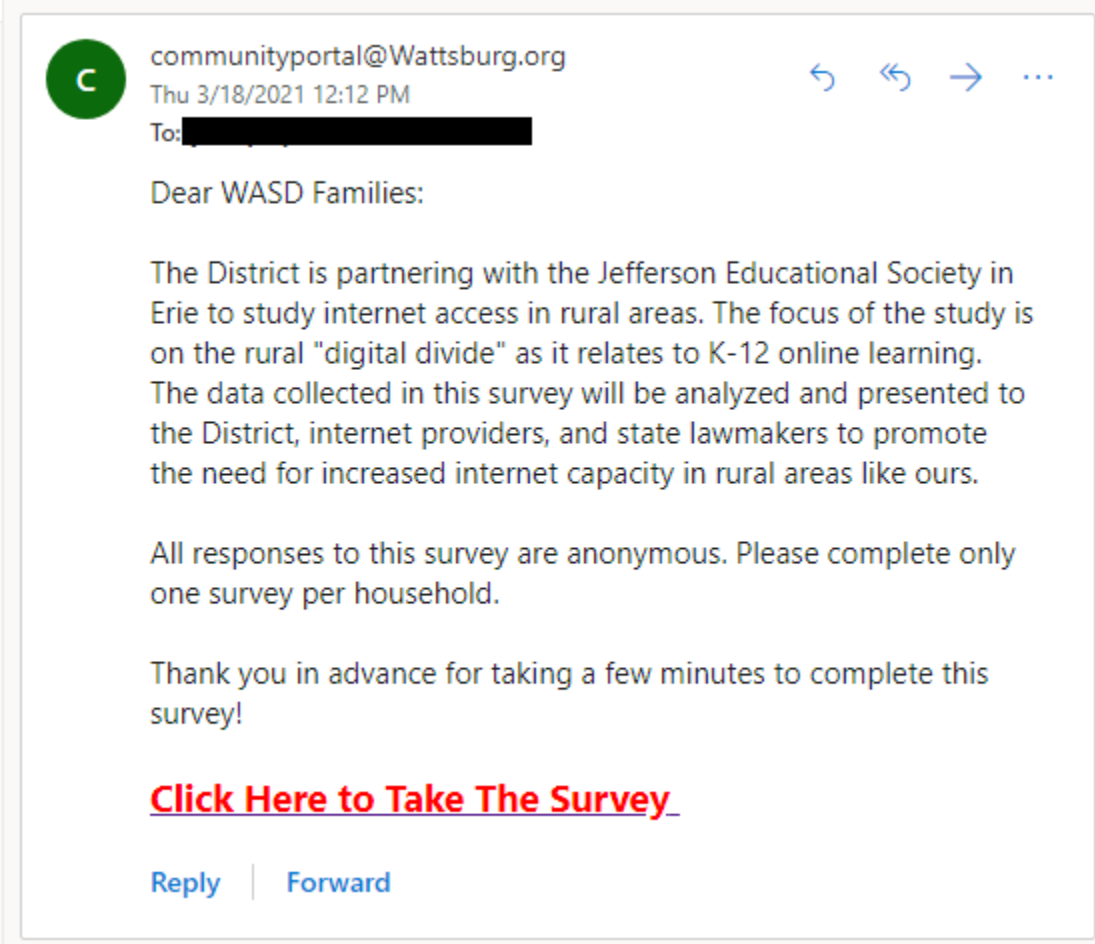current needs of K-12 households for online learning.

Appendices
Appendix A - Internet Connectivity Speed/Reliability Matrix

Name	Speeds	Speed Factors	Reliability Factors	Other Notes
Non-broadband				
Dial-up - Internet access over telecom provider lines ex: AOL	56kbs down 56kbs up	- ISP compression	- Line length - Line noise - Number of line users - Number of exchanges	- High Latency (150ms) - Requires a home phone line - Restricts home phone line - Additional speed increases are unavailable
Broadband Capable (FCC pre-2018 definition)[24]				
DSL - Additional internet service provided by telecom provider ex: Verizon DSL	5-35Mbps down* 1-10Mbps up* *NW PA typically sees speeds from Verizon DSL in the range of: 1-3Mpbs down 500kbps up	- Price - Availability - Subscribers	- Line length - Line noise - Number of line users - Number of exchanges - Age of provider equipment	- Low Latency (10-40ms) - Multiple service offerings available, but not in all areas
Cellular Hotspot *(commodity provider)* - Internet service provided by wireless carrier ex: Verizon LTE	~5-12Mbps down ~2-5Mpbs up	- Price - Subscribers	- Weather - Line of sight - Building construction - Geography - Tower location	- Multiple service offerings available, but not in all areas - Data caps
Cellular Hotspot *(school provided)* - Internet service provided by wireless carrier ex: Verizon LTE	~5-12Mbps down ~2-5Mpbs up	- Subscribers	- Weather - Line of sight - Building construction - Geography - Tower location	- Additional speed increases are unavailable
Broadband Capable				
Satellite *(high orbit)* - Internet service provided by commodity provider ex: HughesNet Gen5	~25Mbps down ~3Mbps up	- ISP compression - Price - Subscribers	- Weather - Line of sight - Number of subscriptions	- High Latency (240-550ms) - Download centric - Vastly different user experiences - Additional speed increases are unavailable - Data caps
Broadband Capable continued on next page...				

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[24] ("Types of Broadband Connections")

Name	Speeds	Speed Factors	Reliability Factors	Other Notes
Satellite *(low orbit)* - Internet service provided by commodity provider ex: Starlink	~300Mbps down ~20Mbps up	- Price	- Weather - Line of sight	- Low Latency (20-40ms) - Still in beta testing - Multiple service offerings available - No data caps
Cellular Hotspot *(commodity provider)* - Internet service provided by wireless carrier ex: Verizon 5G	~50Mbps down ~10Mpbs up *National carriers only report ~15% total 5G coverage for their service areas*	- Price - Subscribers	- Weather - Line of sight - Building construction - Geography - Tower location	- Multiple service offerings available, but not in all areas - Data caps
Cable - Internet service provided by wired coax ex: Spectrum	25Mbps+ down 5Mpbs+ up *Erie County sees speeds offered from Spectrum up to: 940Mpbs down 30Mpbs up*	- Price - Subscribers	- Age of provider equipment	- Multiple service offerings available, but not in all areas
Fiber - Internet service provided by wired fiber ex: Armstrong	25Mbps+ down 25Mpbs+ up *Greene Twp sees speeds offered from Armstrong up to: 1Gpbs down 1Gpbs up*	- Price		- Multiple service offerings available, but not in all areas - Data caps may be in use

Appendix B - Survey Notification

communityportal@Wattsburg.org
Thu 3/18/2021 12:12 PM
To:

Dear WASD Families:

The District is partnering with the Jefferson Educational Society in Erie to study internet access in rural areas. The focus of the study is on the rural "digital divide" as it relates to K-12 online learning. The data collected in this survey will be analyzed and presented to the District, internet providers, and state lawmakers to promote the need for increased internet capacity in rural areas like ours.

All responses to this survey are anonymous. Please complete only one survey per household.

Thank you in advance for taking a few minutes to complete this survey!

Click Here to Take The Survey

Reply | Forward

Thu, Mar 18, 3:26 PM

Please visit the main School District website and complete the online Internet Access Survey:

www.wattsburg.org Text stop:1 to unsubscribe

Tuesday 10:40 AM

Please complete the school district internet access survey at www.wattsburg.org

Thank You! Text stop:1 to unsubscribe

Appendix C - Survey Questions
Wattsburg Area School District
Internet Access Survey

The District is partnering with the Jefferson Educational Society in Erie to study internet access in rural areas. The focus of the study is on the rural "digital divide" as it relates to K-12 online learning. The data collected in this survey will be analyzed and presented to the District, internet providers, and state lawmakers to promote the need for increased internet capacity in rural areas.

All responses to this survey are anonymous. Please complete only one survey per household.

Thank you in advance for taking a few minutes to complete this survey!
_____

1. What internet did your student(s) have access to at home before March, 2020?
    (prior to general Covid-19 stay-at-home guidelines put in place)
    ☐ None
    ☐ Commodity Connection (privately purchased internet access)
2. You answer "commodity connection" in question one, please specify internet type:
    (can select more than one)
    ☐ Broadband (cable/fiber)
    ☐ DSL (phone line)
    ☐ Dial-Up (modem)
    ☐ Hotspot (cellular)
    ☐ Satellite (HughesNet/Dish/Starlink)
3. What internet does your student(s) have access to at home now (today)?
    (can select more than one)
    ☐ None
    ☐ School provided hotspot (cellular)
    ☐ Commodity Connection (privately purchased internet access)
4. What type of privately purchased internet service do you have now?
    (can select more than one)
    ☐ This question does not apply to me
    ☐ Broadband (cable/fiber)
    ☐ DSL (phone line)
    ☐ Dial-Up (modem)
    ☐ Hotspot (cellular)
    ☐ Satellite (HughesNet/Dish/Starlink)
5. Number of students at home?
    ☐ 1
    ☐ 2
    ☐ More than 2
6. You indicated you have more than 1 student at home, do they share a connection?
    (can select more than one)
    ☐ No, they do not share a connection
    ☐ Yes, they share our commodity connection
    ☐ Yes, they share our school provided hotspot
7. You indicated that your students share an internet connection, is it fast enough for daily school work?
    ☐ Yes
    ☐ No

- [ ] My student(s) do not share an internet connection
8. Do you have the ability to increase your internet connection speed?
    - [ ] Don't know
    - [ ] Yes, through my commodity provider I can increase my connection speed
    - [ ] No, my commodity provider cannot increase my connection speed
    - [ ] No, my school hotspot cannot increase my connection speed
9. Are there one (or more) parents working from home using commodity internet?
    - [ ] Yes
    - [ ] No
10. What describes your (shared) internet connection?
    - [ ] Parent(s) and student(s) share a commodity internet connection
    - [ ] Parent(s) use a commodity internet connection and the student(s) use a school provided hotspot
    - [ ] Parent(s) use a work-provided internet connection and the student(s) use a commodity internet connection
11. What describes your (shared) internet connection?
    - [ ] The student(s) have a commodity internet connection to themselves
    - [ ] The student(s) are using a school provided hotspot
12. Do you feel your connectivity has "good" times vs "bad" times?
    - [ ] Yes, it is only reliable at certain times
    - [ ] No, it is never reliable
    - [ ] No, it is always reliable
13. When is reliability noticeably worse? (check all that apply)
    - [ ] Work day, 7am-5pm
    - [ ] Evening, 5pm-9pm
    - [ ] Night, 9pm-7am
    - [ ] Sunny
    - [ ] Snowy
    - [ ] Rainy
    - [ ] Cloudy
14. When is reliability best? (check all that apply)
    - [ ] Work day, 7am-5pm
    - [ ] Evening, 5pm-9pm
    - [ ] Night, 9pm-7am
    - [ ] Sunny
    - [ ] Snowy
    - [ ] Rainy
    - [ ] Cloudy
15. Have you had to postpone online school work because of your connectivity and its reliability?
    - [ ] Yes
    - [ ] No
16. Do you experience outages of 15 or more minutes with your current internet provider?
    - [ ] Frequently, more than 10 times a month
    - [ ] Occasionally, 3-10 times a month
    - [ ] Rarely, 1-3 times a month
    - [ ] Not really, less than once a month
17. Do you have tech support you can call for connectivity/reliability issues?
    - [ ] Yes, the provider I use has excellent tech support
    - [ ] Yes, but the provider I use does not have helpful tech support
    - [ ] Yes, but my only path for tech support is through the school (school IT)
    - [ ] No, I don't know who I can call for tech support
18. What municipality do you live in?
    - [ ] Amity Township
    - [ ] Greene Township

☐ Greenfield Township
☐ Venango Township
☐ Wattsburg Borough

19. Once your student(s) is connected for an online learning session do you have to help them reconnect or troubleshoot during that session?
☐ Yes, I am frequently trying to help them reconnect
☐ Yes, I am occasionally trying to help reconnect
☐ No, I do not have to help my student(s) reconnect

20. WASD was able to provide cellular hotspots for remote learning (through the 2020 Cares Act). Had those hotspots not been available, do you have access to internet service you could buy for your student(s)?
☐ Yes
☐ No
☐ Unknown

21. What type of internet access can you purchase at your location?
☐ Cable Broadband
☐ Fiber Broadband
☐ DSL
☐ Dial-Up
☐ Hotspot
☐ Satellite (HughesNet/Dish/Starlink)

22. What is the biggest obstacle your household faces as it pertains to internet connectivity/reliability?
☐ Lack of desired service options
☐ Reliability of current service
☐ Speed of current service
☐ Price of current service
☐ Tech support for current service
☐ Sharing a connection within the household
☐ N/A - There is no obstacle as it pertains to internet connectivity/reliability
☐ Other

23. What is your desired commodity internet service option/provider?
_____

24. This survey was centered around home learning (for WASD) and the internet connectivity/reliability, do you feel that improved internet service options would positively impact other households and/r businesses in your municipality?
☐ Yes
☐ No
☐ I'm not sure

Appendix D - Survey Results (raw)

1. What internet did your student(s) have access to at home before March, 2020?

- None — 85
- Commodity Connection (priva... — 332

2. You answered "Commodity Connection" in question one, please specify internet type:

- Broadband (cable/fiber) — 166
- DSL (phone line) — 87
- Dial-Up (modem) — 14
- Hotspot (cellular) — 50
- Satellite (HughesNet/Dish/Sta... — 30

3. What internet does your student(s) have access to at home now (today)?

- None — 14
- School provided hotspot (cell... — 129
- Commodity Connection (priva... — 332

4. What type of privately purchased internet service do you have now?

- This question does not apply t... — 53
- Broadband (cable/fiber) — 200
- DSL (phone line) — 72
- Dial-Up (modem) — 13
- Hotspot (cellular) — 64
- Satellite (HughesNet/Dish/Sta... — 31
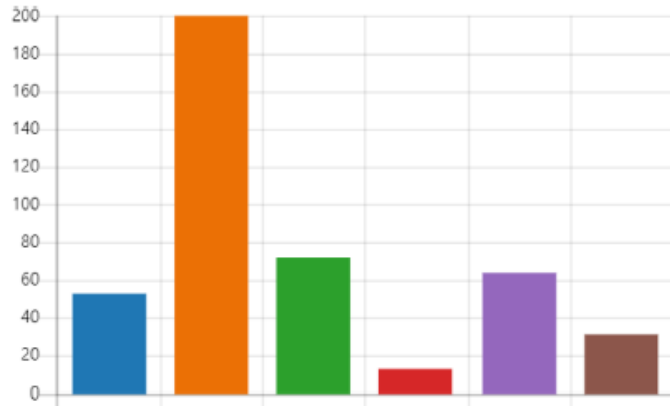
5. Number of students at home?

- 🔵 1   160
- 🟠 2   179
- 🟢 More than 2   78

6. You indicated that you have more than 1 student at home, do they share a connection?

- 🔵 No, they do not share a conne...   11
- 🟠 Yes, they share our commodit...   199
- 🟢 Yes, they share our school pro...   73

7. You indicated your students share an internet connection, is it fast enough for daily school work?

- 🔵 Yes   155
- 🟠 No   99
- 🟢 My student(s) do not share an...   3

8. Do you have the ability to increase your internet connection speed?

- 🔵 Don't know   107
- 🟠 Yes, through my commodity p...   104
- 🟢 No, my commodity provider c...   157
- 🔴 No, my school hotspot cannot...   49

9. Are there one (or more) parents working from home using commodity internet?

- 🔵 Yes   190
- 🟠 No   227

10. What describes your internet connection?

- 🔵 Parent(s) and student(s) share ...   149
- 🟠 Parents(s) use a commodity In...   34
- 🟢 Parents(s) use a work-provide...   7

11. What describes your internet connection?

- 🔵 The student(s) have a commo...   154
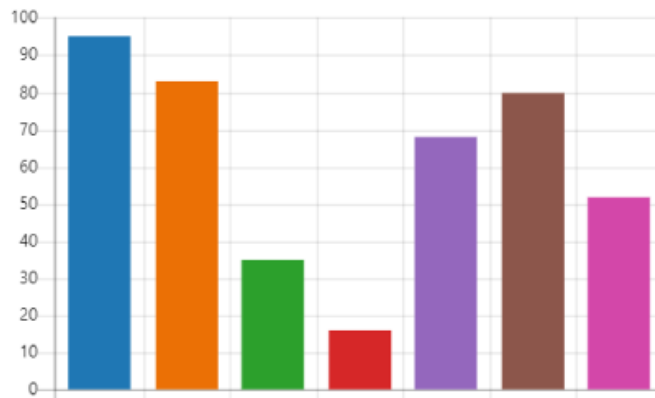- 🟠 The student(s) are using a sch...   80

12. Do you feel your connectivity has "good" times vs "bad times"?

- 🔵 Yes, it is only reliable at certai...   161
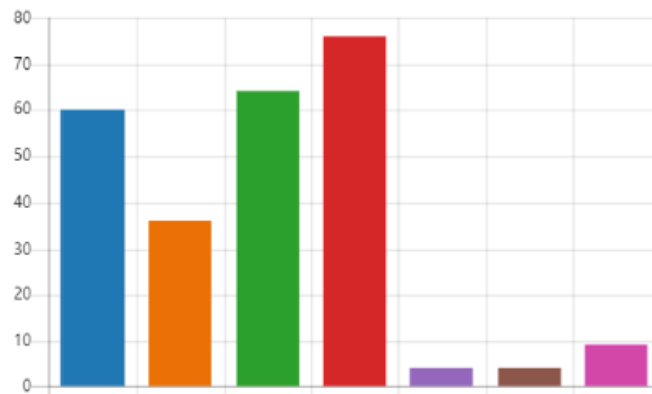- 🟠 No, it is never reliable   77
- 🟢 No, it is always reliable   179

13. When is reliability noticeably worse (check all that apply)?

- 🔵 Work day, 7am - 5 pm   95
- 🟠 Evening, 5pm - 9 pm   83
- 🟢 Night, 9 pm - 7 am   35
- 🔴 Sunny   16
- 🟣 Snowy   68
- 🟤 Rainy   80
- 🟣 Cloudy   52

14. When is reliability best (check all that apply)?

🔵 Work day, 7am - 5 pm	60
🟠 Evening, 5pm - 9 pm	36
🟢 Night, 9 pm - 7 am	64
🔴 Sunny	76
🟣 Snowy	4
🟤 Rainy	4
🟣 Cloudy	9

15. Have you had to postpone online school work because of your connectivity and its reliability?

🔵 Yes	203
🟠 No	214

16. Do you experience outages of 15 or more minutes with your current internet provider?

🔵 Frequently, more than 10 time…	71
🟠 Occasionally, 3-10 times a mo…	69
🟢 Rarely, 1-3 times a month	83
🔴 Not really, less than once a m…	194

17. Do you have tech support you can call for connectivity/reliability issues?

🔵 Yes, the provider I use has exc…	162
🟠 Yes, but the provider I use doe…	118
🟢 Yes, but my only path for tech …	46
🔴 No, I don't know who I can cal…	91

18. What municipality do you live in?

🔵	Amity Township	39
🟠	Greene Township	177
🟢	Greenfield Township	61
🔴	Venango Township	118
🟣	Wattsburg Borough	22

19. Once your student(s) is connected for an online learning session do you have to help them reconnect or troubleshoot during that session?

|		
🔵	Yes, I am frequently trying to ...	71
🟠	Yes, I am occasionally trying t...	116
🟢	No, I do not have to help my s...	230

20. WASD was able to provide cellular hotspots for remote learning (through the 2020 Cares Act). Had those hotspots not been available, do you have access to internet service you could buy for your student(s)?

🔵	Yes	276
🟠	No	90
🟢	Unknown	51

21. What type of internet access can you purchase at your location?

🔵	Hotspot	58
🟠	Dial-up	19
🟢	DSL	75
🔴	Cable broadband	119
🟣	Fiber broadband	66
🟤	Satellite (HughesNet/Dish/Sta...	50
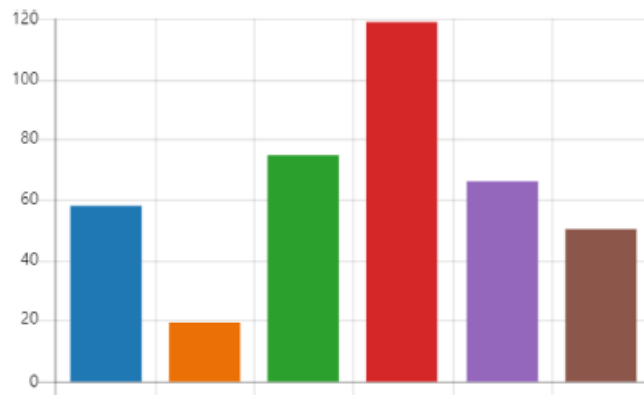
22. What is the biggest obstacle your household faces as it pertains to internet connectivity/reliability?

- 🔵 Lack of desired service options — 60
- 🟠 Reliability of current service — 38
- 🟢 Speed of current service — 77
- 🔴 Price of current service — 87
- 🟣 Tech support for current service — 2
- 🟤 Sharing a connection within t... — 20
- 🟣 N/A - There is no obstacle as i... — 118
- ⚫ Other — 15
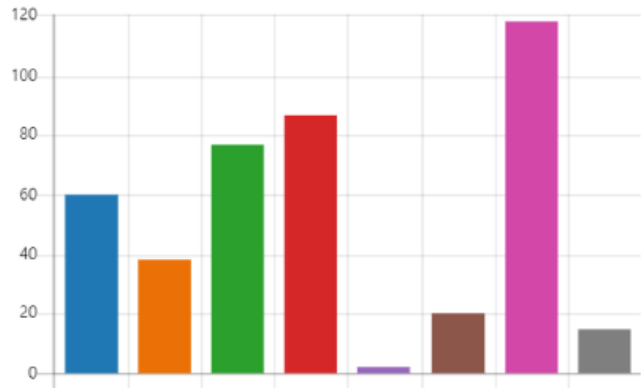
23. What is your desired commodity internet service option/provider?

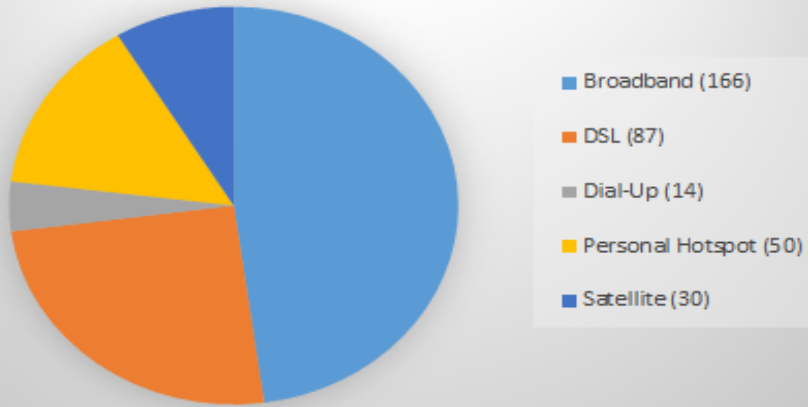## 75
Responses

Latest Responses

24. This survey was centered around home learning (for WASD) and internet connectivity/reliability, do you feel that improved internet service options would positively impact other households and/or businesses in your municipality?
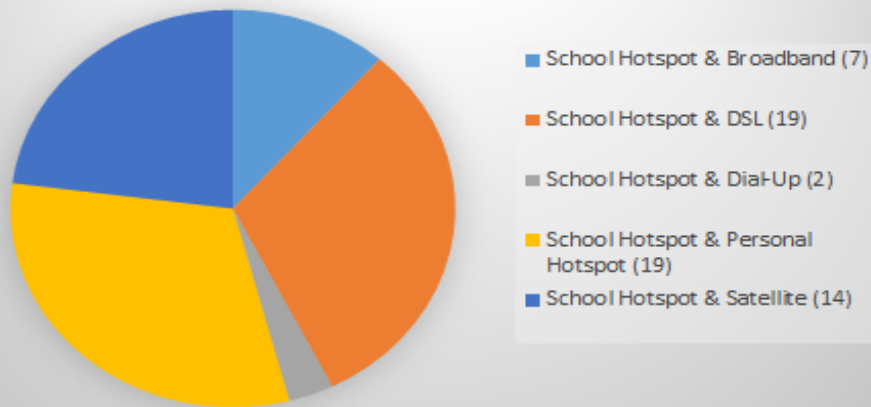
- 🔵 Yes — 359
- 🟠 No — 17
- 🟢 I'm not sure — 41
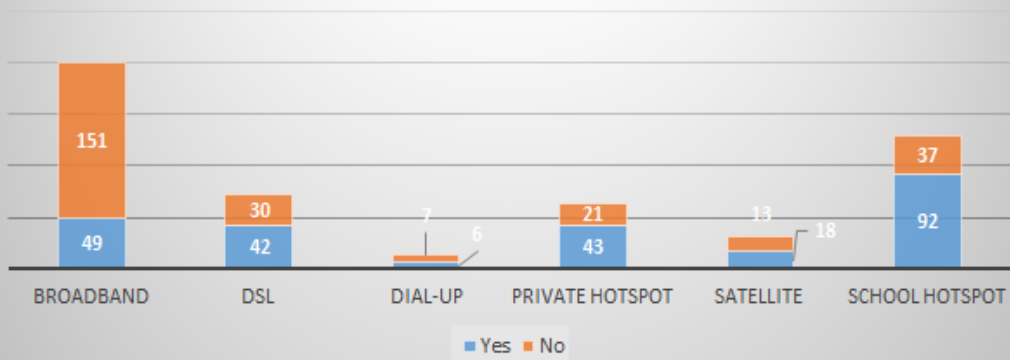
Appendix E - Survey Results (grouped)
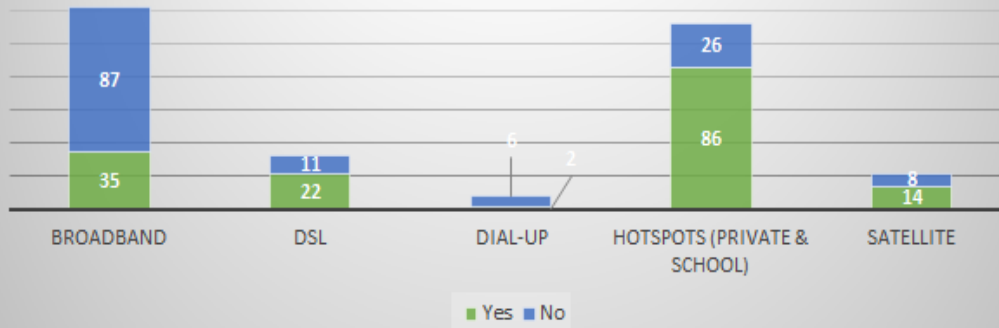

Commodity Service by Household

- Broadband (166)
- DSL (87)
- Dial-Up (14)
- Personal Hotspot (50)
- Satellite (30)

Commodity Service with School Hotspot

- School Hotspot & Broadband (7)
- School Hotspot & DSL (19)
- School Hotspot & Dial-Up (2)
- School Hotspot & Personal Hotspot (19)
- School Hotspot & Satellite (14)

I have to help my student(s) reconnect during online learning

	BROADBAND	DSL	DIAL-UP	PRIVATE HOTSPOT	SATELLITE	SCHOOL HOTSPOT
No	151	30	7	21	13	37
Yes	49	42	6	43	18	92

■ Yes ■ No

I have to help my students reconnect if they share a service

	BROADBAND	DSL	DIAL-UP	HOTSPOTS (PRIVATE & SCHOOL)	SATELLITE
No	87	11	6	26	8
Yes	35	22	2	86	14

Yes   No

I have to help my student(s) reconnect if they share our commodity service with an at home parent

	BROADBAND	DSL	DIAL-UP	PRIVATE HOTSPOT	SATELLITE
No	77	7	6	5	4
Yes	26	19	2	7	3

Yes   No
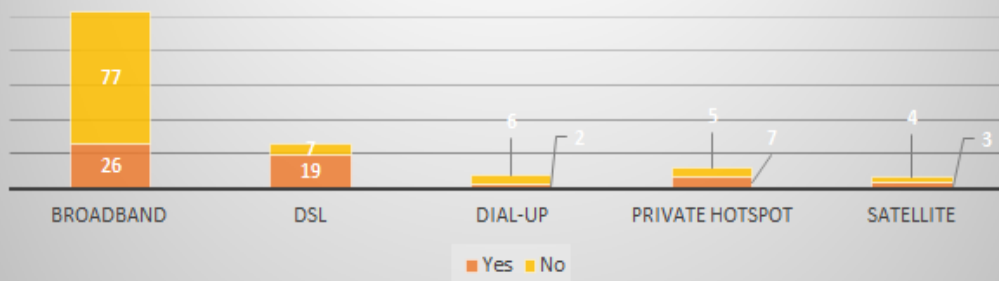
Is the connection always reliable

	BROADBAND	DSL	DIAL-UP	PRIVATE HOTSPOT	SATELLITE
No	59	65	13	158	27
Yes	141	7	8	33	4

Yes   No
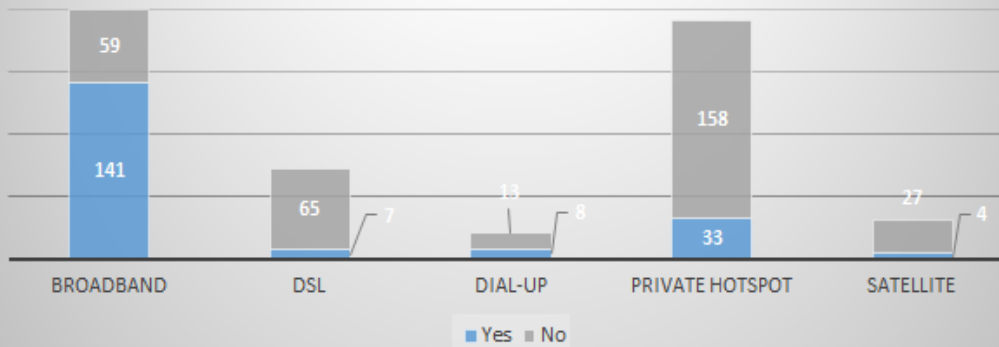
Has the connection required you to postpone school work

	BROADBAND	DSL	DIAL-UP	PRIVATE HOTSPOT	SATELLITE	SCHOOL HOTSPOT
No	157	19	8	18	7	31
Yes	43	53	5	46	24	98

Yes ■ No

Amity Township online access

BROADBAND (6)	DSL (16)	DIAL-UP (0)	PRIVATE HOTSPOT (4)	SATELLITE (6)	SCHOOL HOTSPOTS (16)
6	16	0	4	6	16
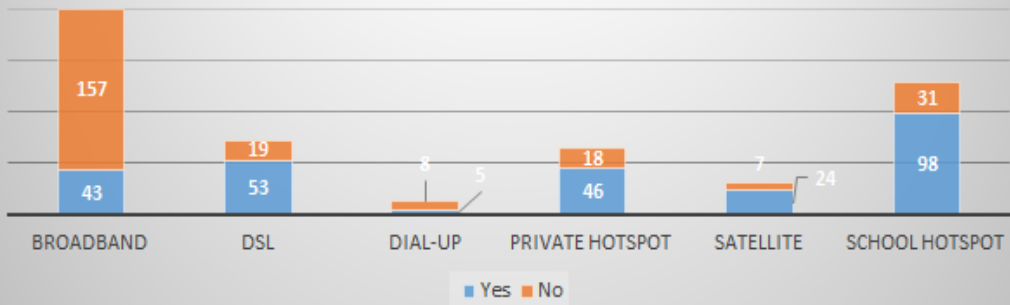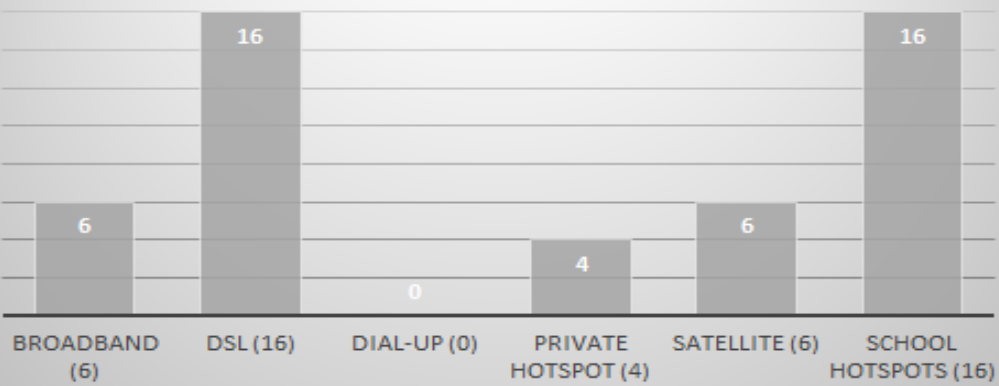
Greene Township online access

BROADBAND (140)	DSL (9)	DIAL-UP (9)	PRIVATE HOTSPOT (9)	SATELLITE (5)	SCHOOL HOTSPOTS (24)
140	9	9	9	5	24
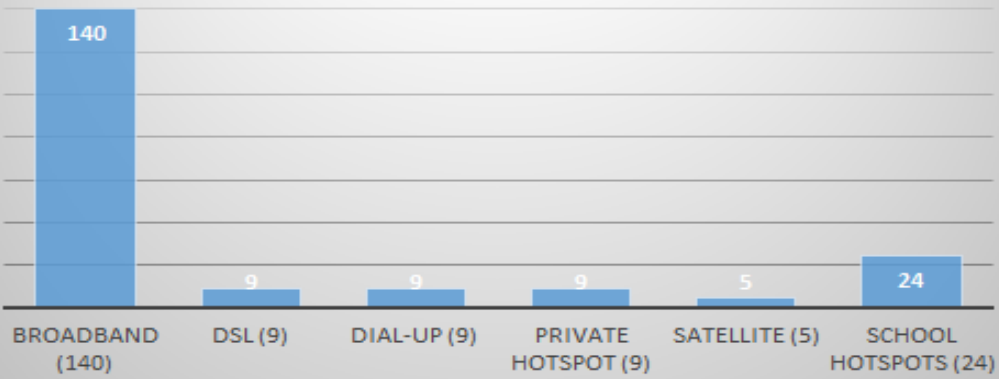
Venango Township online access

Category	Value
BROADBAND (33)	33
DSL (29)	29
DIAL-UP (1)	1
PRIVATE HOTSPOT (34)	34
SATELLITE (13)	13
SCHOOL HOTSPOTS (47)	47
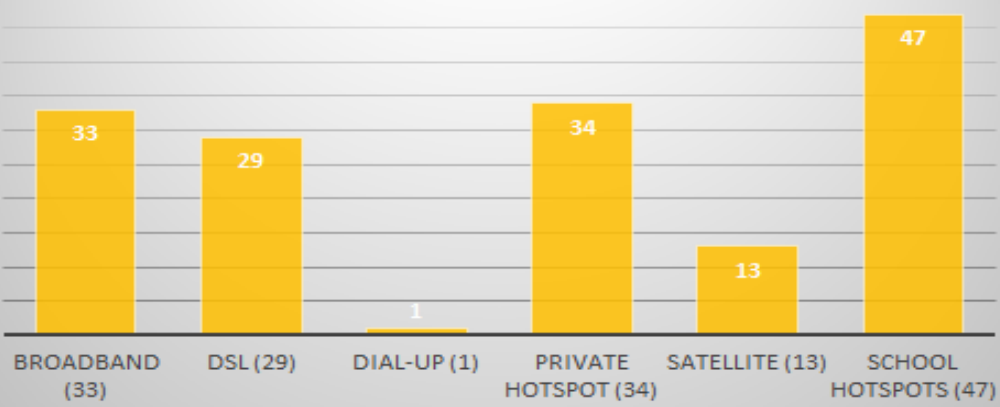
Greenefield Township online access

Category	Value
BROADBAND (7)	7
DSL (15)	15
DIAL-UP (3)	3
PRIVATE HOTSPOT (16)	16
SATELLITE (3)	3
SCHOOL HOTSPOTS (37)	37
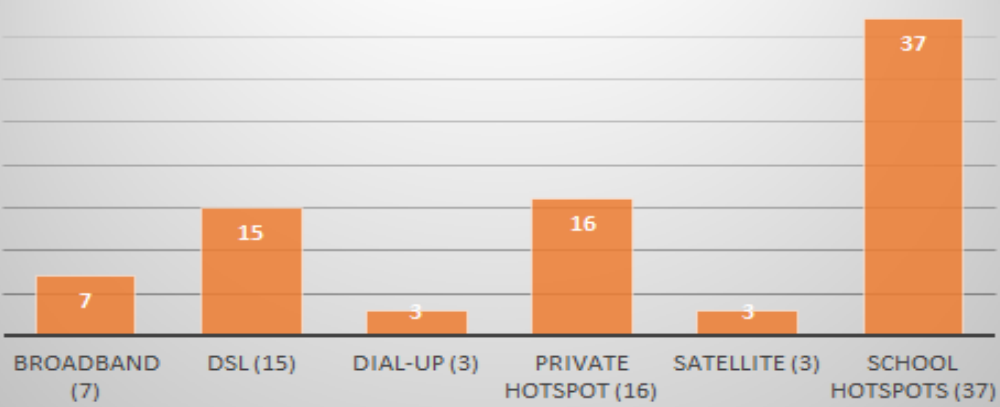
Wattsburg Borough online access

Category	Value
BROADBAND (14)	14
DSL (3)	3
DIAL-UP (0)	0
PRIVATE HOTSPOT (1)	1
SATELLITE (4)	4
SCHOOL HOTSPOTS (5)	5
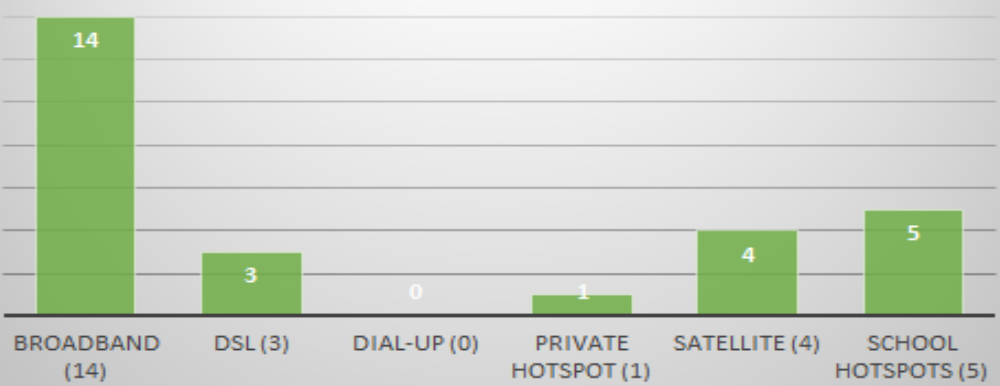
Appendix F - Useful URLs

- PA COVID-19 County Relief Block Grant
  https://dced.pa.gov/download/COVID-19%20County%20Relief%20Block%20Grant%20Guidelines%202020/?wpdmdl=94990
- ESSER Fund
  https://www.education.pa.gov/Schools/safeschools/emergencyplanning/COVID-19/CARESAct/January2021/Pages/default.aspx
- Auction 904: FCC Rural Digital Opportunity Fund
  https://www.fcc.gov/auction/904
- PA General Assembly: Senate Bill 835
  https://www.legis.state.pa.us/cfdocs/billinfo/billinfo.cfm?syear=2019&sind=0&body=S&type=B&bn=835
- U.S. Department of the Treasury Coronavirus State and Local Fiscal Recovery Funds
  https://home.treasury.gov/policy-issues/coronavirus/assistance-for-state-local-and-tribal-governments/state-and-local-fiscal-recovery-funds
- US Department of the Treasury Capital Projects Fund
  https://home.treasury.gov/policy-issues/coronavirus/assistance-for-state-local-and-tribal-governments/capital-projects-fund
- US Department of the Treasury American Rescue Plan email updates
  https://public.govdelivery.com/accounts/USTREAS/subscriber/new?topic_id=USTREAS_1141

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