Maintaining Momentum of 1:1 Programs:

Observations from the Apple and ConnectED Initiative

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Executive Summary

Schoolwide technology initiatives such as 1:1 programs have the potential to catalyze meaningful changes in school climate, instructional practices, and students' educational experiences. Implementing these programs can focus the school community around a shared vision, create opportunities for professional learning and leadership, and lead to more personalized, engaging, and empowering classroom experiences for students.

The Apple and ConnectED Initiative, launched in 2014, has supported 114 participating schools ranging from pre-K to secondary 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 schools serving under-resourced communities across the country, from the inner city to rural migrant communities to Native American villages.

Experience has shown that sustaining the progress of 1:1 programs in schools serving under-resourced communities is hard, as technology requires upkeep and the initial burst of focused energy sparked by new initiatives can dissipate. ConnectED was designed with an intentional approach to building a foundation for continued use of technology and to create conditions that would set school communities on a new learning trajectory, leading to continued deepening and expansion of technology use in classrooms. This vision of sustainability involved ramping up the provision of technology and integration support as schools were ready and then removing these scaffolds gradually to allow schools to assume local ownership of their 1:1 programs.

Through SRI International's (SRI) 6-year study of the initiative, the Apple and ConnectED Initiative provided a unique opportunity to observe how sustainability played out across many schools over an extended time period. This report describes findings from the research about the strategies that schools used to address inevitable challenges to sustainability and what factors and conditions appeared to make a difference. It further addresses the dynamic relationship among these factors and conditions, which can lead to positive reinforcement.

Schools that appeared to maintain momentum of their 1:1 initiatives demonstrated a broad commitment to the program and shared vision for how technology could support instructional goals, strong leadership (often but not exclusively from the principal's office), and community support. This shared commitment and leadership made it possible to put plans in place for mobilizing resources and devising ways to keep the program going. The continued use of technology and, in some cases, continued growth in practices and community engagement using iPad devices, produced visible benefits for key stakeholders which in turn helped to reinforce commitment.

Lessons Learned

The Apple and ConnectED Initiative provides valuable lessons for practitioners, policymakers, and researchers about what it takes to sustain 1:1 programs in schools serving high concentrations of students facing socioeconomic barriers. SRI's 6-year study of the initiative illuminates how key factors and conditions came together in some schools to keep their programs going and reveals some important lessons for future endeavors.

A general finding is that an intensive program combining technology infusion with capacity-building support can dramatically increase the use of technology in service of learning and help to establish conditions for sustaining use, even in the face of many challenges. In schools where we saw evidence of widespread technology use a year after the program's intensive supports ended, we observed a combination of shared commitment to program goals, strong leadership, practical plans for maintaining program components, and community support.

At the same time, even with this foundation, continued growth of instructional practices requires ongoing investment in professional learning. Continued growth of the ways in which technology is used in instruction to support deeper learning happened to a limited extent by leveraging internal resources but was more likely to plateau without targeted investment in external learning opportunities.

Additional lessons learned in key areas include:

Teacher development and new teacher onboarding	• **Intensive, individualized professional learning and integration support** were essential to push teachers up the learning curve to enable continued use and, in some cases, to plant the seeds for continued growth. The SAMR framework[i], introduced early in the initiative by Apple, provided a useful roadmap for some teachers to think about deepening their use of technology. • Ongoing growth of instructional practice with technology is likely to require **targeted external professional learning opportunities** to provide teachers and staff with fresh ideas for using technology and to renew their energy. An option for small or isolated schools is to build **networks of teachers** across schools, putting them in conversation with each other. • Additionally, **in-house grade-level communities of practice** can provide teachers with opportunities to share ideas and knowledge and to collaborate around integration of technology in the curriculum. • A comprehensive strategy for supporting continued technology use should take into account the **varying adoption attitudes and behaviors** among teachers as well as what is needed to **onboard new teachers to the program**.
Device maintenance	• Having **visibility into plans for funding device maintenance and upgrades** can give teachers and staff confidence in the program's longevity and engender a shared sense of responsibility for figuring out solutions.
Community engagement	• ConnectED opened up numerous ways **to engage parents, guardians, and other community members and to create connections between the school and community**. These connections can generate community support, which is important for mobilizing ongoing resources. • The **real-world connections** opened up with 1:1 programs are valuable in schools serving under-resourced communities and may augment community support for 1:1 programs.

Topics covered in this report

- An **Introduction to Sustainability** for the Apple and ConnectED Initiative provides an overview of the sustainability vision and goals in the context of schools serving under-resourced communities.
- **Sustainability Framework and Research** describes the way we conceptualized sustainability and the sources of data that informed this analysis.
- **What Have We Learned About Sustainability** identifies conditions and factors that appeared to make a difference in enabling continued use and growth in technology integration in Apple and ConnectED schools.
- **Conclusion** provides a final reflection on sustainability based on this 6-year study.

[i] SAMR refers to Substitution, Augmentation, Modification, and Redefinition, describing different degrees of technology integration in instruction.

Introduction

Educators at an early childhood education center embrace a shared vision for increasing student agency and engaging the local community.
At an early childhood education center serving a predominantly African American community, educators adopted iPad devices through the Apple and ConnectED Initiative to support a shared vision for expanding educational opportunities and access for students from this geographically isolated community. Since the school joined ConnectED, iPad devices have become an essential feature of the school environment. Teachers have integrated technology into daily classroom routines and instruction, learning how to handle technical issues without outside assistance. To further support the school's vision, the school's leadership provides teachers with planning periods to collaborate, share example lessons, and discuss student progress. The school has also brought parents into the shared vision, continuing the learning at home by using the school's iPad take-home program and teacher suggestions for activities that connect to the classroom. As part of ConnectED, the school developed a technology lab to expand educational opportunities for families as well as students.

Apple and ConnectED Background

The Apple and ConnectED Initiative sought to transform over 100 schools serving a diversity of historically under-resourced communities with by providing them with iPad devices for every student, together with professional learning opportunities designed to build teacher and leader capacity for effective use of technology. The initiative aimed to have far-reaching impacts on schools leading not just to sustained use of technology as a direct result of program activities, but also setting schools on an ongoing path of transformation. Resources and support were intentionally phased in over time to allow for necessary infrastructure and preparation, and then later tapered down to allow schools to gradually take ownership of their programs. Instructional practices enabled by technology were expected to continue to evolve even after the initiative ended due to stronger leadership and teacher capacity, changes in school culture and climate, and established routines around use of technology.

The initiative aimed to have far-reaching impacts on schools leading not just to sustained use of technology as a direct result of program activities, but also setting schools on an ongoing path of transformation.

This was an ambitious undertaking given the challenges that many externally funded educational initiatives face sustaining impacts that are a direct result of program activities. Often, these initiatives have diminishing benefits over time as the initial burst of enthusiasm wanes, injection of external resources ends, and attention turns to new priorities.[1,2] Efforts to improve educational experiences and student outcomes sometimes lead only to short-term benefits and can even contribute to a sense of wariness in schools that such initiatives are both temporary and unremitting (sometimes referred to as "initiative fatigue").

The Apple and ConnectED Initiative sought to take an intentional approach to sustainability by providing intensive support over time and intentionally building the conditions needed to enable ongoing use and growth in practices around technology. ConnectED also provided an unusual opportunity to examine what sustainability looks like for a holistic, multi-year 1:1 initiative and to look across schools to identify factors that influenced their use and growth paths.

As part of an independent, 6-year study of the initiative, SRI researchers tracked changes in practices, perceptions, and outcomes over time. This report shares what we learned about factors and conditions that appeared to support sustainability among Apple and ConnectED schools. Through the lens of this large-scale initiative, we aim to shed some light on what it takes to sustain 1:1 programs in schools serving high concentrations of students facing socioeconomic barriers.

Data for this report were collected before the global coronavirus pandemic, so it does not explore whether and how this disruption impacted ConnectED schools' ability to sustain the progress made through the program. We know that the pandemic had a disproportionate impact on historically under-resourced communities and people of color, and thus is likely to have been severely disruptive for ConnectED schools. It also seems likely that the pandemic has heightened the critical importance for these schools to have both access to technology and capacity to use it in ways that provide high-quality educational opportunities for their students.

Sustainability Framework and Research

Schools in under-resourced communities face heightened challenges sustaining 1:1 programs due to the paucity of resources to pay for technology upkeep and ongoing professional development, because teachers and staff are often stretched thin, and because high levels of turnover can erode capacity gains and shared experience.[3,4]

At the same time, sustaining 1:1 programs in K-12 schools is crucial, as loss of the initiatives means that teachers can lose hard-won gains on their technological pedagogical content knowledge.[5] Students may lose the digital skills they had built and the information access that had been important to their learning, and schools and communities may even lose their identities as technology-rich environments.

Previous research has identified a number of factors that can support sustainability. Enabling sustainability requires that schools establish practices and conditions to support teachers' continued and expanded use, including:

- ongoing formal and informal professional learning opportunities[6]
- a school-based professional community[7]
- a compatible district and school context[8]
- knowledgeable, stable, and supportive school leadership[9]

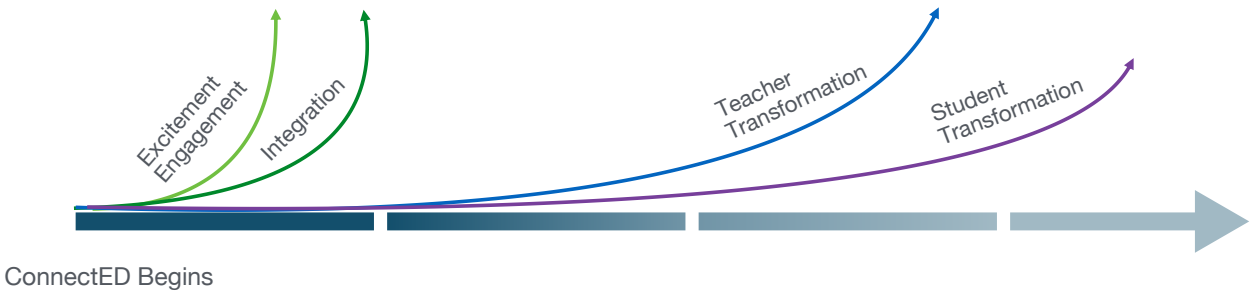
In addition, an important condition for sustainability is having a shared vision and purpose for technology integration in 1:1 programs.[10] Without such a vision, these efforts run the risk of becoming about the devices themselves, rather than about instructional growth.[11] With a clear vision, however, school leaders can lay the foundation for a culture of innovation and collaboration in which the technology can play a role in supporting teaching and learning. Such an approach invites teachers to engage as innovators and partners in the work.[12]

This literature helped to guide our analysis of sustainability, and we did find that these factors were important drivers (or, in their absence, constraints) in our sample of Apple and ConnectED schools. We also sought to understand how sustainability looked in the types of schools that joined ConnectED and to gain insight into dynamic relationships between factors.

Additionally, this analysis was grounded in the Apple and ConnectED Initiative's vision, which reflects the idea that **sustainability is not merely about continued device use, but rather about deepening implementation practices, including instructional practices, over time**.[13] In this vision, using technology for teaching and learning becomes an integral component of daily practice.[14] Technology is used to provide students with learning opportunities that would not be possible with pencil and paper, such as creating exposure to the broader world, enabling new forms of collaboration between students, increasing students' agency over their learning, and providing students with personalized opportunities to develop critical thinking skills. Teachers are continually growing their professional skills by learning about new curriculum-relevant applications and productivity tools and seeking new ways to integrate technology tools into their instruction, including using technology to gain insight into students' progress through formative assessment and differentiating instruction based on this information. These goals can be summed up as ***continued use*** and ***continued growth***.

Figure 1 presents the expected trajectory of ConnectED that was laid out early in the initiative, in which initial excitement and engagement create the foundation for achieving implementation milestones, giving rise to transformation of teaching practices, which in turn lead to changes in student learning and achievement. The gradation of the arrow in this image represents the reduction of external support and increase of local ownership, whereby continued use and growth are fueled internally.

Figure 1. Expected 1:1 Program Implementation Trajectory



When Did Sustainability Begin?

Given the duration of ConnectED, which began in 2014 and continued through 2018 and beyond, an important question is when did sustainability begin? By design, ConnectED launched in phases depending on several metrics of school readiness, such as internet connectivity. The program sought to avoid well-known risks of "throwing technology over the wall" by providing comprehensive implementation support including school leader coaching, 17 days of on-site teacher professional development from an Apple Professional Learning (APL) specialist, and educator attendance at regional and national conferences, in addition to project management and coaching for IT support staff. **Intensive support was followed by a tapering stage during which schools were encouraged to assume local ownership**.

This phased approach enabled researchers to observe signs of continued use and growth in ConnectED schools during the last year of the program and document what strategies they used to overcome challenges to sustainability.

The APL specialists helped build capacity by:

- providing individualized coaching to teachers
- serving as a resource for a range of topics from learning about new apps to trouble shooting technology problems
- leading professional learning sessions on integrating technology in classrooms, and
- helping to establish professional learning communities and distributed leadership.

Data Sources Informing This Report

Most of the data informing this report were from ten case study schools for which we collected in depth data about implementation at two points in time—during the most intense period of support and one year after this support started to wind down. During the later period, we also conducted interviews with leaders and staff at three additional schools that scored high on a measure of sustainability on a teacher survey conducted in 2018. Teacher and school leader survey data provided an indication of trends across all Apple and ConnectED schools. Data sources informing this report are described in Exhibit 1.

Exhibit 1. Data That Contributed to This Report

Initial and follow-up site visits to a sample of 10 schools that were selected based on variation on dimensions including type (elementary, middle, and high schools), student population demographics, school size, urbanicity, and leadership capacity.[ii] During site visits we interviewed principals, teachers, and other key staff such as instructional coaches, students, and parents. We also observed classes to learn how teachers integrated technology in their lessons and collected assignments and student products to understand the extent to which technology use created opportunities for deeper learning.
Interviews with principals and key staff at three additional schools that exhibited evidence in surveys of sustaining use and growth.
School leader surveys from 2015 through 2019 at 101 schools.
Baseline and two follow-up teacher surveys, including one a year after the support had mostly been phased out in 2018, administered at 101 schools.

SRI researchers applied several lenses to this analysis, starting with our core framework of continued use and continued growth. We looked for themes that emerged across schools and examined individual schools to understand potential relationships between sustainability outcomes and the factors and conditions that appeared to support sustained use of technology and continuing growth in instructional practices.

More details about data collection and analytical methods are available in SRI's report *The Apple and ConnectED Initiative: Research Study Methods*.[15] This report on sustainability also complements other SRI reports on findings from the early implementation of the ConnectED initiative and how the initiative addressed disparities in digital access and usage, creating opportunities for students from under-resourced areas to learn digital skills and gain opportunities for new forms of learning.[16,17]

[ii] The initial site visits were conducted at 12 schools, but of these some withdrew from the study and new schools were added to replace those, resulting in a sample of 10 schools in the later years of the study. Because of this turnover some of these schools were visited twice, and others a single time.

What Have We Learned About Sustainability?

Rural teachers share leadership and technology expertise to sustain learning

At a small, rural school, the school improvement team participates in weekly meetings to discuss current school issues. As the only school in the district, the school serves students in grades K-8 from predominately Spanish-speaking households. Most parents are employed in the agricultural industry. The weekly school improvement meetings are part of the school leadership's concerted effort to support teachers' professional learning and instructional proficiency around technology since adopting the Apple and ConnectED Initiative. These meetings feature regular discussions of strategies for integrating technology aligned with the school's standards-based instructional goals. The school's leadership also uses the meetings to encourage collaboration and to support teachers with different technology proficiency levels. Discussion topics for one weekly meeting include plans for an upcoming school walk-through to spotlight effective instruction using technology and debriefing on a model lesson that used Google Earth to teach fifth graders about ancient water sources. Another agenda item celebrates the growing confidence of a less experienced teacher who used the application Clips for the first time during a recent lesson. To close the meeting, the seventh-grade history teacher at the school leads a discussion on potential apps to purchase and encourages teachers to share thoughts or questions for how they might use the apps in their classrooms.

With limited district support and a small staff, school leaders and other staff at the school have taken on additional roles to support technology integration. Through these roles, the staff has overcome challenges such as resolving connectivity issues in the classroom, expanding the program to include a take-home component, and integrating iPad devices into after-school instruction.

Key findings from ConnectED schools:

- Sustaining ConnectED required a **shared commitment** to the 1:1 program. Having a **clear vision** for how technology could be used in service of schools' instructional vision provided teachers with direction and flowed through to supporting activities.
- Teachers reported that they grew to rely upon technology to **streamline their classroom logistics and to communicate with students in new ways**. After making upfront investments in time and effort to learn technology tools and realizing significant benefits, many teachers were committed to continued use.
- Some teachers leveraged their increased proficiency with technology to offer **deeper learning opportunities** for students, and some used the **SAMR framework** introduced by Apple early in the program as a tool to guide their efforts towards deeper learning.
- **Teacher and leader turnover** often posed the largest hurdle to building and maintaining the shared vision needed to sustain technology use. Schools tried to maintain momentum with **intentional onboarding strategies** for new teachers.
- Having a plan for ongoing access to resources for **device maintenance and upgrades** was important for maintaining confidence.
- A key threat to continued growth was lack of **resources for ongoing teacher development**. Schools tried to overcome this challenge with **home-grown communities of practice and professional learning communities**. For a few teachers, opportunities to attend **external professional learning** (e.g., Apple Leadership & Learning Academy, a convening that brought together school leaders and several teachers from each ConnectED school, or outside professional conferences such as ISTE) provided fresh ideas and energy.

Sustainability Enablers in Case Study Schools

Sustaining 1:1 programs in the case study schools started from a broad commitment to the strategy and vision, which provided direction for supporting activities around implementation and mobilization of resources. These conditions enabled changes in teaching practices and, in a few cases, use of iPad devices in community-oriented afterschool activities, which in turn led to a number of visible benefits for students and the community. In several cases, this set of factors and conditions formed a virtuous feedback loop in which visible benefits helped to drive continued commitment to the 1:1 program (see Figure 2). The remainder of this report explores what these dimensions of sustainability looked like in the schools that participated in our qualitative research, followed by a reflection on what factors seemed more important.

Figure 2. Sustainability Enablers

Broad Commitment to 1:1 Strategies

Schools with broad commitment to their ConnectED strategies were often characterized by having **strong leadership** with a **clear vision** for how technology could be used in service of the school's instructional vision, and **high-trust cultures** in which teachers and staff felt **comfortable taking risks**. These schools also benefited from shared commitment extending into their **local communities and/or districts**.

> ConnectED has completely changed teaching and learning at [our school]. Instruction is no longer direct and whole group. Every single classroom teaches in small groups. When students are not working with the teacher for instruction they are using devices to independently learn on individual learning pathways [...] **It has been a culture shift for our school**.
>
> - Principal

Strategic Vision

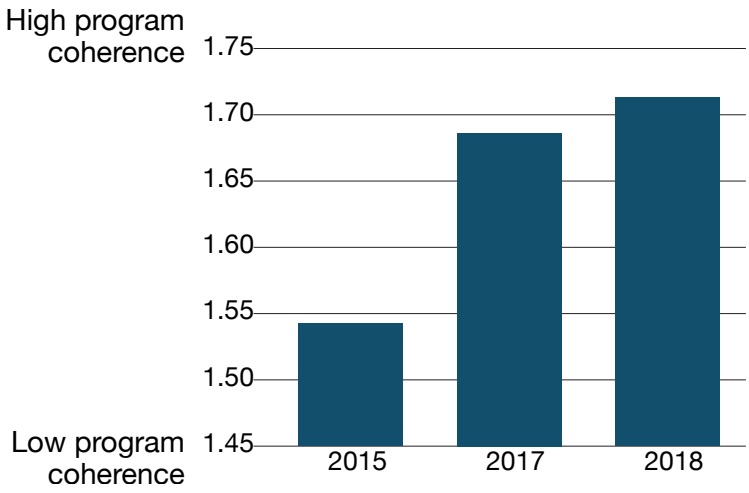
In several schools, teachers and staff described how their implementation of the Apple and ConnectED Initiative supported the broader vision and goals of the school. For example, at one school the initiative supported the school's focus on literacy; at another school, teachers' use of technology was guided by school-wide priorities, including offering students opportunities to learn coding. Administrators described some specific ways in which the initiative would help to achieve their schools' goals (see box on right).

SRI's teacher survey included a measure of program coherence, including questions such as whether "you can see real continuity from one program to another at this school." Teachers' ratings on this measure rose significantly from 2015 to 2018 (including in the last year), suggesting that they may have seen ConnectED as a comprehensive initiative that brought a unifying vision and was integrated with other things going on at the school (see Figure 3).

Examples of school goals that principals advanced with ConnectED:

- Help students at the school to feel empowered and take initiative in their own learning
- Connect students to the outside world
- Enable students to harness the power of technology
- Provide a cornerstone to improve technology access districtwide
- Be the most innovative school in the district

Figure 3. Teacher Ratings of Program Coherence



Source: SRI teacher survey 2015, 2017, 2018

Strong Leadership

In some schools, principals played an essential role in sustaining commitment to ConnectED, acting as the chief champion and role model as well as devising strategies for onboarding new staff. Several principals described ongoing efforts to encourage use of technology, for example by modeling desired behavior with their personal use and communications and by finding new apps to share. They also worked to understand what individual members of their staff needed to move forward. In one school, focusing on converting "laggards" was viewed as a less effective use of energy than providing training to new teachers and those who are more enthusiastic about adoption.

> [Principal] will sit there and say, 'Look at this cool app I just found,' or, 'Look at how this teacher' … I think when teachers see other teachers doing cool things, they wanna do it too, and being recognized is so big here.
>
> -Teacher

Leadership for the initiative did not always come from principals. The Apple and ConnectED Initiative also **opened up new opportunities for instructional coaches and teachers to act as leaders and to view each other as leaders**. Several principals made a point of elevating teachers who were leaders in their use of technology and supporting their growth, including by sending them to Apple events. One school set up a system called "Lighthouse in Learning," a shared document space indicating which teachers were proficient with various apps so that teachers would know where to go for help. This system provided teachers with opportunities to act as leaders and get recognition for their digital skills and knowledge.

> You have to differentiate with teachers just like you have to do that with students. That's very important. Knowing my teachers, knowing what their capabilities are, and how to help them meet that … I do a lot of one on one with talking with them and bringing them in.
>
> -Principal

Culture of Trust and Comfort Taking Risk

A culture of openness and trust was important to building shared commitment. A principal described his desire for open conversations: "We're setting that tone that if there's improvements, things that we need to do, we need to be honest with one another and let's be humble. Let's reach out to one another. Hopefully, that's a culture that I'm continuing to cultivate." They also found it helpful to demonstrate a flexible mindset when things did not go according to plan and to be willing to speed up or slow down implementation as conditions evolved. Another principal said, "Don't let it drop for sure. Don't be afraid to make your goals more fluid as well."

A few teachers described working in environments in which they felt comfortable taking risks. For example, one teacher described attending an ISTE conference and experimenting with a few ideas that she brought back, explaining that it was okay if something didn't work the first time.

> We picked just those few things we wanted to try…If it failed, it wasn't necessarily our fault 'cause as teachers we always like to be, 'What could I have done better? What should I have done different? How do I change it?' …Let's just see, and if it works, great. If not, try something different.
>
> -Teacher

Some participants described asking colleagues for ideas or solutions to problems with technology, indicating that they felt comfortable admitting what they didn't know and seeking help.

On the other hand, **principals recognized that concerns about accountability could stand in the way of risk taking**. One described how teachers who have been successful with pen and paper activities have a hard time giving those up to try new approaches that may impact student performance on state assessments. They expressed a desire for a 2-year break from the accountability system to have space to try different ways of using devices and able to show results.

District Support

Data from two Apple and ConnectED schools suggest that district-level commitment to the initiative can be a key sustainability driver, including by helping secure resources and support needed to sustain use and growth. In instances where there were multiple ConnectED schools in a district, the district could set certain expectations for how the programs were rolled out and sustained. These expectations could extend to learning objectives, as in the case of a district that championed a "challenge-based learning approach" that enabled students to see how they can have an impact in the real world.

Ways districts supported sustainability of ConnectED:

- Provided vision and leadership to embed the 1:1 program in broader district goals and sustain momentum
- Provided centralized tech support and app sourcing
- Organized district-wide PD events and expanded opportunities for teachers to connect with colleagues
- Provided instructional coaching for new and returning teachers
- Mobilized funding for device maintenance and upgrades
- Strengthened community ties and learning experiences using iPad devices
- Provided a larger stage for celebrating ConnectED school achievements and teachers

District support sustains project-based learning

In an urban school district, fifth-grade students in a large K-8 school create a presentation on recycling and single-use plastics in their community for Earth Day. Other students work collaboratively on a project about the importance of literacy that involves interviewing different community members and developing a plan for increasing public awareness. These classroom activities are part of a project-based approach to instruction at the school, intended to create real-world opportunities for students that typically come from low-income households and have few such opportunities. The school adopted the Apple and ConnectED Initiative in 2016 as part of the district's broader commitment to personalized learning and technology support that facilitates project-based instruction. Since adopting ConnectED, district leaders have sustained the program by making additional purchases to ensure students have up-to-date technology and software after the initial grant period. The district has further helped maintain the program's continued success by providing district-level professional learning opportunities that connect educators across schools.

Practical Plans and Resources

Once teachers and staff had bought into the use of iPad devices and invested time and energy in learning to use the technology, they were concerned with how their schools would keep their 1:1 programs going. **In several case study schools, broad commitment to the strategy flowed into concrete practices and plans for sustaining the program**. These concrete plans involved establishing routines for care and use of the technology, creating ongoing opportunities for teachers to learn new applications and plan technology integration into lessons, and finding resources to maintain and upgrade devices.

Establishing Routines Around Use of Technology

During the initial ConnectED rollout, some case study schools established routines and expectations around use and care of iPad devices, an important condition for enabling continued use. Several early-grade students reported learning to "hug" the devices when carrying them around. Schools enacted policies for appropriate use in class and, in a few cases, for sending iPad devices home with students in order to extend the school day. **These practices are important for extending the life of devices and building stakeholder support for their use**.

One teacher described her district's procedures for purchasing new licenses. It starts with filling out a form that asks questions such as whether the requester has checked Common Sense Media, how many students it will serve and how often, and the license fee if the app is not freely available. A staff member reviews requests and then vets the app, for example, to check for advertisements or links

to social media sites. Then they take it to the School Improvement Team for discussion. **Having procedures such as this in place can enable continuing growth by providing teachers with clarity about what to do when they identify new apps they want to use**.

Professional Support and Learning Opportunities

Case study schools found a variety of ways to continue professional learning, relying mostly on internal resources and expertise. ConnectED's "vanguard teams," which were clusters of teachers who took responsibility for maintaining the changes brought about by the program, underwent local adaptation in most case study schools, continuing some elements of the vanguard team structure but using different ways to characterize their work.

Some principals strategically positioned the teachers who were farthest up the learning curve as leaders and provided opportunities for them to mentor less proficient teachers, including new hires. The "Lighthouse in Learning" system described previously functioned as **in-house integration support**, giving teachers resources they could turn to for help.

In several schools, home-grown communities of practice provided teachers with regular, ongoing opportunities to discuss strategies for integrating technology into instruction. Organizing these communities by grade levels enabled teachers to discuss use of technology for specific content and lessons. Communities of practice did not always focus exclusively on technology; rather, in a couple cases they involved broader planning sessions on curriculum and instruction and incorporated technology when it made sense to do so. In addition, a few schools created **internal professional learning communities**, such as at one school where teachers ran a weekly professional development session focused on developing a particular skill like coding or using Keynote®.

> Last week we shared [that] every teacher should come in the PLC meeting with one app that they have been using and they think is useful for them… We took down the list, and that is the list that we're going to implement coming next year.
>
> --Principal

In a few cases teachers were able to get fresh ideas by participating in learning opportunities outside their own schools after the ConnectED support ramped down. One district held an annual event that brought teachers together to share effective approaches. Teachers could learn something new at these events to take back to their schools and classrooms. Another district trained coaches to provide individualized one-to-one instruction in the classroom to teachers, as well as providing the support teachers needed at a more centralized location.

Participation in virtual networks surfaced as one way to gain access to new ideas, as a teacher described the benefits of a Facebook group of teachers from the same discipline.

> I just want to know how other ELA teachers are using technology, if there's things that I haven't considered. Maybe that's the thing I would suggest. Maybe we could network. I'm part of some secondary teacher Facebook groups and I learn so much through them for ELA, just in general.
>
> -Teacher

Attending Apple conferences renewed enthusiasm and created growth opportunities after ConnectED's intensive support tapered off. Participating teachers reported being energized by participating in these national, high-profile events, getting to share their experiences and approaches, and obtaining ideas from other teachers. At one school, teachers on the leadership team attended offsite professional development sessions, whether these were Leadership and Learning Academies that included educators from across Apple and ConnectED schools or across the district, and these teachers then disseminated key insights from PD opportunities to the rest of the school.

At the same time, we heard from multiple teachers that the lack of such opportunities would likely lead to a deceleration in their growth. One said: "We didn't go to the [Apple] conference this year, so I think that the resources are there, but not knowing how to apply them may have slowed me down a little bit now."

Teacher and Staff Onboarding

The Apple and ConnectED Initiative accelerated the initial adoption process with its intensive support, as described in the SRI report on *Lessons from Early Implementation*.[18] Sustaining this progress was complicated by staff turnover, as new teachers joined who had less experience with technology and who had not experienced ConnectED's early enthusiasm and professional development opportunities.

Principals of schools with high turnover did not just need to get their existing faculty up to speed; they also needed to create lasting systems for onboarding new hires. They described several ways of addressing this challenge. For example, one principal was intentional about hiring teachers with a compatible mindset and made sure to signal a technology-rich environment as soon as new teachers walked in the door, giving them devices and showing them how to use Clips to introduce themselves. Principals also described pairing new teachers with veterans who could provide support for technology use and encouraging new teachers to observe others using technology. Perhaps as a result of these types of approaches, over 90% of new teachers in the 2018 survey reported that they were expected to use iPad devices in class, and nearly 90% agreed or strongly agreed that ConnectED was a priority for their schools.

> When we get new teachers in, we acclimate them to the iPad. We do orientation where we teach them how to use the iPad and incorporate it into their instruction. We also train them on the different apps, like GarageBand®, Pages®, Keynote … Our technology department for the district also comes over, and they do a training on the iPad and how to use it. I can see this program lasting.
>
> --Instructional coach / former teacher

While some teachers reportedly left schools due to discomfort with technology, the ConnectED initiative may also have helped with retention. One teacher emphasized that the program provides teachers with more freedom and support and is really important to teachers at their school.

> I think that's the biggest thing, because our district [has] a lot of teacher turnover. Teachers are overworked and underpaid, so I think yeah, there's a lot of benefits for students, but also, I'm so happy to have the iPads, because I feel like it gives me a lot freedom, and it gives me a lot of support.
>
> -Teacher

A teacher at another school said, "I think one of the biggest things that's keeping me here at [school] is the fact that I don't know how to go back to not having technology."

Device Maintenance and Upgrades

In some schools, uncertain availability of funds to maintain and upgrade technology posed a significant challenge to sustaining 1:1 programs and risked eroding confidence and commitment. **Many Apple and ConnectED principals saw securing resources to maintain and refresh devices as a high priority**. A couple considered programmatic and staffing tradeoffs, and one described her success in finding funds in the operating budget to sustain devices. Strategies that relied upon predictable funding sources appeared more likely to instill confidence than those that relied upon securing future grants. One participant said: "We want the grants, but we're not guaranteed we're going to get the grant. We're being proactive."

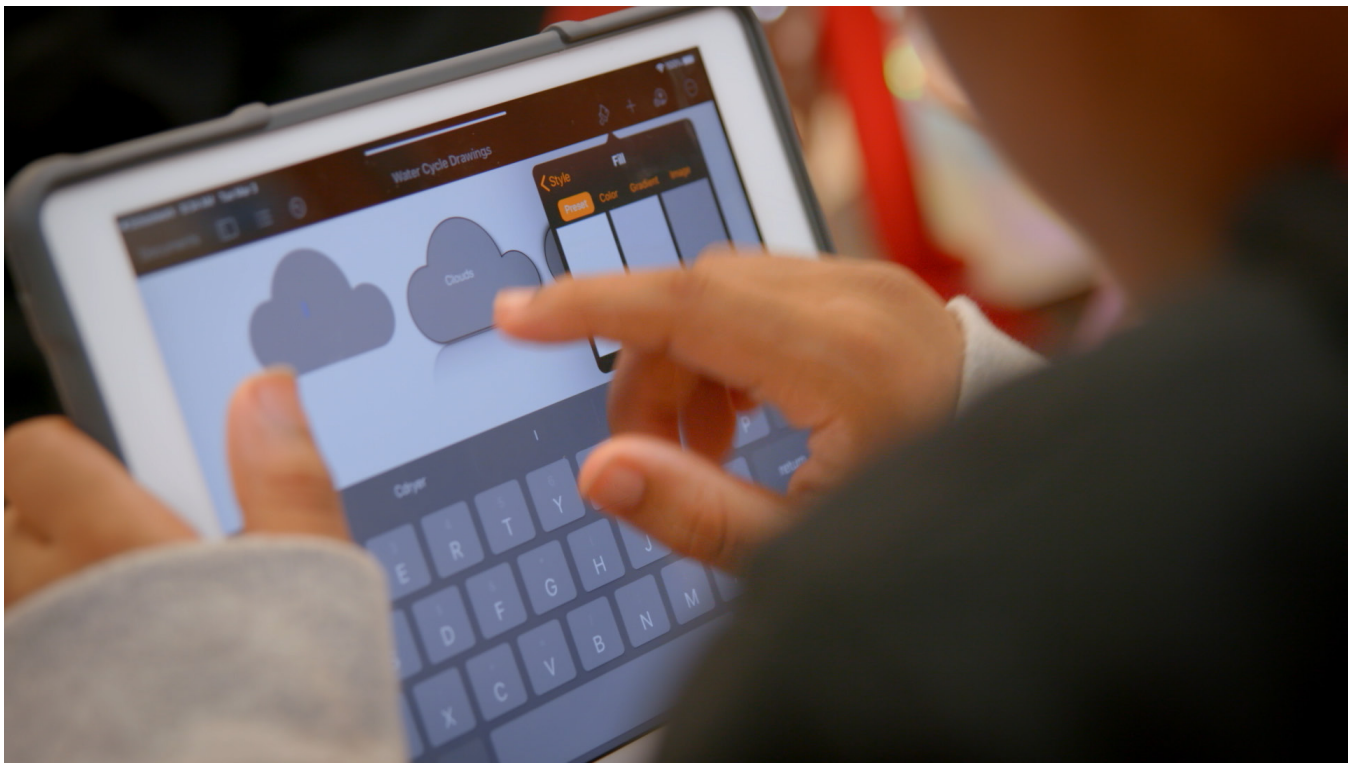
When funds for new devices were not readily available, teachers appreciated candid discussion and consideration of the school's options. These options included strategies for extending the life span of iPad devices, such as policies to have students check them out only during the school day. One school was considering how students could share iPad devices, should funding not be available to purchase new ones. Transparency about how these decisions were handled was important, as one teacher said: "What is good is that we're having a lot of honest conversations about things that may have to be different next year. And we're doing testing early for the possibility of going to shared iPad."

In cases where school leaders had identified additional funding for 1:1 programs, these resources were often earmarked for device maintenance and upgrades. Most schools relied on internal expertise for professional learning opportunities, while securing additional funds for external professional development was less common. One exception was a school where the district's Educational Technology Department provided ongoing professional development during the summer each year before the teachers received the devices, and then provided ongoing afterschool staff development.

School-Wide Technology Adoption

In some case study schools, the practical plans and resources enacted to support and sustain technology use made it possible for changes in teaching to persist and, in a few instances, continue to evolve. Some case study schools also took advantage of technology availability to offer digitally enhanced programming for community members, potentially deepening support for the Apple and ConnectED Initiative. Here we highlight some important findings for school technology adoption related to sustainability, with particular attention to examples of continued use and continued growth in technology integration and use of technology for community engagement. (Note that transformation in teaching and learning is described in greater depth in SRI's reports on early implementation and on the digital divide.)

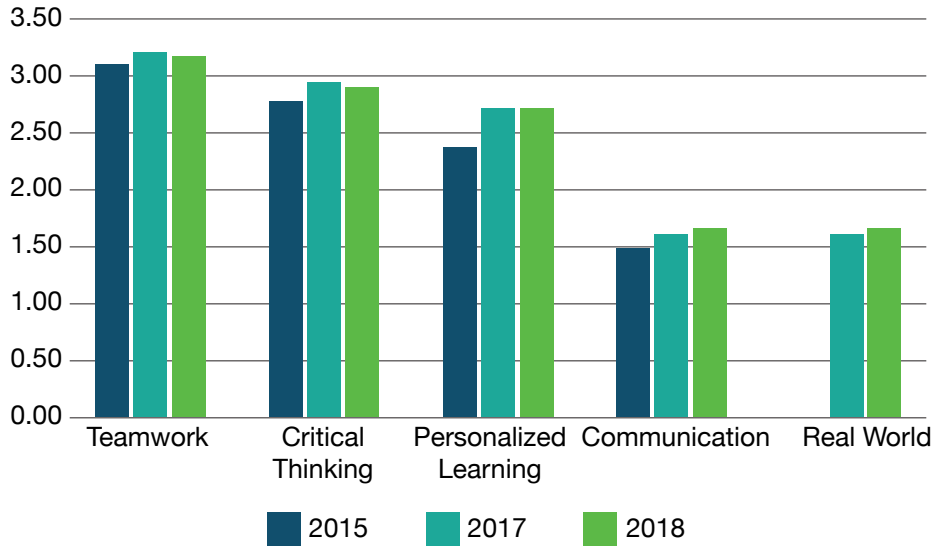
> The classrooms at [school] have been totally transformed. Every single classroom uses technology every single day … We have a long way to go still but students are developing critical thinking skills and are figuring out the answers to problems rather than being instructed on how to solve them.
>
> -Principal



Continued Technology Use and Growth in Teaching

Many teachers said they had come to rely upon iPad devices to streamline their classroom logistics. Teachers had learned the basics of core applications such as Pages®, Keynote, and Numbers®, and were using tools for communication and sharing such as AirDrop®. With this technological proficiency, some teachers said they found everyday classroom management easier and found new ways to communicate with their students. In a 2018 survey, teachers generally reported that they had maintained but did not significantly deepen their use of technology to create learning opportunities such as teamwork, critical thinking, and personalized learning one year after the intensive period of support ended. In a 2019 survey of principals, over 70% reported that students used technology daily in all academic classes.

Figure 4: Teacher Use of Technology Over Time to Create Learning Opportunities for Students



Source: SRI teacher survey, 2015, 2017, 2018

Principals and teachers cited **teacher comfort with technology as a gateway to the inclusion of deeper learning in instruction**. For example, as teachers became more proficient themselves with creating presentations, they were more effective at supporting students with creating presentations that were intentional about how information was communicated to their audience. Teachers' increased confidence using technology also appeared to be associated with greater comfort allowing students to exercise agency and creativity with iPad devices, such as selecting different ways of presenting their knowledge. Many teachers described how iPad devices enabled them to give students personalized assignments, use formative assessment to gain real-time insight into student performance, and offer real-world learning activities, such as connecting their class with others in distant parts of the country or world or holding class outside.

Many of these changes in practice were observed during the first site visit in 2016-17. Study data suggest that the most significant changes to instruction began early in the initiative and then stabilized. **Thus, teachers gaining digital proficiency did not guarantee continued growth but did serve as an important foundation for continued use of technology.**

The SAMR (Substitution, Augmentation, Modification, Redefinition) framework provided a useful tool for some schools. A number of participants described their growth with reference to SAMR, using the framework as a way to think about how much students' learning opportunities were really changing with the introduction of technology. Although most technology use remained basic, several principals and teachers reported aspirations for moving beyond "substitution" to instruction that routinely provides opportunities for students to deepen learning. One described how the iPad devices made it possible to move an activity from "modification" to "redefinition" by extending the ways in which students could demonstrate their knowledge.

> I always think of the SAMR model. When we started, we were very just basic substitution. I think that … most classrooms here are really climbing up that ladder and learning how to make our lessons more meaningful, more engaging, more differentiated, and student-centered.
>
> -Principal

A few teachers shared specific ideas for what continued growth might look like for them. For example, one teacher said they would like to use technology for students to track their progression in physical education and performance in football, arguing that these applications would "impact their learning, their knowledge of weight training, and their progression. They get to see the benefit of what they're learning." Another teacher described wanting to use an Apple tool such as Notes® to create portfolios and show students how to create portfolios for themselves. Others described aspirations of learning how to use technology to do more formative assessment, to make class activities more creative, and to continue opening and broadening the world for their students.

> I think the first year or two that we had the Apple, we really hit strong with showing them what the SAMR model was. We did some great activities with the coordinators through Apple, the ones who came here and did training … I do feel like in the past year or so, we haven't done as much of that, and that could be why we're seeing more teachers at the S [substitution] level.
>
> -Teacher

As discussed earlier, several teachers indicated that progression on the SAMR framework had stalled without continued external PD support. One principal worked to maintain this momentum by stepping into the role of instructional design coach, helping to identify apps and show how they could be used to engage students.

Having experienced new success with technology, several teachers described wanting to find ways to keep growing. One said, "Sometimes you get stuck with doing the same thing and the same thing. I don't want us to get stuck. I want us to keep moving forward with learning, keeping up with the technology that's coming out, and making sure that we use it efficiently and effectively."

> We're all in. We love the devices. We love the fact that we've all learned these devices. In moving forward, I think we have the community onboard. It's just a matter of making sure that we have the right funding and we use our resources well to make sure that we can continue to provide this for our students... There's no way we can go [back to] being a non-tech school. There's no way. We'll have [a] complete revolt....
>
> --Teacher

Community Engagement

Some ConnectED schools used iPad devices in afterschool programs targeted to members of the community. For example, iPad devices were used in after-school programs such as Girls Who Code and Robotics, and in one a specialist conducted coding workshops for parents. A variety of community events such as a STEAM festival and Family Literacy Nights also used the devices. Another school operated an after-school program in partnership with a local college, using the iPad devices for projects such as recording oral histories of local veterans and in coding programs. At other schools, students used their iPad devices to create products that connected to real-world issues in their local community, such as a video that raised awareness about violence against indigenous women or a podcast documenting the history of local veterans.

Participants described aspirations for expanding community services with technology. One school aimed to integrate iPad devices into their plans for becoming a community school, enabling parents to use the technology for activities such as job searching. At another school the principal envisioned a community-based challenge in which students would collect data on food trends and research healthy eating, and then the school would partner with local grocers to enable students and parents to consider nutritional requirements together when making purchases. These activities aimed to extend services to the community, with the added benefit of building support for the 1:1 programs.

Visible Benefits

Sustaining a 1:1 program requires that a critical mass of the teachers, staff, and other stakeholders have bought into use of technology and are committed to doing what is necessary to keep the program going. Many teachers experienced direct benefits and observed ways in which technology use was beneficial for their students. Parents, guardians, and other community members also described having greater visibility into students' classwork and in a few cases experienced direct benefits from community programs using technology. The visibility of these benefits helped to maintain commitment and momentum for ConnectED.

Teachers reported that they found students to be more engaged and that they experienced feelings of success from streamlining their classes, differentiating instruction for students at different levels, and creating new kinds of learning opportunities. Several said that they felt like they could be more creative in their teaching practices. Some felt that they saw improvements in students' academic outcomes that were attributable at least in part to the use of technology. They expressed strong resistance to giving up these hard-won gains.

Changes in teaching practice were appreciated and embraced by many students and parents who participated in interviews. Some had begun to see their acquisition of digital skills and exposure to the broader world opened up through the internet as an important component of their educations. **Parents appreciated their new visibility into their children's learning and their heightened level of engagement with learning, and most expressed strong enthusiasm for the 1:1 program to continue**. At one school the iPad devices enabled a collaborative environment among teachers, parents, and children: "With them going home the parents are involved. We're involved. The kids are involved. Everybody, we're learning together."

How schools created **visible benefits** with iPad devices:

- Sharing student work with parents
- Sending iPad devices home with students to extend the school day
- Sharing information about schools or community with wider audience
- Conducting positive behavior intervention support program featuring student-created videos
- Holding parent technology nights

Several participants emphasized that sharing positive results from ConnectED and demonstrating success in achieving the school's goals would help to motivate teachers and staff and raise their expectations for what the school can achieve, contributing to a positive feedback loop.

Community Support

Strong support from parents and other community members bolstered sustainability in some schools by raising expectations about use of technology and helping to justify resource allocation to technology. In fact, one district voted to increase local taxes in order to support the 1:1 program. This willingness to mobilize resources stemmed from perceived benefits to students, in particular increased student engagement and pride in themselves and their school. ConnectED also enabled greater external orientation in both teaching and community outreach, strengthening connections with parents and other community members.

What Conditions and Factors Mattered Most?

Among the 13 ConnectED schools for which we have qualitative data several years into the initiative, those that showed the strongest indications of continued momentum tended to have multiple supporting factors and conditions in place. **Factors most highly associated with continued momentum appear to be strong leadership, shared vision for what the school aimed to achieve through ConnectED, and community support**. No schools had all the sustainability drivers that have been identified in literature and surfaced in our research, and it may be that strength in some areas can help to compensate for gaps in others.

Our analysis suggests that schools needed multiple areas of strength—including a critical mass of support from teachers and community members—in addition to a strong champion in order to overcome the challenges they faced to sustainability, many of which were beyond the purview of the initiative. For example, during the study period one school experienced a major shift in its student population, and others underwent leadership transitions. Starting with a low base of capacity, uneven buy-in from teachers, or high teacher turnover posed daunting headwinds to sustainability for even highly committed leaders.

In our sample of case study schools, schools with most evidence of momentum for their 1:1 programs tended towards one of two types. A couple served fairly isolated communities and were characterized by tight-knit teachers and staff and low turnover. In these cases, a shared sense of purpose and commitment enabled teachers to overcome lack of access to resources and at least partially compensate for lack of external professional development in the final year, creating their own internal learning communities and working together to figure out strategies for device maintenance. The second cluster of schools benefited from strong district leadership, providing resources and helping to maintain continuity. These two scenarios provide a glimpse into what kinds of conditions might facilitate sustainability in underserved schools.

Conclusion

Schools that serve high concentrations of students facing socioeconomic barriers often encounter significant challenges to sustaining the progress of 1:1 programs. For example, some of the Apple and ConnectED Initiative schools faced changes in leadership and high teacher turnover, and others faced public policy changes that limited screen time for one school and led to a major shift in the student population of another. Resource constraints caused uncertainty over how technology would be maintained and upgraded and limited opportunities for external professional development. These types of challenges are very typical—perhaps inexorable—among technology initiatives in under-resourced schools.

Despite these headwinds, this research found that technology continued to feature prominently in many Apple and ConnectED classrooms a year or more after the most intensive period of support ended. Among the case study schools whose initiatives remained particularly active, stakeholders pursued many strategies to maintain momentum, and these strategies were often shaped by specific factors in their schools. For those characterized by high teacher turnover, district and school leaders focused attention on ensuring that new teachers embraced the ConnectED vision and had access to support to get up to speed with integrating technology. For schools characterized by extremely constrained resources, stakeholders banded together to form internal learning communities and to devise practical solutions for extending the lives of their iPad devices or obtaining additional funding. Members of the school and local communities were motivated to make these efforts by the visible benefits they experienced with technology integration and the opportunities that the 1:1 programs afforded to their students. A frequent refrain among those we interviewed was that they "could not imagine going back."

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