

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554**

In the Matter of

Modernizing the E-rate Program for
Schools and Libraries

WC Docket No. 13-184

REPLY COMMENTS OF GOOGLE INC.

As the initial comments reveal, addressing the future broadband needs of schools and libraries is of utmost importance to preserving our country's leadership in the global information economy. Google supports modernizing the E-rate program to better meet the forward-looking needs of school and library communities. We believe in the Internet's power to help people of all ages discover, connect, and learn. Quickly achieving the President's objective of connecting schools and libraries that serve 99% of U.S. students at broadband speeds of *at least* 100 megabits per second, with a gigabit target and wireless connectivity, would directly benefit teachers, students, families, and employers.

We offer recommendations based on our experience as a provider of fiber-optic networks, affordable Internet-enabled hardware, and an array of online educational and informational resources. In our view, realizing the benefits of digital learning and modern educational experiences depends particularly on a few key factors:

- Robust fiber connections to schools and libraries;
- Innovative, affordable, and easy-to-use devices; and
- To maximize the impact of federal support, effective controls including open measurement of broadband performance.

Below, we discuss the benefits that fast, affordable Internet access will bring to digital learning communities, and offer suggestions on how these three key elements bear on reform of the E-rate program.

I. To Realize the Benefits of an Increasing Array of Online Resources, Schools and Libraries Need High-Capacity Broadband Connections.

A. Online Resources Provide a Wealth of Educational Opportunity.

The link between digital resources and learning is well-established. A 2010 study published by The Organisation for Economic Co-operation and Development (OECD) concludes that computer use increases science achievement after controlling for differences among students, their families, and their schools. The improved performance, though, seems to be due mainly to the use of a computer at home.¹ Another OECD study similarly found using a computer at home was related to digital reading performance in all countries studied.²

Computer use not only benefits students and learners directly, but also enriches school and community environments and saves money. Because online digital learning and informational services require minimal on-site support, accessing resources over the Internet can vastly reduce schools' and libraries' technology costs while expanding the horizons of people of all ages, languages, and technical skills. Online services can be readily updated and accessed from nearly anywhere. In addition, many online

¹ Vincenzo Spiezia, *Does Computer Use Increase Educational Achievements? Student-level Evidence from PISA*, OECD J.: ECON. STUD. (2010), available at http://www.keepeek.com/Digital-Asset-Management/oecd/economics/does-computer-use-increase-educational-achievements-student-level-evidence-from-pisa_eco_studies-2010-5km33scwlvkf_page1 (last visited Nov. 8, 2013).

² PISA 2009 Results: Students On Line, Digital Technologies and Performance (Volume VI), OECD (2011), available at <http://www.oecd.org/pisa/pisaproducts/pisa2009/48270093.pdf> (last visited Nov. 8, 2013).

services that are useful for education also are widely used in the consumer market; this familiarity helps to ease transitions and speeds learning among teachers and students.³

Google, for example, supports education systemically and at scale with online products and services that are open, affordable, accessible, and easily customized—so learners everywhere can find what they need, when and where they need it, and use it safely and effectively. Google’s educational tools and resources include:

- *Apps for Education*,⁴ a web-based suite that includes Gmail, Calendar, Docs, and Groups and allows teachers and administrators to collaborate on lesson plans and project-based curricula. Offered free of charge to nonprofit educational institutions, Apps for Education is used by more than 25 million students, faculty, and staff in approximately 190 countries worldwide.
- *Online Learning Programs*,⁵ a range of innovative search and discovery tools such as Constitute, which provides a portal to access, research, and compare constitutions from around the world, and the Cultural Institute, which allows students to learn more about historic moments through collections, archives, and first-hand testimonials.
- *YouTube EDU*,⁶ which lets teachers access millions of videos from top educators around the world, full courses from leading universities, professional development material from fellow educators, and talks from global thought leaders.

Similar to these tools, massive open online courses (MOOCs) allow educational institutions to bring their content online easily and tap into an emerging platform to make learning engaging for students. That is why Google is contributing to edX’s new site, MOOC.org, a new open source service that will allow any academic institution, business, or individual to create and host online courses.

³ See, e.g., Victor Chang et al., *Towards a Structured Cloud ROI: The University of Southampton Cost-Saving and User Satisfaction Case Studies*, SUSTAINABLE GREEN COMPUTING: PRACTICES, METHODOLOGIES AND TECHNOLOGIES (IN PRESS), IGI GLOBAL, 179-200 (2012), available at http://eprints.soton.ac.uk/272607/29/VC_Call_for_Chapter_final.pdf (last visited Nov. 8, 2013).

⁴ See Google Apps for Education, <http://www.google.com/enterprise/apps/education/> (last visited Nov. 8, 2013).

⁵ See Google in Education, <http://www.google.com/edu/tools-and-solutions/index.html - search-discovery> (last visited Nov. 8, 2013).

⁶ See YouTube Education, <http://www.youtube.com/education> (last visited Nov. 8, 2013).

Many other commercial and non-profit providers offer online resources as well. Collectively, online materials constitute an historically unprecedented wealth of material on which schools and libraries can draw for free or at affordable cost. A paramount objective of E-rate reform should be enabling all schools and libraries to connect to these resources and use them in the most effective and efficient way.

B. Training Is Essential to Utilization of Online Resources.

For online educational resources to be used and useful, teachers and students need to be comfortable with them. First, teachers must be able to use the relevant technology. Training, school culture, and peer endorsement all affect acceptance of technology as a teaching tool.⁷ Professional development for teachers thus is critical to the success of new technological tools in the classroom, and should be included in any strategy to develop 21st Century classrooms.

To that end, Google has established and sponsored professional development programs to help teachers and educators, such as:

- *Computer Science for High School (CS4HS)*,⁸ an initiative to promote computer science and computational thinking in middle school and high school curricula. Universities develop these 2-3 day workshops for local high school and middle school teachers and incorporate informational talks by industry leaders.
- *Google Teacher Academy*,⁹ a free professional development experience designed to help primary and secondary educators around the world get the most from innovative strategies and technologies.
- *Google Education on Air*,¹⁰ which offers free, online professional education using Google+ Hangouts. Educators also can form or joint Google+ communities to communicate with each other and share information and best practices.

⁷ Bill & Melinda Gates Foundation, *Innovation in Education: Technology and Innovation in Education, United States Program* (Feb. 2012), https://a2.edsurge.com/public/BMGF_Innovation_In_Education.pdf (last visited Nov. 8, 2013).

⁸ See Google Computer Science for High School, <http://www.cs4hs.com/> (last visited Nov. 8, 2013).

⁹ See Google in Education Google Teacher Academy, <http://www.google.com/edu/programs/google-teacher-academy/> (last visited Nov. 8, 2013).

- *The Google Faculty Institute*,¹¹ which aims to improve the teaching of technology in teacher preparation programs.

To benefit from online learning, students must be comfortable completing basic tasks on the web, and they should be educated about safe user practices. Google online tools such as the Digital Literacy and Citizenship¹² curriculum for educators and the Good to Know¹³ site and consumer education campaign for families can help.

Parents also must have familiarity with digital tools in order to properly oversee their child's education, help with coursework, and monitor for safe behavior, and they generally must be comfortable with the use of online tools in the classroom. Google partners with the leading child safety organizations to develop resources for educators and parents like ThinkB4U,¹⁴ and connects parents and children through kid-friendly tools such as Teach Parents Tech.¹⁵

C. Future-Oriented Community Connections and Appropriate Devices Are Critical As Well.

With today's unprecedented level of online educational resources, and a growing number of programs to assist in using them, an essential ingredient remains the ability to access these resources through affordable, robust broadband connections and low cost, easy-to-use hardware.

¹⁰ See Google Education Hangouts on Air, <https://sites.google.com/site/eduonair/> (last visited Nov. 8, 2013).

¹¹ See Google Faculty Institute, <https://sites.google.com/site/facultyinstitute/> (last visited Nov. 8, 2013).

¹² Google Digital Literacy and Citizenship Curriculum, <http://www.google.com/goodtoknow/web/curriculum/> (last visited Nov. 8, 2013).

¹³ Good to Know: A Guide to Staying Safe and Secure Online, <http://www.google.com/goodtoknow/> (last visited Nov. 8, 2013).

¹⁴ ThinkB4U, <http://www.thinkb4u.com/> (last visited Nov. 8, 2013).

¹⁵ Send Your Parents a Tech Support Care Package, <http://www.teachparentstech.org/> (last visited Nov. 8, 2013).

1. High-Capacity Fiber Connections.

Fiber connections built to the Gigabit Internet standard provide a cost-effective way of getting communities online now and in the future.¹⁶ Indeed, while supported institutions should have flexibility to use the specific technologies that best meet their needs,¹⁷ only a short-term view would allow anyone to conclude that a school or library does not “need the bandwidth provided by fiber connectivity.”¹⁸ Fiber connectivity offers the most future-proof way to deliver high capacity broadband to schools, libraries, and other community institutions.

In Kansas City, Kansas; Kansas City, Missouri; and Provo, Utah—and soon in Austin, Texas—Google Fiber is taking an innovative approach to the community-wide adoption challenge. Among Google Fiber’s offerings in Kansas City and Provo are Gigabit Internet service that is more than 100 times faster than the broadband speeds available to most Americans, for a monthly fee of just \$70 per month. Or users can choose Google Fiber’s Free Internet offering, which provides a network box and standard Internet access service—with download speeds of up to 5 mbps and upload speeds of 1 mbps—for a one-time installation charge of \$300 (payable in monthly installments) in Kansas City and \$30 in Provo. There is no recurring charge for Free Internet, and the free offer is guaranteed for at least seven years.¹⁹

Google Fiber’s Internet service is improving communications services, raising property values, and catalyzing local business success and entrepreneurship. In Kansas City—our initial market—Google Fiber already has ignited migration of tech

¹⁶ Notice of Propose Rulemaking, FCC 13-100, ¶ 67 (rel. Jul. 23, 2013) (NPRM).

¹⁷ See NPRM ¶ 77.

¹⁸ See NPRM ¶ 68.

¹⁹ See Google Fiber, <https://fiber.google.com/about/> (last visited Nov. 8, 2013).

businesses to the “Silicon Prairie.”²⁰ Beyond that economic impact, the Free Internet offering provides an opportunity for households that previously could not afford Internet access to become connected.

Google Fiber has established a Community Connections program that allows schools, libraries, community centers, and other public facilities selected by the host city to receive free Gigabit Internet connections. Google Fiber also is partnering with local organizations to provide digital literacy grants and training to historically underserved areas.

When paired with Wi-Fi connectivity, fiber connections can provide high-speed Internet access for portable devices anywhere in a classroom or throughout a school, library, or other community institution. Such integration of fiber-to-the-premises connections and unlicensed Wi-Fi access can provide maximum flexibility for learning while using readily available access technology that localities can deploy and control themselves.

Increased use of interactive video tools and remote data storage, moreover, may make upstream and downstream traffic more balanced. Connections heavily biased

²⁰ See, e.g., Cecilia Kang, *Google Fiber Provides Faster Internet and, Cities Hope, Business Growth*, WASH. POST, Jan. 25, 2013, at http://articles.washingtonpost.com/2013-01-25/business/36549408_1_internet-speeds-google-fiber-cable-companies (last visited Nov. 8, 2013) (“Three months into Google’s much-publicized experiment, signs of new business life have emerged.”); Rob Roberts, *French Cloud Computing Firm Picks KC for North American HQ*, KAN. CITY BUS. J., Oct. 30, 2013, <http://www.bizjournals.com/kansascity/news/2013/10/29/french-cloud-computing-firm-picks-kc.html?page=all> (last visited Nov. 8, 2013) (“The fact that Google made the decision to make Kansas City its initial market for Google Fiber helped validate Kansas City as a technology town”); Colleen Taylor, *Brad Feld Is Looking For Founders To Live And Work Rent-Free In His New Kansas City ‘Fiberhouse’*, TECHCRUNCH, Feb. 13, 2013, <http://techcrunch.com/2013/02/13/brad-feld-is-looking-for-founders-to-live-and-work-rent-free-in-his-new-kansas-city-fiberhouse/> (last visited Nov. 8, 2013) (“Google began rolling out Fiber in Kansas City late last year, and this obviously has given Kansas City renewed potential to be an ideal home for startups.”); Sean Buckley, *Has Google Fiber Set the Pace for 1 Gig FTTH Pricing?*, FIERCETELECOM, Sep. 20, 2013, <http://www.fiercetelecom.com/story/has-google-fiber-set-pace-1-gig-ftth-pricing/2013-09-20> (last visited Nov. 8, 2013) (“A 1 Gbps connection won’t appeal to every user, but what’s clear is that Google Fiber and other municipal-based providers are shaking up the way the telecom and cable industry thinks about the value of a broadband service.”).

toward download speeds may compromise educational uses. Just as Google Fiber provides its users symmetric Gigabit connections, symmetric ultra-fast connections offer schools and libraries the greatest possible flexibility and utility.

Federal, state, and local governments can further increase the availability and affordability of Internet access by minimizing network deployment costs.

Commonsense policies that promote competition while benefiting users include “dig-once” rules, as well as requiring existing occupants of public rights of way to lease their unused infrastructure. Likewise, providing adequate wireless coverage for a school or library requires sufficient unlicensed spectrum. Due to propagation characteristics, deployment costs may be significantly lower if spectrum below 1 GHz is available. This reinforces the need for such allocations by the Commission.²¹ Broadband-friendly policies of this nature are an important complement to government investment, and can substantially advance the overall educational, economic, and community-building goals of this proceeding.

2. Low Cost, Easy-to-Use Internet-Enabled Devices.

Of course, high-speed connections are only as useful as the devices that connect to them. Internet-enabled hardware works best when it provides a simple, transparent connection between the user and online resources.

Google has developed innovative devices for use in school and at home, including Chromebook laptop computers and the Chromebox classroom workstation. These Chrome devices bring the speed, simplicity, and security of the Chrome browser to computing. There is no need to install software; web apps run seamlessly alongside

²¹ See Comments of the National Cable & Telecommunications Association at 17-18; Comments of Comcast Corporation at 20.

the array of education sites and tools available on the Internet. Administrators can pre-install apps and extensions, including application packs specifically designed for elementary, middle, and high school grades.

Google will soon expand its education offerings to include Nexus tablets, which will provide additional tools for realizing the benefits of E-rate broadband connections.

II. Open Measurement of Broadband Performance Is Essential to Success of the E-Rate Program.

Finally, testing the speed and quality of broadband connections supported with E-rate funds is necessary for the program's success.²² To encourage effective use of federal funds and promote transparency in this public program, the Commission should adopt an open approach to measurements that allows fund contributors and potential service providers, as well as schools and libraries, to engage with the results and help tune to process.

The Commission—through its Office of Engineering and Technology and Consumer and Governmental Affairs Bureau—has led in open measurements by using the M-Lab platform and engaging the research community in the Measuring Broadband America program. For the E-rate program, the Commission should further advance its commitment and require *totally open* network measurement that includes:

- Open source testing methodologies, in which the means of testing connections are publicly documented and available along with the code used in these measurements;
- An openly documented and run measurement platform, in which the infrastructure and configuration of the measurement end points (the measurement platform servers) is publicly documented and informed by best current practices;
- Public release of all measurement data in raw, disaggregated form, such that stakeholders and researchers can examine and validate results; and

²² See NPRM ¶¶ 20-35.

- Public release of all post-hoc analytic methodologies applied to the raw data when generating published results, to make clear the processes by which assessment mechanisms have been constructed.

In addition to improving the quality of the data collected, employing these open measurement methodologies will maximize opportunities for meaningful reporting on financial management and program successes; support enforcement of program requirements; provide data to facilitate further refinements; and build confidence in the E-rate program overall.

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Private sector innovations in online educational services, digital literacy and online safety, network deployment, Internet-enabled devices, and performance measurement provide readily available resources as well as practical guidance for reform of the E-rate program. The Commission should be cognizant of these opportunities and, when establishing funding guidelines, should maximize opportunities for utilization of private resources as it works to modernize the E-rate program to meet the future needs of schools and libraries in the global information era.

Respectfully submitted,



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