Student Home Connectivity Study

CoSN, under a grant from the Chan Zuckerberg Initiative (CZI), has conducted a study to determine **home internet connectivity requirements to support student learning** in today’s education environment. The analysis conducted will be used to:

- **Standards** - Establish recommendations for home internet connectivity standards to support student learning in a virtual, hybrid, or remote environments.

- **Methodology** - Provide a methodology for school districts to use to evaluate the impact of limited home internet connectivity on high need student cohorts such as low income, English Learners, students with disabilities, etc.

- **Recommendations** - Provide recommendations that District Leaders can use to work with ISPs and community leaders to address lack of sufficient bandwidth for the students and families that need it.
Measuring the Student Experience

Using data sources such as network filters logs and online meeting quality of service data, we have discovered effective methods to determine the adequacy of network throughput for each student.

The “student experience” varies widely based on the network bandwidth that each student obtains. There are many factors which may impact the student such as:

- Bandwidth provided by the ISP
- Number of users and devices on home network
- Speed and age of computing device used by student
- Quality and type of network signal
- Distance of student from the wireless router.

Network upload and download bitrates significantly impact the student experience in a remote or hybrid learning environment.
Participating Districts

- Aldine ISD, TX
- Beaverton School District, OR
- Boston Public Schools, MA
- Ector County ISD, TX
- Dallas Independent School District, TX
- Fauquier County Public Schools, VA
- Forest Ridge School District 142, IL
- Hillsborough County Public Schools, FL
- MSD of Wayne Township, IN
- Rock Hill Schools York 3, SC
- Santa Fe Public Schools, NM
- St. Charles CUSD 303, IL
- Wake County Public School System, NC
To measure home internet performance, we have selected key metrics shown on the left which can be applied against the four dimensions shown on the right.
Home Internet Connectivity Study

Findings and Recommendations Report

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Free, but must set up complimentary account
Finding #1: Learning with Video is Essential for Education

A. Over 85% of network traffic in remote learning is used for **video** (both synchronous and asynchronous).

B. A sufficient **upload speed** critical.

C. A sufficient **download speed** is critical for uninterrupted viewing of synchronous or asynchronous video.

D. Video-intensive content and apps are increasing and will continue to require more bandwidth.
Recommendations for Learning with Video

1. Increase the Minimum Standard for Student Home Internet Bandwidth - current FCC household broadband definition of 25 Mbps download speed / 3 Mbps upload speed is inadequate. CoSN recommends a new broadband definition: **25 Mbps for download / 12 Mbps for upload speeds per student.**

2. Remove Data Caps for Classwork and Learning Activities
Using data provided by Ookla, we constructed a national map that shows upload, download, and latency for all Ookla Speedtests conducted within each District Boundary.

We have this data for both fixed broadband and mobile.

The interactive map and the data will be part of the public data set that will provided as part of the grant.
Finding #2: Students are Mobile & Rely on Wi-Fi

A. Students participate in online learning from peers’ homes, and even attending classes from other cities, states, and countries.

B. **92% of students use WiFi** instead of a wired connection, therefore critical to address home WiFi issues.

C. Alongside district-provided devices, students often concurrently use mobile devices, such as **personal phone or tablet**, which contributes to increased home bandwidth needs.
Many Factors Can Impact Student Home Internet Experience

**Computing Device**
- Type of device
- Age of device
- Quality of antenna
- Type of network connectivity
- CPU Utilization
- No of applications running
- District filtering and monitoring agents

**Home Network**
- Router
- No of Devices
- People in household
- Distance from router
- Router rebooting
- Signal interference
- Wired or Wireless

**ISPs**
- Download Speed
- Upload Speed
- Latency
- Video Throttling

**SaaS Provider**
- Capacity Constraints
- Network traffic
- Device resource utilization
Recommendations for Home WiFi

1. Help families acquire **new routers** if their router has not been upgraded in a few years
2. Work with ISPs to replace outdated routers
3. Provide **network extenders** in areas with poor signals
4. **Educate families** on router placement and maintenance
Finding #3: Certain Communities, Especially Remote and Rural Areas, Require More Support and Resources

A. Students in more **remote or rural areas** most often have limited internet access.

B. Students working in areas with a **large concentration of students** may experience poor connectivity.

C. Even students from higher socioeconomic families have frequent problems in remote learning/online meeting experience.
The Digital Divide: Rural/Remote Vs. Urban/Suburban Areas

This map (left), created by Innive K12 360°, shows an example of the difference in available bandwidth between rural/remote school districts and urban school districts.

Available Bandwidth

Strong
Poor

In Oregon (right), one can clearly see that the dark red remote school districts in the southeast corner of the state have poorer connectivity than urban and suburban school districts in green along the west coast.

No One Solution Meets All Students Connectivity Needs

1. **Need local flexibility** to truly address ALL students.
2. The new Emergency Connectivity Fund (+$7bil) provides unconnected students with hotspots and internet enabled devices, as well as routers. Also WiFi on buses.
3. **Work with ISPs** and community leaders to ensure that ISPs offer suitable plans for the community.
4. **Leverage other federal and state funding** to leverage a variety of internet access pathways, such as:
   - District-Provided Mobile Wi-Fi
   - CBRS
   - LTE Broadband
   - Satellite
Finding #4: The Remote Learning Experience is Significantly Impacted by Device Used

A. Quality of student experience can be impacted by age, type, and quality of device, as well as device configuration (i.e., user authentication and network filtering tools).

B. Student experience can be improved by routinely collecting datasets that provide insight into the student use of district-provided devices.
The network bandwidth varies significantly depending on the type of computing device used. For example, for one school district we notice significant speed differences between iPads and Chromebooks. The difference in speed could be a result of many things such as:

- CPU speed
- RAM
- CPU utilization from other apps running in background
- Network connection (2.4 Ghz or 5 Ghz)
- Quality of antenna or wifi card in the device
- Type of filtering software used

Districts must consider the impact of various types of computing devices when determining student network throughput requirements.
Recommendations for District-Provided Devices

1. Students need a **high-quality device(s)** to participate in online remote learning. Factors to be considered:
   a. CPU type, speed, and number of cores
   b. Amount of memory
   c. WiFi connection
   d. Integrated webcam
   e. Integrated microphone
   f. Headphone port

2. Refer to device **requirements for online meeting software**.

3. Using funding to improve data capture and analysis will help districts make more informed decisions around student devices and home internet supports.
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keith@cosn.org