

Bridging the Digital Access and Use Divides in the Apple and ConnectED Initiative



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Contents

Executive Summary 1

Introduction5

The Apple and ConnectED Initiative7

About the Apple and ConnectED Schools8

Understanding the Digital Divides 10

Bridging the Digital-Access Divide in Apple and
ConnectED Schools12

Bridging the Digital-Use Divide in Apple and
ConnectED Schools 18

Conclusion..... 28

Endnotes..... 29

Executive Summary

Within and beyond the U.S., access to advanced technology for students and teachers is held out as a path toward educational transformation. However, in historically underserved schools and communities, this promise remains elusive. Many schools do not have access to the technologies that can open new learning opportunities for teachers and students (the digital-access divide). Even with increased access to technology, the use of that technology in active and creative ways does not automatically follow in schools serving high concentrations of students facing socioeconomic barriers (the digital-use divide).

This report explores the dual digital divides of disparities in access to technology and its use in instruction through the lens of the Apple and ConnectED Initiative, which has been the focus of a rigorous 6-year research study. It is one of a series of reports on the Apple and ConnectED research that address different aspects of implementing 1:1 programs that provide each student with access to a technological device.

Launched in 2014, the Apple and ConnectED Initiative has supported 114 participating schools across the country with an iPad for every child. Schools received a host of programmatic support including extensive professional learning opportunities for teachers and leaders, technology infrastructure upgrades, and process management. The initiative and this research are explicitly situated in a diversity of traditionally under-resourced communities, with schools ranging from pre-K to secondary and from the inner city to rural migrant communities to Native American villages.

This report presents findings from the Apple and ConnectED research related to

- **bridging the technological access divide**, which refers to providing technological infrastructure, tools, and support, and
- **bridging the technological use divide**, which involves moving from passive consumption to using technology in active and creative ways.

For each type of digital divide, the report describes how it looked in ConnectED schools and why it mattered, and offers lessons learned (see Exhibit ES-1 for a summary).

Exhibit ES-1. Bridging the Digital Divides in Apple and ConnectED Schools

	Bridging the Digital-Access Divide	Bridging the Digital-Use Divide
How it Looked in Apple and ConnectED Schools	<p>Schools received</p> <ul style="list-style-type: none"> • Devices • Infrastructure • Tech support • Digital learning resources • Leadership coaching • Instructional support 	<p>Communication and creation to demonstrate understanding and convey an idea to an audience increased relatively quickly.</p> <p>Teachers capitalized on new and varied opportunities to make real-world connections.</p> <p>Students collaborated more.</p>
Why it Mattered	<p>Dynamic access brought current, relevant, rich information into schoolwork and class discussions.</p> <p>Students developed important digital proficiencies.</p> <p>Students were able to connect to something larger than their own communities.</p>	<p>Students were more engaged, enthusiastic, and motivated to learn.</p> <p>Student successes built on themselves.</p> <p>Teachers had higher expectations for students.</p>

Lessons Learned: Bridging the Digital-Access Divide

- **Infrastructure upgrades and technical support are essential.** Technological devices are foundational to bridging the access divide. Just as important, infrastructure upgrades and technical, instructional, and leadership support, which were part of the initiative's design, ensured those devices could be integrated into the fabric of the ConnectED schools.
- **Phased rollouts allow teachers to become familiar with the technology.** To give teachers time to build comfort and plan their instruction, teachers in most study schools received their devices an average of three months before the students.
- **Initial professional learning with practical tips and tools gives teachers the confidence to begin integration.** A year of professional learning offerings focused on making technology integration accessible for teachers and gave them practical ways to embed iPad into their lessons that could be applied across subjects.
- **Straightforward routines help manage access to devices during the school day.** For some schools, initial decisions about providing access to devices during the school day and ensuring that they were fully charged was more complicated than expected. In middle and high schools, a common approach was to have students pick up and drop off their devices in their homeroom class each day.
- **Decisions about take-home policies require careful consideration.** A major policy decision centered on whether students could take their iPad devices home. Common reasons for not sending devices home included concerns about variable Internet access at home; device theft or breakage; and students forgetting to bring the devices back or that the batteries would not be charged.
- **1:1 access requires intentional classroom management strategies.** Despite high levels of engagement during learning with iPad devices, some teachers, parents, and students were concerned that the newness of the technology and the accessibility to external content would be distracting in the classroom. Several teachers asserted that good classroom management minimizes distractions of any type, and some developed specific strategies to minimize off-topic use.

Lessons Learned: Bridging the Digital-Use Divide

- **Teachers can be motivated to bridge the digital-use divide by a desire to broaden students' horizons and prepare them for the future.** In many ConnectED schools, stakeholders viewed the technology as a vehicle for opportunity that would put them on a par with students in more-resourced schools and communities. The motivation to use the Apple and ConnectED resources to achieve these effects drove the practices of many teachers.
- **Some key affordances of iPad helped teachers and students quickly start to bridge the digital-use divide.** Productivity and creativity apps helped students create a variety of presentations and artifacts demonstrating their learning. Students' ability to independently search the internet enhanced teachers' capacity to connect learning activities to the real world.
- **Professional learning activities focused on technology integration and content creation are essential.** Many of the Apple Professional Learning (APL) activities provided as part of the initiative addressed applications of technology that helped bridge the digital-use divide for teachers. Well-established professional learning communities in some schools also helped teachers extend what they were learning through the APL.
- **A long time horizon allows teachers to learn, experiment, and become comfortable with the technology.** Having the first year for teachers to become comfortable and experiment with the technology eased the pressure to become immediately proficient. Exploring different apps and resources spurred the creativity of some teachers to expand the range of learning opportunities they offered, including in ways that bridged the digital-use divide.

Introduction

An early education center serves predominantly Black students in a mid-Atlantic town that is physically isolated from the surrounding townships. Although once an economically robust and diverse area, the town has become segregated over time, offering limited opportunities for students to experience other cultures or economic backgrounds. Indeed, the staff is concerned that students might never experience life outside of the town. Students benefit from a group of long-serving teaching staff, many of whom are also community members. The school also enjoys a high level of family engagement and plays an integral role in serving the needs of parents, with the goal of social mobility and support.

A middle school serves a rural, Southern community. Like the community itself, the student population is nearly all White. Resources are scarce: many homes lack internet and technology access, and the school provides food for students over the weekend. In recent years, the town lost its local newspaper, which was an important avenue for the school to communicate with parents and the community. The school has a high proportion of students with reading difficulties and students receiving special education services. While improving literacy and mathematics scores are perennial goals, school leaders and parents also share the goal of trying to provide students with as many skills and opportunities as possible to prepare them for the workforce.

A K-12 school in a remote rural village in the western U.S. is 25 miles from the nearest town and a few miles from a Native American reservation. This school is housed primarily in a single building. Students come from a 25-mile radius, typically from the reservation and small villages with just a few homes. Most students are Native American, and most teachers are White. Staff and faculty cultivate an informal atmosphere: having students present and welcomed is more important than dress codes, sitting at desks in orderly rows, or tightly controlled student behavior. Student art and inspirational displays, many with connections to Native American culture, line the hallways. Students and adults at the school enjoy an easy familiarity.

A high school in the Midwest serves a new immigrant population. Students come from many countries, often arriving from refugee camps where they received no formal education. The teaching population is also diverse, representing a variety of countries with different teaching traditions and experiences with technology. At the school, students learn English and how to navigate the U.S. so they can make the most of newly available opportunities. Some students had no previous formal instruction, so course offerings range from basic academic classes to more advanced classes with high-school level content. Because of the students' life experiences, helping them develop life skills, such as decision-making, time management, and resiliency, is as important as language development and academics.



These schools are all part of the Apple and ConnectED Initiative, which coupled 1:1 access to iPad technology with comprehensive support in diverse schools across America that serve high concentrations of students facing socioeconomic barriers. The schools described above reflect the range of participating schools and exemplify a key motivation for the initiative: to provide technological resources to the schools and communities that need them the most but can afford them the least.

This report focuses on implementation of the Apple and ConnectED Initiative with respect to the dual digital divides along socioeconomic lines in access to technology and its use in instruction. The report describes why it was important to bridge those divides in the ConnectED schools and offers some lessons learned for others who are implementing similar initiatives. It is one in a series of research reports that describe the Apple and ConnectED Initiative and address topics related to implementing 1:1 programs.

All data for this report were collected before the global coronavirus pandemic, so the report does not explore whether and how the technology made the transition to virtual learning during the pandemic any less disruptive for ConnectED schools, teachers, and students. However, the broader set of issues related to technology access and use discussed in this report remains relevant as the pandemic has highlighted longstanding and newly arising inequities in these areas.

The Apple and ConnectED Initiative

Launched in 2014, the Apple and ConnectED initiative has supported 114 participating schools across the country, with the ambitious goal of transforming educational and life opportunities for students in America's most under-resourced communities. The schools range from pre-K to secondary, and from the inner city to rural migrant communities to Native American villages. To qualify to apply to the initiative, 96% or more of each school's students must receive free or reduced-price lunch. The initiative offers a unique sample for the study of technology adoption across a wide range of schools serving high concentrations of students facing socioeconomic barriers.

Guided by research and by Apple's long experience in classrooms, the design of the initiative reflects the understanding that success requires strong leadership and a variety of ongoing support for implementation.^{1,2} To that end, the initiative provided comprehensive support for schools, including devices (an iPad for every student and technology for every teacher); infrastructure upgrades and project management; and a dedicated team of professionals to support leadership and teachers, including strategic planning and 17 days of on-site teacher professional learning in the first year after rollout. Recognizing the diversity of the participating schools, the initiative also customized implementation timelines and professional learning approaches to meet the unique needs of each school setting.

Apple and ConnectED Research

This report is part of an independent 6-year research study, conducted by SRI International, that investigates the implementation and outcomes of the Apple and ConnectED Initiative. The study included multiple complementary components, including surveys of school leaders, teachers, and students; case studies of selected schools; rubric-based analysis of learning opportunities based on lessons and student work samples; and a study of achievement outcomes.³

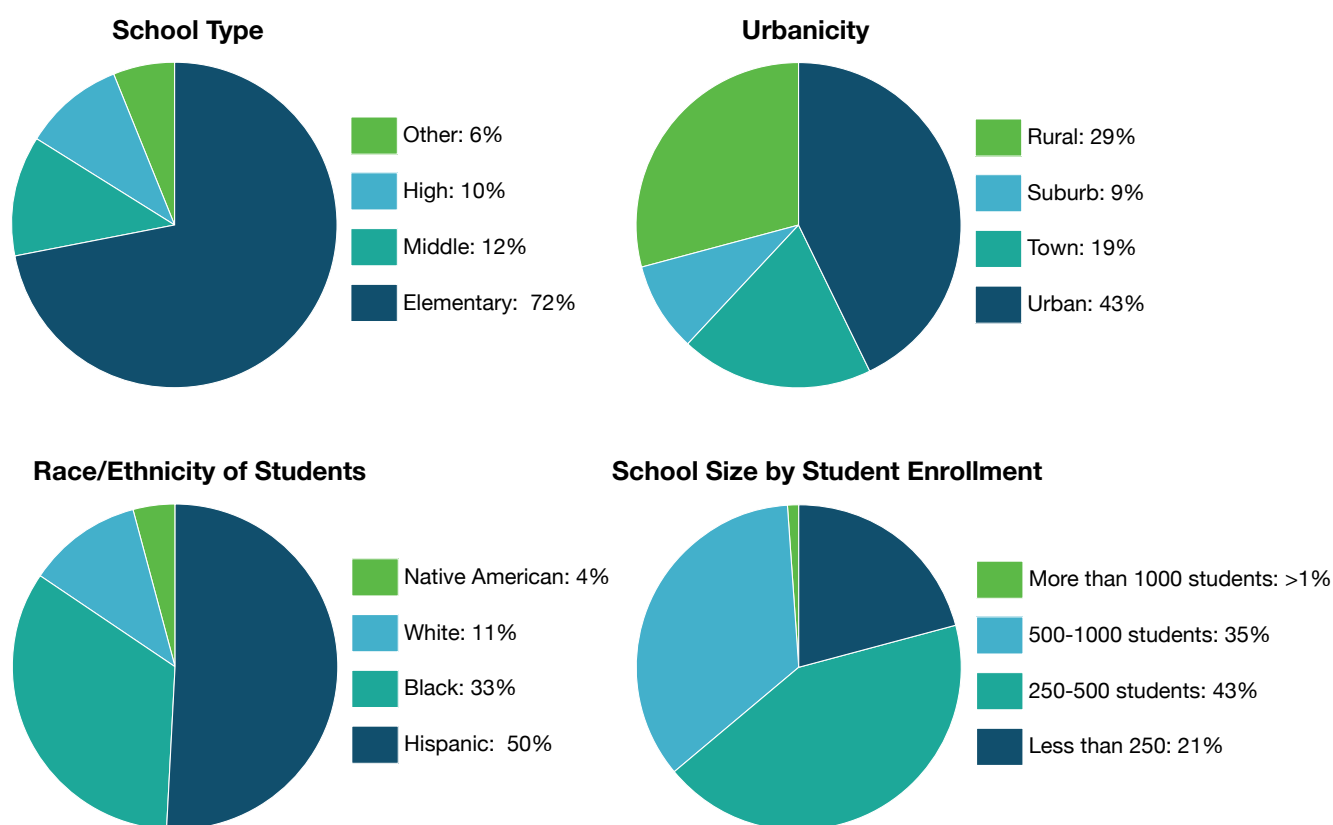
This report draws on data from

- surveys of teachers and principals in 101 ConnectED schools conducted from 2015 to 2019,
- site visits of 15 case study schools conducted from 2016 to 2019,
- a study of learning opportunities and student work conducted from 2016 to 2019, and
- surveys of students in 15 ConnectED schools conducted from 2017 to 2019.

About the Apple and ConnectED Schools

To qualify for participation in the Apple and ConnectED initiative, at least 96% of a school's students had to qualify for free or reduced-price lunch.ⁱ The schools that met this criterion and other selection criteria are geographically and demographically diverse and serve a wide range of communities, as illustrated in Exhibit 1. Exhibit 2 provides additional detail about the case study schools.

Exhibit 1. Characteristics of Apple and ConnectED Schools



ⁱ Eligibility for free and reduced-price lunch is defined by the National School Lunch Program. Although it is used by education researchers as a proxy measure for the concentration of students facing socioeconomic barriers in a school, it is not the same as the number of students whose families live below the federal poverty threshold.

Exhibit 2. Key Features of Case Study Schools

School Type*	Locale	2015 Enrollment	ConnectED Start Date	Population Served**
Early Childhood	Urban	180	Fall 2015	African American
Early Childhood	Urban	550	Spring 2015	Hispanic
Elementary	Rural	188	Spring 2016	Hispanic
Elementary	Rural	248	Spring 2016	African American
Elementary	Urban	350	Fall 2015	Hispanic
Elementary	Town	350	Fall 2015	African American
Elementary	Urban	388	Spring 2016	Hispanic, African American
Elementary	Suburban	587	Fall 2015	Hispanic
Elementary	Rural	600	Fall 2016	Hispanic
Middle	Rural	367	Spring 2016	White
Middle	Urban	753	Spring 2015	Hispanic
High	Urban	120	Spring 2016	African American
High	Suburban	1373	Fall 2015	African American
Combined	Rural	80	Spring 2015	Native American

*The high proportion of elementary schools reflects the greater number of elementary schools served by the Apple and ConnectED initiative as a whole.

**Population is listed if it made up at least 30% of the student body.

Although the ConnectED case-study schools are diverse, many of them face the types of challenges that are chronicled in the literature on schools serving large concentrations of students facing socioeconomic barriers, including issues with absenteeism, student mobility, and learning difficulties.^{4,5} Compared with other schools across the country that serve high concentrations of students eligible for free and reduced-price lunch, the ConnectED schools experienced similar rates of principal turnover (approximately 41 percent over the first two years of the Apple and ConnectED initiative).⁶ The schools had higher than average numbers of new teachers than the overall nationwide average (approximately 22 percent of ConnectED teachers surveyed in 2015 had less than 4 years of experience, compared with 15 percent across all schools nationwide).⁷

The schools also had strengths that are less well-documented in the literature, such as deep connections to their communities; strong relationships among adults and students; and a sense of school, community, or cultural pride.^{8,9} The unique combination of local strengths and challenges in each school had important influences on the schools' goals for students and teachers, their implementation of ConnectED, and the support needed for technology integration.

Understanding the Digital Divides

Within and beyond the U.S., access to advanced technology for students and teachers is often viewed as a critical path toward educational transformation. However, this promise remains elusive in many schools serving high concentrations of students facing socioeconomic barriers.

Two distinct digital divides offer a useful way of thinking about educational technology initiatives in such schools and communities. Current conceptions of the digital divides include the well-documented discrepancies along socioeconomic lines **in access** to advanced technological resources in schools and communities and **in the use** of technology in K-12 instruction.

Differences in access to the internet and high-performance computers mean that the power of information is distributed inequitably.

Despite considerable attention and some progress over several decades, the digital-access divide persists across the U.S. (See box below). Differences in access to the internet and high-performance computers mean that the power of information is distributed inequitably. These inequities further disadvantage students in historically underserved communities.¹⁰ Students who have access to digital resources in school, but not at home or in their community, can experience a “homework gap” that puts them at risk of falling behind in terms of academics and access to information.¹¹ The COVID-19 pandemic has brought these aspects of the access divide into sharp relief.

63 percent of rural Americans reported having broadband access in 2019, compared with **75 percent of Americans** overall.¹²

58 percent of Black Americans and **57 percent of Hispanic Americans** reported owning a desktop or laptop computer, compared with **82 percent of White Americans**.¹³

The affordances of technology for traditionally underserved student groups heightens the need to close the access divide. For example, multimodal technologies that allow English learners to record themselves and work at their own pace can improve comprehension, literacy, and language acquisition.^{14,15} Also, the design features of tablets, combined with assistive applications for developing skills and learning content, make them appealing and educationally valuable to students with special needs.¹⁶

The presence of technology within the school building is not sufficient to realize these affordances: it must be accessible to students as they learn. Bridging the access divide, therefore, requires hardware and connectivity of sufficient quality and reliability so that teachers can count on its availability for instruction. Further, it requires that teachers have the skills and confidence to build its use into their lessons.

Recent research has called attention to a second aspect of the digital divide: the digital-use divide contrasts “learners who are using technology in active, creative ways to support their learning and those who predominantly use technology for passive content consumption.”¹⁷ Even though technology has become more widely available, it is not being used to its fullest potential to support active engagement with academic content and creativity in learning.¹⁸ Similar to the access divide, socioeconomic status plays a role in the opportunities students have to use technology for creativity and deeper learning. Computers are used more often for drill-and-practice and basic content acquisition in schools serving high proportions of students facing socioeconomic barriers than in schools that serve well-resourced communities.^{19,20,21} Although the existence of the digital-use divide is well documented, the literature does not elaborate on the causes.^{22,23,24,25,26,27,28}

The digital-use divide contrasts “learners who are using technology in active, creative ways to support their learning and those who predominantly use technology for passive content consumption.”



The following sections of this report discuss some key features of the Apple and ConnectED Initiative that are relevant to these digital divides. The infrastructure upgrades, devices, and technical support provided during the early phases of the initiative were aimed at the digital-access divide. The initiative helped some teachers and schools bridge the digital-use divide with support for leaders to develop a vision for how and why to incorporate technology and 17 days of professional learning activities to help teachers use iPad for instructional transformation. These activities included national professional development convenings for administrators and teacher leaders, opportunities for individually paced professional learning to become an Apple Distinguished Educator, the Challenge-Based Learning curriculum, and resources and professional learning activities related to deeper learning.

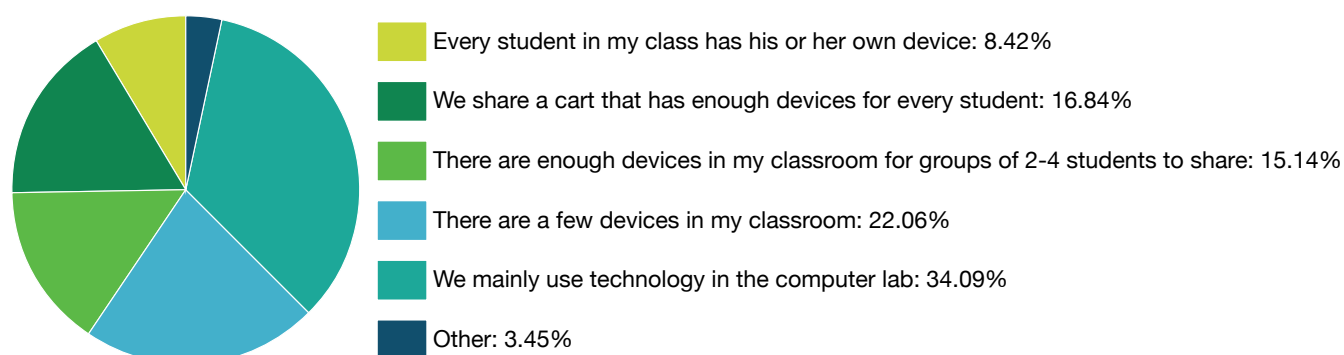
Bridging the Digital-Access Divide in Apple and ConnectED Schools

An early focus of the Apple and ConnectED initiative was to help participating schools bridge the digital-access divide by providing devices, Wi-Fi upgrades, and process and technical support. Schools' management of access to the devices, including whether and under which circumstances they went home with students, required prior planning to develop policies and procedures, along with ongoing monitoring and adjustments to those policies and procedures as the initiative matured. Although some schools experienced challenges setting up the technology, learning how to use it, and maintaining high levels of uninterrupted access as the initiative matured, the impact of bridging the digital-access divide was powerful for the ConnectED schools and students.

Digital Access Before Apple and ConnectED

Before the initiative, access to technology in many ConnectED schools was unreliable, difficult to schedule, or not available to all students (e.g., in some schools, technology initiatives supported only academically advanced students). In 2015, 85 percent of teachers surveyed reported that students had some access to technology at school. Exhibit 3 shows the types of access reported by that subset of teachers.

Exhibit 3. Students' Access to Technology at School Before the Apple and ConnectED Initiative



Access in ConnectED communities and homes also varied widely.

- Approximately 20 percent of students surveyed reported not having internet at home.
- About 80 percent of school leaders estimated that fewer than half of the students in their schools had a working laptop or desktop computer.

Some ConnectED schools provide computer labs for community residents who do not have access to technological resources. In some of the case study communities, parents and school leaders said that residents commonly park their cars in front of churches, fast food restaurants, or other public spaces to access free Wi-Fi.

Technological Tools and Support to Bridge the Digital-Access Divide

The tools and support that were part of the Apple and ConnectED initiative largely eliminated the digital-access divide in the schools (Exhibit 4). Some schools experienced challenges related to managing the technology during the early stages of implementation, but these challenges diminished over time. For example, one school experienced difficulties managing access to devices and content when students logged in with their personal and school-generated Apple IDs at different times. Other schools experimented with a few different approaches for managing access to the devices during the school day before settling on their eventual approach.



Exhibit 4. Tools and Support Provided to Apple and ConnectED Schools

Devices	Schools received an iPad for each student and teacher, a MacBook for each teacher, and an Apple TV in every classroom.
Infrastructure	Apple and its partners provided Wi-Fi and other infrastructure upgrades, as well as classroom device management and other management applications.
A dedicated support team*	Included (1) an Apple Development Executive (DE) to support school leadership in visioning, instructional leadership, and change management; (2) a dedicated Apple Professional Learning (APL) Specialist, who was onsite at the school for a total of 17 days in the first year after rollout to provide individualized professional learning offerings related to technology integration through a coaching and mentoring model; (3) a Project Manager (PM) to manage and guide the process of implementation and coordinate support providers; and (4) a Project Engineer (PE) to support technical issues.
Tech support	Schools had access to a dedicated Project Engineer and AppleCare hardware and software support as needed. This technology support included ongoing assistance for any technology-related issues, including those associated with hardware, operating systems, and wireless infrastructure, as well as coaching for school IT professionals.
Digital learning resources	Teachers and students had access to a wide range of apps and educational resources available from Apple's App Store, Books Store, and Apple Music.

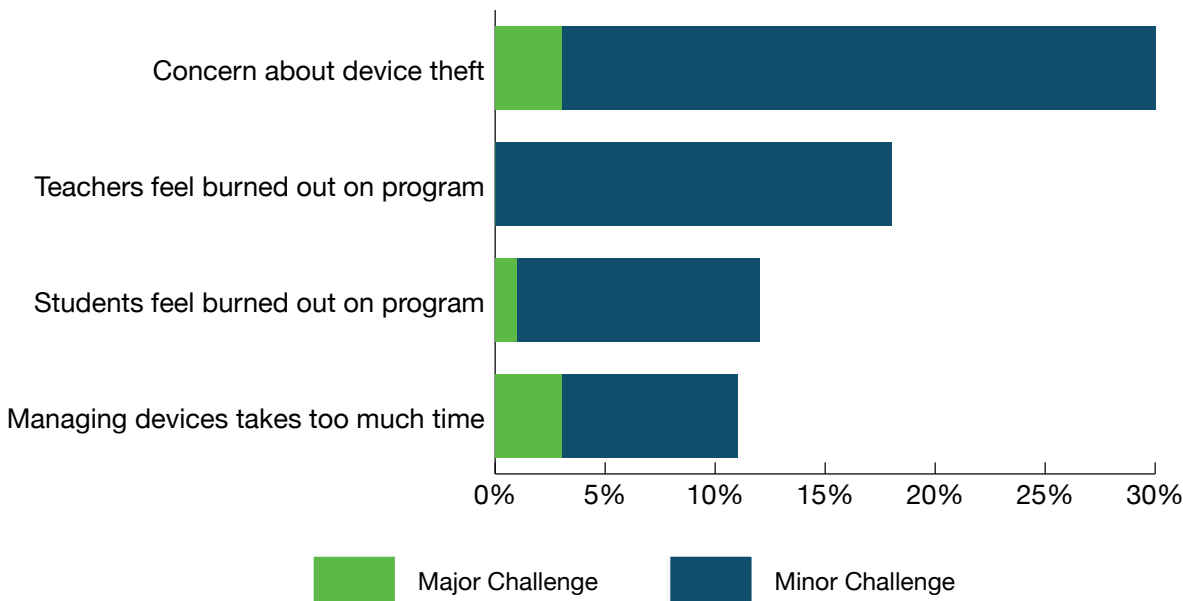
*DEs and APL Specialists are all education professionals on Apple's staff with experience as teachers and/or administrators.

Findings from the teacher and school leader surveys demonstrate that the initiative largely met its goals for reducing impediments to reliable access to working computers and the internet. At the start of the initiative, teachers' top five concerns about using technology in their classrooms were

- students' lack of home technology access;
- slow or unreliable internet;
- malfunctioning or broken devices or apps;
- lack of instructional time; and
- lack of reliable technical support.

While 31% or more of teachers cited these concerns as major challenges in 2015, that number decreased to 20% or less in 2017. Similarly, device management and technological issues were among the least prominent concerns for principals in year 4 of the initiative (Exhibit 5).

Exhibit 5. Least Prominent Challenges for Principals, 2019



Why Bridging the Digital-Access Divide Mattered

Parents, teachers, and school leaders widely shared the perception that the lack of technology access before Apple and ConnectED placed young people in their schools and communities at a disadvantage in society and isolated them from learning experiences, resources, and opportunities. The access to ConnectED resources made new knowledge and learning opportunities available to teachers and students.

“We’re still in the area where Internet connection is not available to everybody… We just want to give our kids…as many advantages as possible coming from a rural area trying to go out into the work world.”

-Middle school instructional facilitator

“Our library isn’t the most up to date, so now we have an infinite amount of things that the students can go and learn about.”

-Elementary instructional coach

Teachers and parents believed that having access to technology enabled students to develop competencies that were vital to their futures, such as keyboarding, coding, proficiency with creation and productivity apps, and research skills. For example, typing and spell check made students' work look neater, reportedly improved their writing ability, fostered pride in their written work, and reduced questions about spelling and the meaning of words. Using the iPad devices as an enhanced dictionary made it easy for students to find pictures, videos, and definitions of terms and concepts.

Parents and teachers also believed that the technology provides a way for students to make connections beyond their own communities by conducting internet research, taking virtual field trips, and exploring differences between their lives and those in other parts of the world. Indeed, slightly less than half of students surveyed in the 2018-19 school year reported using their iPad to discover something interesting about the world.

"I teach in a small town...where most of our kids don't get to see other places and other things...The iPad gives them a glimpse into what's possible. The iPad is a wonderful tool for children like ours who don't get to see the world."

-PreK-8 teacher

"They didn't realize there's parts of the world that didn't have water. They didn't realize that there's parts of the world where children are dying because they're shoved into a civil war. It was really powerful for them to be able to interact with that..."

-Middle school teacher

Lessons Learned about Bridging the Digital-Access Divide

- **Infrastructure upgrades and technical support are essential.** Of course, technological devices and the other support illustrated in Exhibit 4 were necessary to bridge the digital-access divide. Just as important, the infrastructure upgrades and technical support that were part of the initiative's design ensured that those devices could function properly as teachers became familiar with them. With those conditions in place, the leadership and instructional support for technology integration helped the devices become part of the fabric of the ConnectED schools.
- **Phased rollouts allow teachers to become familiar with the technology.** Another important design feature of the initiative was that device rollout at a school should be based on the readiness of the teachers and the technical infrastructure. School-based leadership teams worked with the Apple Development Executive to develop strategic plans that included a tailored schedule of iPad deployment to teachers and students. To give teachers time to build comfort and plan their instruction, teachers in most ConnectED schools received their devices an average of three months before students did.
- **Initial professional learning with practical tips and tools gives teachers the confidence to begin integration.** Accompanying the devices that teachers received in advance of the students, an Apple Professional Learning specialist was onsite to help teachers plan and prepare for classroom use. Workshops were designed to offer practical strategies for classroom use,

giving teachers an initial “bag of tricks” that they could quickly learn to use with their students. As a result, student access to technology in their learning was high in many schools beginning shortly after they received their devices.

- **Straightforward routines help manage access to devices during the school day.** For some schools, providing access to the devices during the school day and ensuring that they were fully charged every morning was more complicated than expected. The logistics were simpler in elementary schools, where students generally stay in the same classroom each day. In middle and high schools where students did not take the devices home, a common approach was to have them pick up and drop off their devices in their homeroom each day. These changes have required flexibility and an understanding that it may take practice for students to internalize new structures and norms. Teachers discussed building trust and rapport around digital citizenship, being explicit about their expectations related to the devices, and having backup plans (e.g., extra charging cables for emergencies). These strategies enabled students to learn the new routines and not be unduly punished for not following them.
- **Decisions about take-home policies require careful consideration.** A major policy decision revolved around whether students could take their iPad devices home. Some schools reported that they had initially intended to allow the devices to go home but decided against it. Others did not allow the devices to go home but left the policy open for reconsideration. One school allowed students to take their iPad home during the first year of the initiative then discontinued that policy. Commonly cited reasons for not sending devices home included variable Internet access at home; concerns about device theft or breakage; and concerns about devices forgotten at home or that the batteries would not be charged. Some schools created time after school where students could use the iPad. One school allowed students to take their devices home when they needed to catch up on schoolwork, and another required an adult family member to sign out the iPad for home use and return it. A K-12 school allowed students above grade 3 to take the devices home on Monday through Thursday evenings, but not on weekends.
- **1:1 access requires intentional classroom management strategies.** Despite high levels of engagement while learning with iPad devices, some stakeholders expressed concern that the newness of the technology and the easy accessibility of external content made the devices a distraction in the classroom. Others viewed the iPad as an amplifier, rather than a cause, of distraction. Several teachers, typically those with more experience, asserted that good classroom management minimizes distractions of any type, and some had developed specific strategies for minimizing off-topic use. Some teachers focused on setting shared classroom norms, building trusting relationships with students, and keeping students engaged with meaningful learning activities. Other strategies included walking around the classroom observing students’ screens, having students close iPad devices when not in use, occasionally asking individual students to share their screen during class, and muting students’ devices or locking their screens on an app related to the current learning task.

Bridging the Digital-Use Divide in Apple and ConnectED Schools

This discussion focuses on the main criterion of bridging the digital-use divide as described by the National Educational Technology plan: “students using technology in active, creative ways to support their learning.” In schools serving high concentrations of students facing socioeconomic barriers, bridging the digital-use divide means helping students shift from being passive consumers of digital information to using technology in active and creative ways.

Related to this criterion, this discussion addresses two aspects of teaching and learning that were studied during the Apple and ConnectED research: using technology for creation and communication and using technology to provide real-world experiences for students.ⁱⁱ

Some Key Changes to Learning Opportunities and Instruction

Integration of the iPad devices into instruction was generally high in ConnectED schools, but it varied. Within the context of overall use, iPad devices allowed many teachers to make instructional changes that bridged the digital-use divide as defined here. ConnectED teachers who made those changes mentioned enabling factors that included Apple Professional Learning, a desire to use technology to level the playing field in their schools, and a timeframe that allowed them to become comfortable with technology.

The initiative offered many opportunities for bridging the digital-use divide. As designed, the support provided through the Apple and ConnectED initiative allowed most teachers to embed technology into teaching and learning on a regular basis. On a 2017 survey, 75% of teachers reported daily iPad use in their classrooms within the first year after rollout. However, as with many educational technology



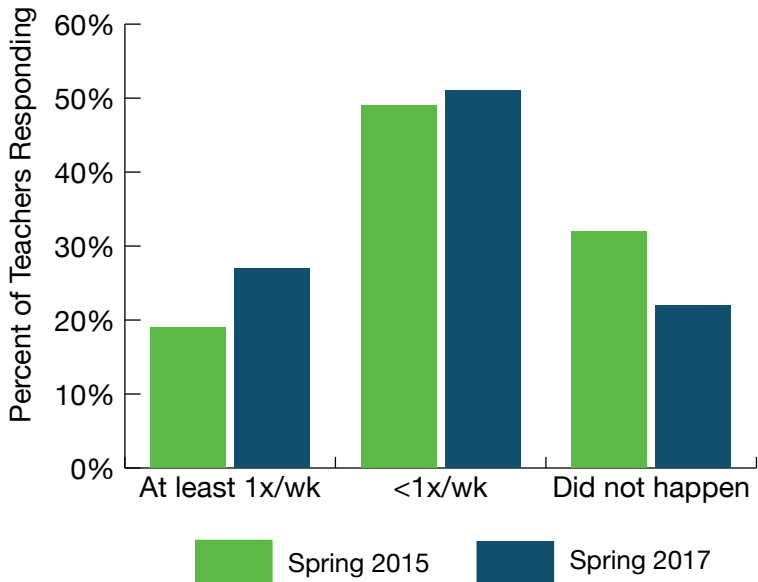
ⁱⁱ Creation and communication and real-world experiences are two of six elements of deeper learning that were examined during the Apple and ConnectED research. They are emphasized here because their connections to the digital-use divide are straightforward and offer concrete examples for others to consider. The Apple and ConnectED Initiative Research Study Methods report³ provides a full description of deeper learning and how it was studied.

initiatives, not all uses of iPad by ConnectedED teachers achieved this aim. This discussion focuses on uses that did bridge the digital-use divide and describes their prevalence, how they looked in ConnectedED classrooms, and why these uses were important to the students in ConnectedED schools.

1. **Students were more frequently using technology for communication and creation soon after schools received the technology.** At baseline, 19 percent of teachers surveyed reported that their students created academic products such as reports, presentations, podcasts, and videos for communication at least once a week. Two years into the initiative, that proportion of teachers increased to 27 percent. At the same time, the percentage of teachers who reported that students did not create products that communicated what they were learning decreased from 32 percent at baseline to 22 percent in 2017 (Exhibit 6).

Exhibit 6. Students' Use of Technology to Communicate Their Ideas

How often do your students create products to communicate information or a point-of-view, such as a report, presentation, video, podcast, website?



Source: Teacher survey 2015 & 2017

"My own teaching has definitely changed... I'm more like a facilitator. I get them started. I guide them, but then I let them produce. I'm pushing them to create. I'm pushing them to think innovatively."

-Elementary teacher

2. **Students commonly created presentations to (a) demonstrate their understanding and (b) convey an idea to an audience.** Apps such as Keynote, iMovie, and Explain Everything helped students demonstrate their knowledge and express their ideas in a range of ways. Accordingly, students' presentations varied widely, as shown in Exhibit 7. The degree of choice teachers offered to students also varied. Some teachers provided templates for student presentations, and students entered the content into the template. In other cases, which were more consistent with bridging the digital-use divide, students chose the topic of their presentations, the apps to use, the type of presentation to create (e.g., reports, Keynote, movie), and how to design their work products to best communicate with the intended audience. Some teachers developed scoring rubrics for student work products, and some teachers had students use those rubrics to evaluate others' presentations, while teachers in other schools grappled with how to evaluate new work products such as songs or movies.

Exhibit 7. Using iPad Devices for Communication and Creation

Purpose of Student Presentation or Work Product	Examples
Demonstrate understanding of content	<ul style="list-style-type: none"> English learners in a middle school circle words in a text to show mood, find online pictures to represent that mood, and create voiceovers in Keynote explaining their choices. Elementary students develop Keynote presentations about various systems in the human body. Middle school students create a digital yearbook of Civil Rights leaders. High school students study three ways to graph a linear equation, then use Explain Everything to present and explain their graphs.
Convey an idea to specific audiences	<ul style="list-style-type: none"> Middle school students develop and administer a survey on community literacy and present results to an audience at a local university. Upper level students in a K-12 school write speeches on a topic of their choice and use a green screen and teleprompter to record the speeches, which are shared with younger students in the school.

High-School Students Create a Public Service Announcement

Students in an epidemiology class in a K-12 school sit silently in the dark. They had just finished watching a public service announcement about influenza that they had made together with iMovie.

The teacher turns on the lights and asks, “Well, what do you think of that?”

“Production-wise? It was horrible!” a student says.

“Okay, now let’s tear it apart,” prompts the teacher. “How are we going to make it better? Remember, this is going to be playing on a continuous loop at the clinic.”



Students discuss how they would revise their PSA so that it could be shown in the local health clinic.

They had spent weeks researching influenza as an epidemiologist would: how it affected their community on the reservation, how the disease was transmitted, and what types of vaccines were helpful. They contacted the clinic to ask about their frequency of cases and delved into databases from the state. Once they had their research, the teacher split them into groups to work on the messaging of the PSA. Some students worked on presenting data while others worked on disease prevention. Then, students were asked to view their final product and revise it together so that it would have the right amount of information for the right audience and age range for their community.

“If this goes well, let’s think about making a PSA for headlice later in the year,” the teacher says as she listens to her students discuss creating smoother transitions in iMovie.

3. **Teachers capitalized on new and varied opportunities to connect learning activities to the real world.** Reliable access to the internet combined with apps that facilitate measurement, design, and productivity provided new opportunities for teachers to connect learning activities to real world problems, phenomena, and audiences. As shown in Exhibit 8, ConnectedED teachers used these resources in three primary ways: to provide a realistic context for in-class activities, have students participate in authentic tasks with a real-world purpose, and create opportunities for virtual immersion in the real world. Providing a realistic context was the most common approach: 65% of teachers surveyed reported that they incorporated real-world activities at least one a week, 26% reported that they asked students to do tasks with a real-world purpose, and 22% reported activities that involved virtual engagement with the real world.

Exhibit 8. Using iPad to Connect Learning Activities to the Real World

Approach	Prevalence*	Examples
Providing a realistic context for in-class, academic activities	65%	<ul style="list-style-type: none"> • A teacher uses Google Earth to show students the location of the world's largest volcano. • Students analyze a population dataset of their neighborhood and visually represent population trends. • Algebra II students use Google Earth and measurement and graphing apps to design and virtually install a solar array for the roof of their school building. • Students plan a cross-country trip, including mapping, budgeting, and travel planning.
Having students participate in authentic tasks that have a real-world purpose	26%	<ul style="list-style-type: none"> • Fourth-grade students create booklets about weather for second-grade students, and the second graders provide feedback on the booklets. • Sixth – eighth-grade students use a structured app-design process to develop a Girls Who Code app. • High school students develop and produce a student-journalism podcast involving community interviews for a National Public Radio competition.
Creating opportunities for virtual immersion in the real world	22%	<ul style="list-style-type: none"> • Second-grade students use iPad to simulate the boat journey that students in Haiti take when they attend school in a different village. • Students explore cells in the human body online with 3-D models and perform virtual dissections. • Students study medicine wheels from their culture in connection with virtually exploring archaeoastronomy sites such as Stonehenge.

*As reported on the 2018 teacher survey

4. **When creating presentations to communicate their ideas, students collaborated more.**

Teachers in several case-study schools shared that students were interacting with each other more, presenting to each other more, and providing each other feedback on their work. Teachers also said that students were spontaneously showing each other how to use the technology and share content, working as teams even when each student had their own device.

“My students are not afraid...to put themselves out there when it comes to publishing or sharing their work on an app where all of the students are able to see/collaborate with each other.”

– Second grade teacher

Fourth-Grade Students Educate Their School About Plastic Pollution

Bright posters and student work cover the walls of a 4th grade classroom. Books about Hillary Rodham Clinton, Amelia Earhart, Eleanor Roosevelt, and Frida Kahlo are featured along the whiteboard. Students work in groups on their tablets; some sit outside the classroom, some squish together on a small couch, and others crowd around a table, their heads and shoulders touching as they share an iPad. The teacher and students switch seamlessly between Spanish and English. It is a week before Earth Day. The classroom is abuzz as students work together to teach the school about plastic pollution.



Some students use the Sketches app to design posters. “Muy bonita flores en tu proyecto!” the teacher says, pointing to the beautiful flowers on the group’s poster. One pair goes over the Keynote presentation they will use to educate the principal about ways the school could reduce their plastic footprint. Images of Styrofoam trays crossed out and replaced by paper trays flash by as they scroll through their slides. “If we have all the title words capitalized, it is more powerful when you present,” the teacher advises. One student points out to her group that plastic eaten by the fish will pollute human bodies too. The students then look for an image to add to their Clips video that warns the school about the dangers of plastic pollution. The teacher nods, “I love it! Excellent work team. Please Airdrop this to me, and then jump into coding.”

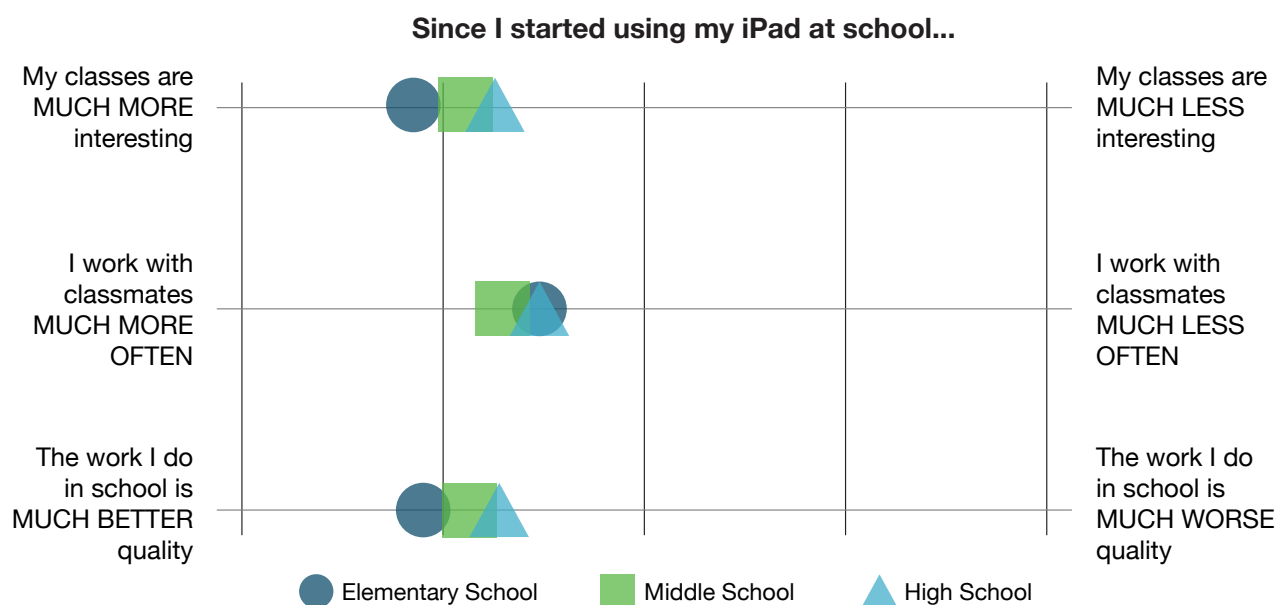
Why Bridging the Digital-Use Divide Mattered

Schools had a wide range of goals for the Apple and ConnectED initiative including expanded access to opportunities, technology skill building, achievement, engagement and confidence, and instructional changes. While improving math and literacy were commonly held ideals among ConnectED schools, their aspirations went beyond academic achievement. Considering the challenges their students and communities faced, many school leaders considered the goals of increasing engagement and broadening students' horizons, promoting resilience and self-efficacy, and having students imagine bright futures for themselves just as important as test scores. The leaders hoped that increased access to and use of advanced technological resources would transform instruction in ways that prepared students to succeed in school and beyond.

In the context of these goals, bridging the digital-use divide was especially important for students in ConnectED schools for many reasons, including:

- **Students were more engaged, enthusiastic, and motivated to learn.** This increase in engagement and enthusiasm has been the most widely reported outcome of the initiative. As Exhibit 9 shows, students in all grade levels reported several improvements in the learning environment and in their performance. Importantly, in different ways, the technology also engaged many students who had been disconnected from the learning process due to earlier education experiences and other factors. The effects on student engagement, attendance, and other outcomes are described in detail in SRI's report on 1:1 teaching and learning in the Apple and ConnectED initiative.²⁹

Exhibit 9. Student Perceptions of iPad*



*Students were asked to indicate their perceptions on the impact of iPad devices on a 5-point continuum between two opposite statements; the results in the figure indicate averages among elementary, middle, and high school students.

Some of this engagement was associated with using iPad devices in the active, creative ways described above. However, the technology also spurred enthusiasm for learning even during activities that were not associated with bridging the digital-use divide. For example, the use of iPad devices for listening and recording speech, sometimes in the context of learning content, boosted the confidence of English learners. Learning games and adaptive skill development and practice apps that allowed students to work at their own pace without stigma promoted engagement and delight for the first time in many students' careers.

"We have [elementary] teachers who have kids do their own Number Talks and use a program and record it so you can see the math happening...[W]e have one [student] who's [selectively non-speaking], we have another one who hardly ever talks, and they turn in beautiful work."

-K-8 principal

- **Student success built on itself.** For many students, the ability to express themselves and their knowledge in a variety of ways such as through movies, Keynote presentations, written reports, songs, podcasts, graphs, and other representations, increased their confidence, effort, and academic performance. In some cases, this increased confidence and engagement in learning supported stronger connections to teachers and the school. In others, it stimulated more creativity and a greater desire to learn.

"I see that they're taking ownership...and they feel really good. I feel like they're feeling more positive about themselves...and that in itself gets them to do better in all the other areas at school."

- Elementary school teacher

- **Some teachers reported having higher expectations for students.** Many students became more self-directed in the context of using iPad devices for active and creative learning by exercising more agency and taking greater responsibility for their learning and classroom performance. Productivity tools enabled them to turn in higher quality presentations that required fewer cycles of revision and assignments that focused more on content than on drawing or handwriting skills. Some teachers reported that their expectations for students grew after seeing how independent students had become, their proficiency with technology, and their ability to create a variety of presentations and express themselves in different ways. These changes prompted some teachers to give students more choice and responsibility in their learning.

"Students have become independent. They're not dependent upon the teacher. Not only that, they want to be become independent. They want to do it by themselves."

- Fifth grade math and science teacher

Lessons Learned about Bridging the Digital-Use Divide

- **Teachers can be motivated to bridge the digital-use divide by a desire to broaden students' horizons and prepare them for the future.** This desire was particularly pronounced in schools that were geographically, linguistically, or socially isolated and faced an especially acute lack of resources, including lack of devices and connectivity in the community. In those contexts, technology was widely seen as a vehicle for opportunity because it promoted confidence and engagement in learning and provided students with skills, experiences, and knowledge that would put them on a par with students in more-resourced schools. The strong motivation to use the Apple and ConnectED resources to these effects drove the practices of many teachers.
- **Some key affordances of iPad helped teachers and students quickly start to bridge the digital-use divide.** Students' ability to independently explore their interests and search the internet increased their autonomy, made learning more personalized, and enhanced teachers' capacity to connect learning activities to the real world. Beyond these features of 1:1 access, intuitive productivity and creativity apps associated with iPad helped students make a wide variety of presentations and artifacts related to their learning, even for those who were less experienced with technology. These initial instructional changes were often very meaningful for teachers and students, and inspired some teachers to further expand their repertoires toward increasingly rich learning opportunities that involved active engagement with the content.
- **Professional learning activities focused on technology integration and content creation are essential.** The teachers and school leaders in the Apple and ConnectED initiative benefitted from extensive support for professional learning and strategic planning (see Exhibit 4). Many APL activities were focused on communication and creation, and APL specialists modeled using technology to make real-world connections. While access to this level of professional learning support is atypical, particularly in under-resourced settings, the features of the professional learning might be valuable for other schools and districts seeking to undertake a comprehensive 1:1 student-technology implementation.

In addition to the external APL support, several case study schools have well-established professional learning communities. These learning communities took various forms, including grade level, department level, and cross-department teams within grades. In several schools, teachers used their learning communities to reflect on and extend what they were learning through the APL.

- **A long time horizon allows teachers to learn, experiment, and become comfortable with the technology.** The technology learning curve was steep for many ConnectED teachers. In several case-study schools, teachers reported that the year of APL gave them basic skills and confidence to begin using iPad more in their lessons. For many teachers, having the first year to

become comfortable and experiment with the technology eased some of the pressure they felt to become immediately proficient. The time and freedom to explore different apps and resources spurred the creativity of some teachers to expand the range of learning opportunities they offered, including in ways that bridged the digital-use divide.

Apple Professional Learning

Apple Professional Learning (APL) offerings were an important and differentiating element of Apple’s services to the ConnectedED schools. An APL Specialist was onsite at each school for a total of 17 days in the school’s first year after the iPad rollout, providing individualized professional learning for technology integration through a coaching and mentoring model. All APL Specialists were education professionals with experience as teachers and/or administrators. Professional learning services were intended to provide a custom program in response to the needs, interests, and capacities of each school, with activities that typically included a mix of whole-group workshops, small-group activities, and one-on-one coaching. Consistent with research-based characteristics of effective professional learning, the APL program was designed according to three primary pillars: customized, hands-on, and sustained (Exhibit 10).^{30,31,32,33}

Exhibit 10. Pillars of Apple Professional Learning

Customized	Hands-On	Sustained
<ul style="list-style-type: none">• Support tailored to the school context• Classroom-based instructional coaching	<ul style="list-style-type: none">• Intensive exploration and experimentation with iPad devices and apps• Teachers creating and developing their own projects	<ul style="list-style-type: none">• 17 days of coaching per school in the first year• Additional remote support as needed• A suite of always available digital resources

Conclusion

The Apple and ConnectED initiative aimed to bring the power of technology-supported learning to schools and communities that could most benefit from these resources. These efforts helped to bridge the dual digital divides of technological access and instructional use of technology.

In terms of bridging the digital-access divide, ConnectED schools benefitted from the infrastructure upgrades, technological devices, and technical support that were part of the initiative's design. In addition, professional learning opportunities for teachers early in the initiative helped make sure that the technology—beyond being accessible in the building—was in students' hands as they learned. These resources were important because they made new knowledge and learning opportunities available to teachers and students, enabled students to develop competencies that were vital to their futures, and provided a way for students to make connections beyond their own communities. Making sure those devices could become part of the fabric of the ConnectED schools involved considerable forethought and preparation, along with ongoing management of students' access and use. Particularly for schools serving high concentrations of students facing socioeconomic barriers, the complexities of infrastructure, process, and device management sufficient to make the technology fully available to support learning should not be underestimated.



ConnectED schools also received extensive support to use iPad technology to transform teaching and learning. As a result of the changes teachers were able to make, students were more engaged, enthusiastic, and motivated to learn; students experienced successes in school that built on themselves; and some teachers reported having higher expectations for students. While this level of support may be atypical, especially in under-resourced settings, professional learning programs seeking to bridge the digital-use

divide should go beyond basic device use to offer accessible and curriculum-relevant ways to leverage new opportunities for learning. It is important that they include enough time for teachers to become comfortable with the technology so that they can expand their repertoires. Helping teachers bridge the digital-use divide can leverage their motivation to broaden students' horizons and prepare them to succeed in school and beyond.

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