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Evaluation of the First Year of the Oakland Blended Learning Pilot

November 2013

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Suggested Citation:
Woodworth, K., Greenwald, E., Tyler, N., Comstock, M. (2013). *Evaluation of the First Year of the Oakland Blended Learning Pilot.* Menlo Park, CA: SRI International.

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Executive Summary

Much in the same way technology is changing the way we work and interact in other aspects of our lives, technology will inevitably influence the way we approach teaching and learning. Blended learning describes the integration of technology—and online learning in particular—into classroom-based instruction. In 2012–13, the Rogers Family Foundation (RFF) and Oakland Unified School District (OUSD) launched a blended learning pilot program in four schools.

With support from RFF, OUSD, and other external assistance providers, the goal of the Oakland Blended Learning Pilot is to support teachers in instructing students in small groups, integrating digital content, and using data to inform differentiated teaching and learning. The first year of the pilot, involving four schools and 26 teachers, supported substantial experimentation as teachers worked toward increasing their comfort and sense of efficacy in each of these areas. The idea is that as teacher practice changes along these dimensions, students will experience more personalized learning and more engaging learning activities and have increased opportunities for self-direction and metacognition. These student experiences, in turn, are expected to increase student engagement and agency and ultimately academic achievement, while also increasing teachers' professional satisfaction.

This report presents evaluation findings from the first year of the pilot. The purpose of the evaluation was twofold: (1) to support the pilot program by informing mid-course refinements and corrections, and (2) to provide information to the larger education community on the challenges and successes associated with implementing blended learning in a large urban school district. To inform the evaluation, the SRI team collected data through teacher surveys, classroom observations, school visits that included teacher and principal interviews and student focus groups, and additional interviews with key stakeholders. Because the pilot intended to support substantial experimentation in this first year, the evaluation was designed to examine early-stage implementation and does not assess the impact on student outcomes. Pilot sponsors report a commitment to examining student outcomes as the initiative matures in the next 2 years.

Key Findings

Technology infrastructure. Implementing blended learning requires, at the most basic level, ensuring Internet access, high-quality hardware, and access to digital content. For many schools and districts, establishing the basic infrastructure to support reliable Internet connectivity and sufficient bandwidth is no easy task. In OUSD, bringing school facilities into the 21st century is a work in progress.

- In two of the four pilot schools, the infrastructure was in place at the start of the school year and ongoing technology issues were minimal.
- At another school, the Internet and hardware worked, but the launch was delayed because the technology was put in place later; at this school, teacher satisfaction with tech support was mixed.
- In one school, technology challenges undermined the pilot effort.

Selection and use of digital content. Online programs offer a variety of instructional features in a range of formats, such as interactive game-based activities, instructional videos, nonfiction articles, and open-ended questions, among others. A critical step in establishing a blended-learning environment is teachers' selection of digital content suitable to their classroom contexts and the strategic use of that digital content to meet classroom needs.

- Pilot teachers faced a variety of early and critical decisions when integrating digital content: which and how many programs and what role those programs would play in instruction. The decisions they faced about the role digital content would play in instruction included (1) assigning digital content or leveraging adaptive features of particular programs, (2) using digital content for remediation or introduction of new content, and (3) determining which students to target with which online programs.
- Over the course of the year, pilot teachers used a range of digital content for a variety of instructional purposes. Among the digital programs were Achieve 3000, i-Ready, Khan Academy, ST Math, and iLearn iPASS.
- Pilot teachers most often used online programs for remediation and practice; teachers tended not to use the computer-based programs to introduce new concepts, nor did they find the programs well suited to helping students develop higher-order thinking skills. Still, the majority of pilot teachers reported online programs to be of high quality overall.
- Pilot teachers faced a variety of challenges with integrating digital content. Two-thirds (67%) saw lack of time to learn the digital content as a barrier to using digital content, and more than half of all pilot teachers (58%) found lack of time to plan lessons to integrate digital

content to be a barrier. In addition to time constraints, nearly two-thirds of all pilot teachers (62%) identified insufficient professional development on using digital content as a barrier.

- Implementation of only a select few digital programs enabled teachers to develop a thorough understanding of the programs and use them strategically.

Classroom management. For the most part, the blended learning pilot supported the implementation of a "station-rotation model" in which students moved from stations in which they worked online to stations in which they worked directly with their teachers in small-group settings; in some cases, students also went to independent-work stations, off the computers.

- Introducing and managing a rotational model was challenging for many teachers.
- Teachers had the added challenge of supporting students so that they could be successful in a blended-learning classroom, including help with basic computer use and troubleshooting, as well as self-regulation necessary for independent learning.
- Facilitating small-group rotations and easing students into independent learning on the computers were more easily accomplished when teachers had help. In many classrooms where implementation went smoothly, a second adult was in the classroom.
- Even teachers who had a second adult in the classroom felt the need to establish new routines and systems to facilitate smoother implementation of blended learning.
- When teachers successfully implemented new strategies and students were comfortable with the procedures and routines, both on and off the computers, teachers were able to let students make more choices. However, giving students more independence came with its own set of management challenges.

Using data, digital content, and small-group instruction to personalize teaching and learning. Fully realizing a vision of personalized blended learning involves differentiating students' learning experiences based on more, better, and faster data. Taking this step requires relatively easy access to meaningful data and strategies for providing students with tailored learning experiences, based on good information about what they need next.

- Teachers implementing blended learning had access to some combination of three kinds of digital data platforms: individual platforms from each online program; a "data dashboard" that integrated across programs; and assessment platforms that enabled teachers to create, score, and analyze their own assessments.
- Digital content providers offer tools to facilitate interpretation and use of data, but few teachers have become comfortable using these tools regularly to inform instructional decisions.

- Pilot teachers seek rapidly interpretable snapshots of student progress toward content standards; some also emphasize information to help monitor students' on-task behavior.
- While conceptions of differentiated instruction varied, the two most common forms of differentiation among pilot teachers were the use of small-group instruction by performance level and the use of adaptive computer programs for individualized learning experiences.
- Some teachers strategically employed a variety of online programs based on perceptions of fit between program and student performance level.
- Teachers who regularly used data to differentiate instruction often leveraged strategies that support students to monitor their own learning through real-time feedback and progress tracking.
- A few pilot teachers reported enabling higher-performing students to work on different content once they had mastered current standards.

Perceived student benefits and teacher satisfaction. Any intervention in schools ultimately aims to improve academic achievement for students, including Oakland's Blended Learning Pilot. However, because this was the first year of a pilot that encouraged substantial experimentation, coupled with the small sample size (i.e., four schools) and lack of a well-matched comparison group, SRI did not analyze student test scores. Instead, the evaluation examined teachers' and students' perceptions of the academic and nonacademic outcomes associated with blended learning, as well as teacher satisfaction with the pilot.

- Teachers' perceptions of the extent to which blended learning has helped increase student learning are mixed. Nearly two-thirds (61%) of pilot teachers agreed that students' learning and understanding of material had improved due to the increased use of small-group instruction, whereas fewer than half of all pilot teachers (43%) agreed that students' learning improved due to the use of digital content. Interestingly, fewer than one in four pilot teachers (22%) agreed that their students performed better on benchmark assessments since blended learning was introduced in their classrooms.
- Most pilot teachers reported that using digital content increased both student engagement (91% agreed that students were highly engaged by the online programs) and student agency (70% agreed that the digital content helped students take ownership for their own learning).
- Blended learning increased students' comfort with technology and created some opportunities for collaboration.
- Teacher satisfaction with blended learning varied. Overall, most teachers who participated in the pilot in 2012–13 would recommend blended learning to others (70%), thought that blended learning met the needs of their students (65%), and were eager to continue with the blended learning pilot program again in 2013–14 (79%).

Lessons Learned

As technology increasingly influences—and ideally enhances—teaching and learning in K–12 classrooms, the field must consider how best to support teachers and schools in making this transition. We know from decades of reform efforts that there are no silver bullets: it is very difficult for any education reform to meaningfully change teaching and learning (Tyack and Cuban, 1995). To ensure that blended learning becomes a strategy for supporting effective instruction and increasing student agency, rather than a replacement of paper assignments with digital worksheets, program developers and educators must be intentional about the role and purpose of online learning, leveraging the best of what it has to offer and adapting as the technology changes. Although current efforts to implement blended learning are in the early stages, lessons from the experiences of the pioneers may help others as they engage in this important work.

Given the wide range of teachers' comfort with technology and experience with the instructional strategies consistent with blended learning, adopting blended learning is more of a leap for some teachers than for others. As such, one lesson may be that it makes sense to begin any rollout with the more eager, early-adopter teachers and bring along the more hesitant teachers when others have already worked through some of the inevitable challenges and have positive experiences—perhaps even implementation models—to share. It may also be beneficial to focus implementation and the associated support by choosing to work initially in just one content area or at one school level (i.e., middle or elementary).

Once schools and teachers are recruited, the first step to transitioning to a blended-learning model is to acquire the necessary technology infrastructure. This piece should not be underestimated. Next, teachers will need ample time and support to become acquainted with the digital content and determine its purpose in their classroom contexts. As Oakland pilot teachers learned, less is more: committing to a few carefully selected programs allows teachers to gain a more thorough understanding of those programs and to implement them more strategically. Teachers and their support providers also need to plan for classroom routines and systems that support integration of digital content. In Oakland, while teachers' success with implementation of small groups, student-directed learning, and systems around digital content use varied, pilot teachers rarely had the opportunity to collaborate and observe other pilot teachers' classrooms. Schools, districts, and others interested in implementing blended learning should consider providing teachers with well-structured opportunities to collaborate with and observe other teachers' classrooms and to share best practices for creating effective systems around the use of online instruction. Schools and teachers will also benefit from implementation models that have been field-tested with a variety of learners.

Using data to inform instruction is another important aspect of the blended-learning model. Among pilot teachers, data from digital content programs were largely underutilized, and the pilot teachers who regularly incorporated data into their practice typically used student results to inform groupings without significantly tailoring instruction within those groupings. Thus, another lesson is that teachers not only need to understand how to access and interpret data, they also must understand how to translate those data into targeted, differentiated teaching strategies that meet their students' specific needs and abilities.

In sum, implementing personalized blended learning requires the coordination of many essential components: updated technological infrastructure, carefully selected online learning programs, new classroom routines that help students take responsibility for their own learning, robust data systems, and instruction that is tailored to meet the needs of a diverse student population. Over the course of the first year of this pilot, educators in Oakland made progress on all these fronts. Moreover, the pilot's ongoing emphasis on innovative and effective instruction, increased student agency, and the deliberate integration of facilitative technology holds promise for the future.

Introduction

Much in the same way technology is changing the way we work and interact in other aspects of our lives, technology will inevitably influence the way we approach teaching and learning. Blended learning describes the integration of technology—and online learning in particular—into classroom-based instruction.[1] In fall 2011, the Rogers Family Foundation (RFF) and Oakland Unified School District (OUSD) school leaders began to plan a blended learning pilot program that launched in four schools in 2012–13. More specifically, the Oakland Blended Learning Pilot aims to support teachers in changing their instructional practice through the introduction of online learning in the classroom with an emphasis on small-group rotations. In the blended-learning lexicon, this model is referred to as the "station-rotation model" (Staker and Horn, 2012).

With support from RFF, OUSD, and other external assistance providers, the goal of the pilot is to support teachers in instructing students in small groups, integrating digital content, and using data to inform differentiated teaching and learning (Exhibit 1). The first year of the pilot supported substantial experimentation as teachers worked toward increasing their comfort and sense of efficacy in each of these areas. The idea is that as teacher practice changes along these dimensions, students will experience more personalized learning and more engaging learning activities and have increased opportunities for self-direction and metacognition. These student experiences, in turn, are expected to increase student engagement and agency and ultimately academic achievement, while also increasing teachers' professional satisfaction.

This report presents evaluation findings from the first year of the pilot. As a report on the first year of a complex and dynamic pilot effort, it is a snapshot in time; pilot schools and support providers are working to strengthen implementation and much continues to change. The goal is to provide actionable information to stakeholders in Oakland and more general lessons to the larger education community on the challenges and successes associated with implementing blended learning in a large urban school district.

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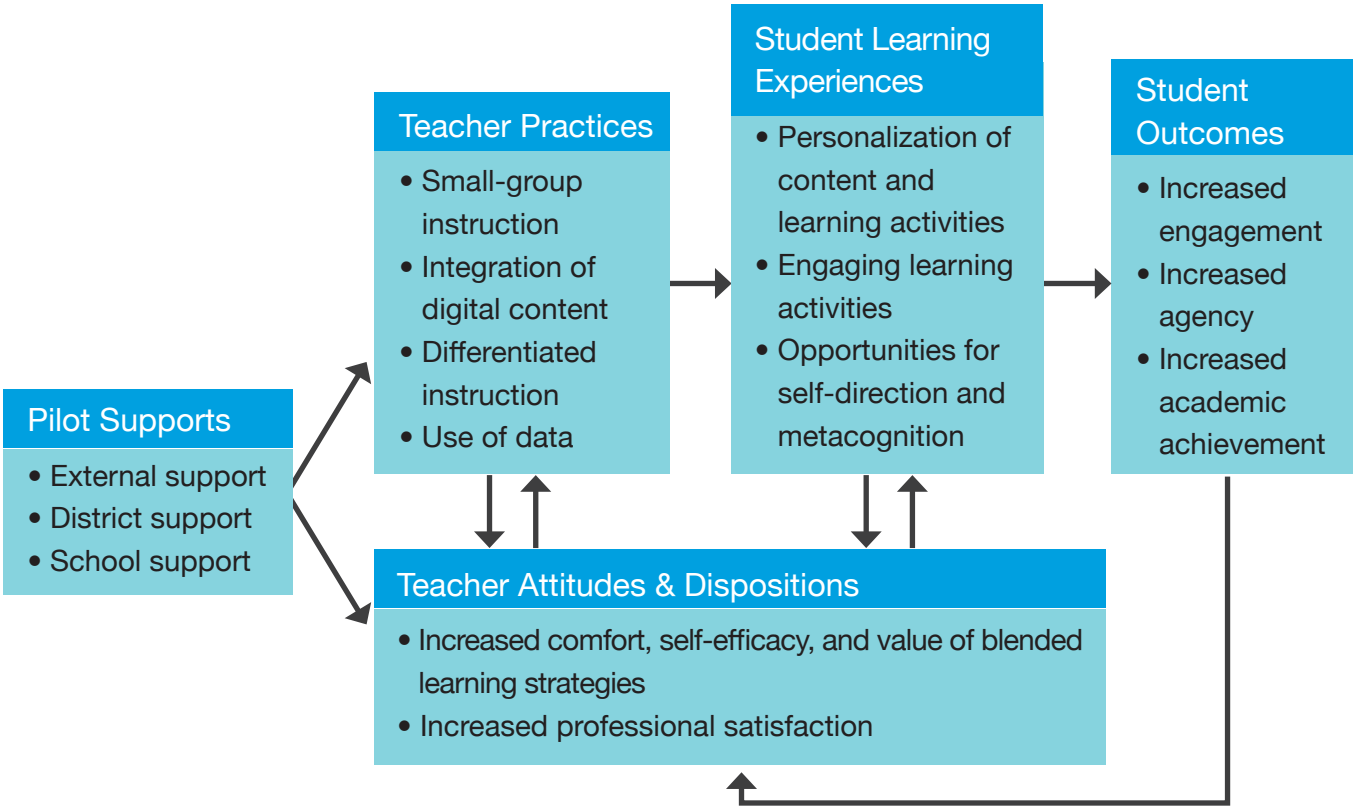
1 To encourage the use of shared language as educators and researchers implement and study blended learning, Staker and Horn (2012) have offered the following definition: "Blended learning is a formal education program in which a student learns at least in part through online delivery of content and instruction with some element of student control over time, place, path, and/or pace and at least in part at a supervised brick-and-mortar location away from home."

Exhibit 1. Theory of Change



Context for the Pilot

While much of the experimentation with—and research on—blended learning is occurring in charter schools (see Bernatek, Cohen, Hanlon, and Wilka, 2012), the context for this pilot is a large urban school district. The contextual factors that may be relevant to this intervention include

- OUSD's long history of complex governance structures and management challenges;
- leadership committed to innovation and improved outcomes for young people;
- communities that are affected by crime, drug abuse, and gang activity where social capital is uneven;
- pockets of excellence as well as ongoing challenges in attracting, supporting, and retaining effective educators;
- declining student enrollment and significant fiscal constraints;
- new curriculum adoptions;
- other initiatives aimed at boosting student learning; and
- a changing teacher evaluation system.

Moreover, OUSD and its schools operate in a federal and state policy context that includes academic standards for students and high-stakes assessment and accountability systems, all of which are in the midst of a transition to the Common Core State Standards (CCSS).

The pilot included four schools, two elementary and two middle, located in the high-poverty, high-crime area of East Oakland. The schools applied to be part of the pilot, and RFF selected them on the basis of their strong leadership, good instructional foundation, positive learning culture, and data-driven teaching strategies. All four schools had seen sustained positive growth in their API scores, averaging a 109.5-point increase in 5 years (2007–11), compared with the 68-point growth that OUSD averaged over the same 5 years.

Even though the OUSD Blended Learning Pilot started small, it was quite ambitious and required support from a variety of players. At the outset, RFF and OUSD established a Blended Learning Coordinating Committee that brought together stakeholders from many different areas and met every 2 weeks until December 2012; from that point on, it met every 6 weeks.[2] In addition, each school established its own planning committee, and school leaders committed to support their pilot teachers by providing initial planning time, designating ongoing professional development time for the work, and prioritizing the pilot. RFF provided support through its Director of Blended Learning and two blended-learning specialists. These three people provided whatever support was needed of them, including but not limited to technical, instructional, and moral support. OUSD dedicated a project manager to coordinate the district's involvement and provided up-front support by setting up the infrastructure necessary to implement a blended-learning classroom, including increasing bandwidth, adding wireless access points, and providing student information and assessment information to support increased use of data.

2 This committee included representatives from OUSD's departments of Leadership, Curriculum & Instruction; Information Technology; and Research, Assessment & Data; as well as RFF leadership and school leaders.

Structure of the Pilot

Ultimately, RFF intended for the pilot to support whole schools in making the transition to blended learning. However, in the first year, schools had substantial latitude in developing their plans, and the scope of implementation varied significantly from site to site (Exhibit 2). In addition, the support schools received to launch the pilot differed considerably.

Technical assistance providers. RFF brokered introductions to two technical assistance (TA) providers. The technical assistance providers were charged with establishing buy in, encouraging experimentation and risk-taking, and managing the steep learning curve for teachers. More specifically, they were to

- work with school planning committees to establish goals for the pilot, make decisions about hardware and online learning programs, and redesign classroom space;
- work with OUSD to assess existing bandwidth and develop a plan to ensure sufficient bandwidth to support the pilot;
- provide some professional development—either themselves or in collaboration with others;
- develop a user interface to support a "single sign-on" portal and a "data dashboard" that would integrate information from the online programs to provide real-time information on student progress; and
- support the schools through a change management process.

Two of the schools opted to work with TA Provider 1; these partnerships endured throughout the 2012–13 school year. In these schools, the TA provider took the lead early by laying the foundation for collaborative decision-making and professional learning. They ensured clear memoranda of understandings with the school leadership, built relationships with the teachers, and worked with the district to establish paid collaboration time for pilot teachers. While this kind of change management is, of its essence, an ongoing task, TA Provider 1's significant investment of time with the two schools at the beginning of the process is reflected in pilot teachers' higher levels of satisfaction with their technology infrastructure, selection of digital content, classroom management experiences, and use of data and differentiation to personalize student learning experiences.

The two other schools elected to work with TA Provider 2; however, in September 2012, TA Provider 2 discontinued its relationships with both schools. In TA Provider 2's absence, the two schools, and RFF, scrambled to fill the void. Teachers at these schools had opportunities to participate in professional development provided by an outside organization, and RFF staff

provided ongoing support (though at different levels at the two schools). Ultimately, teachers at these schools were left without the same level of support that teachers at the other schools had and with some concerns about the initial advice TA Provider 2 had given.

Teacher participation. Teachers became involved in the pilot in different ways at each school. In two schools, teachers opted in voluntarily; in one school, the principal recruited specific teachers for the pilot; and in the other school, the principal required all teachers to participate. In the end, the number of teachers participating in the pilot ranged from 2 to 12 per school.

Hardware and digital content. School planning committees' work with their technical assistance providers to choose hardware and software also led to different choices. Schools chose hardware ranging from refurbished desktop PCs to new Windows desktops and laptops to Apple laptops. Teachers also selected a diverse set of online programs that spanned English language arts (ELA), mathematics, science, and social studies. Specific programs varied by school and within school by grade level, discipline, and teacher.

Professional development. The pilot included professional development (PD) to support teachers in making the transition to blended learning. The PD was to be needs based and adaptive to teachers, with the idea that it would be tailored to teachers' existing level of knowledge and teachers would be given time to work at their own pace. It came from a variety of sources: RFF's Director of Blended Learning, TA Provider 1, an external PD provider, and various digital content providers.

Exhibit 2. Summary of School Participation and Variation

School	Grades served	Grades involved	Number of teachers involved	Online content areas	TA provider	How teachers became involved	Hardware
Elementary 1	K–5	4th grade	2	Math; ELA	TA Provider 1	Recruited by principal	Mac laptops
Elementary 2	K–5	1st–5th grades	12	Math; ELA	TA Provider 2	Whole school	PC desktops
Middle 1	6–8	6th–8th grades	7	Math; Social Studies; Science	TA Provider 1	Opt-in	PC laptops
Middle 2	6–8	6th–8th grades	5	Math; ELA; Science	TA Provider 2	Opt-in	PC laptops and desktops

Evaluation Methods

In March 2012, RFF engaged SRI International to design and conduct an evaluation of the pilot. The purpose of the evaluation was twofold: (1) to support the pilot program by informing mid-course refinements and corrections, and (2) to provide information to the larger education community on the challenges and successes associated with implementing blended learning in a large urban school district. Because the pilot intended to support substantial experimentation in this first year, the evaluation was designed to examine early-stage implementation and does not assess the impact on student outcomes.[3] Project sponsors report a commitment to examining student outcomes as the initiative matures in the next 2 years.

To inform the evaluation, the SRI team collected data through teacher surveys, classroom observations, school visits that included teacher and principal interviews and student focus groups, and additional interviews with key stakeholders.

Teacher surveys. SRI administered baseline (summer/fall 2012) and spring (2013) surveys to all classroom teachers at all four pilot schools. Because the ultimate goal was to implement blended learning schoolwide, the research team sought to collect baseline data from all teachers, including those who might opt to participate in the pilot at a later date (Exhibit 3). However, unless otherwise noted, survey findings are reported for pilot teachers only, combined across all four schools. Although the sample size is small, almost all of the participating teachers completed the survey, and we are confident describing their experiences with implementing a blended-learning approach in the 2012–13 school year; nonetheless, because this is a small-scale pilot, we cannot generalize from these data regarding what might have occurred had the district as a whole adopted a blended-learning approach. In addition, the sample sizes for school-level survey findings, which may be noted in the text, are too small to allow for reliable statistical inference but, in most cases, include all participating teachers at a school so do reflect the perceptions of the particular teachers participating in the pilot.

Classroom observations. A pair of SRI researchers conducted four classroom observations over the course of the year in each of four different classrooms. The research team also conducted post-observation interviews with each teacher. SRI selected the teachers for this aspect of the study in consultation with RFF. Selection criteria included that the teachers represent both the middle and elementary levels, have a mix of prior experience with technology in the classroom, and are making a real effort to implement blended learning in their

3 Consistent with the U.S. Department of Education's Institute of Education Sciences (IES) and the National Science Foundation's guidelines (2013) that urge researchers to reserve "impact research" for "fully developed interventions," SRI encouraged RFF to focus evaluation resources in this first year of the pilot on implementation with the goal of strengthening the intervention such that it would be more likely to improve student outcomes in the longer term.

Exhibit 3. Response Rates for the Four Pilot Schools at Baseline and Spring

School	n All teachers	n Pilot teachers	Baseline 2012		Spring 2013	
			All teachers	Pilot teachers	All teachers	Pilot teachers
Elementary 1	19	2	100%	100%	84%	100%
Elementary 2	14	12	88%	88%	86%	92%
Middle 1	19	7	84%	100%	79%	100%
Middle 2	16	5	60%	100%	75%	80%
Overall	68	26	85%	97%	81%	92%

classrooms. In the end, the teachers included a middle school math teacher, a middle school social studies teacher, and two elementary school teachers (grades 3 and 4), from three of the four schools.

School visits. A team of SRI researchers spent one day at each of the four schools. The visits included principal interviews, observations and interviews with pilot and non-pilot teachers, and student focus groups. The research team asked for student focus groups at each school with students who were in at least one blended-learning class and represented a range of achievement levels. Only three of the four schools were able to put together student focus groups; and, in these cases, the focus group students may not have represented a wide cross-section of students.

Interviews with key stakeholders. A total of eight stakeholders were interviewed in spring 2013 from each of the invested organizations—Rogers Family Foundation, Oakland Unified School District, TA Provider 1, and the external PD provider.

Organization of This Report

The remainder of this report focuses on teachers' experiences implementing blended learning in their classrooms. We describe the support they received and the influence of contextual factors as the teachers perceived them. Our findings are organized as follows:

- Technology infrastructure
- Selection and use of digital content
- Classroom management
- Using data, digital content, and small-group instruction to personalize teaching and learning
- Perceived student benefits and teacher satisfaction
- Lessons learned

Technology Infrastructure

Implementing blended learning requires, at the most basic level, ensuring Internet access, high-quality hardware, and access to digital content. For many schools and districts, establishing the basic infrastructure to support reliable Internet connectivity and sufficient bandwidth is no easy task. In OUSD, bringing school facilities into the 21st century is a work in progress. At the four pilot schools, the quality of the infrastructure ranged from strong enough to fully support blended learning to so poor that it inhibited efforts to experiment with Internet-based technologies.

In two of the four pilot schools, the infrastructure was in place at the start of the school year and ongoing technology issues were minimal.

In two schools, teachers recognized the substantial work that went into ensuring that Internet connectivity and bandwidth, hardware, and online content were in place at the start of school. Referring to the work of TA Provider 1, RFF, and OUSD, a pilot teacher explained: "They fixed all the computers, they fixed the Internet, they made it so it was very usable." She went on to explain that TA Provider 1 set up her classroom and established a single sign-on interface for students. She noted that "there's a lot of behind-the-scenes work that they did at the beginning of the year"—without which implementation of blended learning would have been "really hard." Another pilot teacher similarly reflected on the importance of "putting all the resources into place to make this happen from day one" and noted that this support is essential for "any school that's considering going blended."

Of course, getting to this place involved a variety of actors working together on behalf of these two schools. TA Provider 1 staff met with the district and school principals over the summer to assess bandwidth capacity at the schools. A TA Provider 1 representative explained that they had a strong focus on establishing bandwidth infrastructure over the summer before the start of the pilot because they had heard from teachers that "there was a real lack of [trust] around anything related to technology being stable." Based on TA Provider 1's assessment, the OUSD project manager and information technology (IT) lead made sure that additional wireless access points were installed as needed. RFF grant funds purchased some of the wireless access points, and district staff oversaw their installation. Similarly, RFF bought the requested hardware and worked with the district as well as outside contractors to image[4] each machine.

4 When a machine is imaged the hard drive is cloned and saved. The image is an exact replica of a computer at the time the image was taken. This allows a computer to be restored to the state it was in at the time of the imaging, protecting it from accidental deletions, problematic upgrades, viruses, etc.

Even with solid infrastructure in place at the start of the year, technology problems could have emerged at any time; however, at these two schools, teachers reported very few technology issues, and when tech support was needed, the help was there. In fact, in these two schools, 100% of the pilot teachers were "satisfied" or "very satisfied" with the support they received when they or their students experienced technical difficulties. Again, this support came from a variety of sources: teachers had support from RFF's Director of Blended Learning, RFF's blended-learning specialists, and TA Provider 1. For example, when technology issues did arise during the year, they could put in "tickets" to TA Provider 1 requesting assistance. The issues that emerged included such problems as a student not appearing on a class roster for a particular program or a student's password not working. While the teachers varied in terms of the extent to which they took advantage of this support, the teachers who did use it found TA Provider 1 to be "very responsive." TA Provider 1 staffed its help desk to provide prompt responses, and, if the question was really for an online content provider, they would follow up with that provider and get an answer for the teacher. As RFF's Director of Blended Learning noted, "In the grand scheme of things, [the issues] are little, but to that teacher, they are immediate." RFF's Director of Blended Learning also credited Deep Freeze, a software program that protects the operating system once the computers restart, for the lack of technical issues: "No matter what the kid does, they delete the icon, change the background, delete the bookmark or whatever it is, you just restart the computer, and it goes right back to looking exactly how it's supposed to look."

At another school, the Internet and hardware worked, but the launch was delayed because the technology was put in place later; at this school, teacher satisfaction with tech support was mixed.

Because of competing demands and limited capacity of OUSD IT staff, this third school did not have sufficient bandwidth at the start of the school year. In addition, while some classrooms got started with blended learning by October 1st, other classrooms did not have their computers up and running until late January or early February. As the new computers arrived, RFF staff helped unload them and plug them in. These delays inevitably affected teachers' attitudes about the adequacy of the tech support. Forty percent of the pilot teachers at this school were not satisfied with the support they received to solve technical difficulties, while the remaining 60% were equally divided in their responses between somewhat satisfied, satisfied, and very satisfied.

Teachers' concerns with the support may have resulted from the delays or because this group of teachers needed more support than their colleagues at the other schools, but also perhaps because they did not have access to the same level of support (i.e., no full-service technical assistance provider, like TA Provider 1). The teachers did, however, receive substantial assistance. For example, both RFF blended-learning specialists worked at this school—

one spent all of her time working at this school (29 hours per week), and the other spent approximately 20 hours per week there. These support providers worked to address a range of needs, including acquiring earphone covers for lice prevention and getting more classroom chairs when needed. As the principal explained, "The support is real." It may be that, in this case, despite the substantial support, still more was needed.

In one school, technology challenges undermined the pilot effort.

At this school, wireless connectivity worked inconsistently, so teachers could not make use of laptops. When they turned to hardwired computers, they had too few for students and too many for the physical space of their classrooms. Teachers and students also struggled with the fact that they never established a single sign-on system. All of the pilot teachers at this school reported that infrastructure was at least a minor barrier to incorporating digital content in their classrooms.

A teacher explained how all these challenges undermined her ability to implement a blended-learning model in her classroom: "The problems came from hardware and tech issues. You have to get that stuff hammered out and it needs to be as flawless as possible as quickly as possible. As a teacher, you want to start early in the year, get kids used to it, get them acclimated. I was always hesitant. It always felt messy, but it could have been so smooth." She went on to add, "We know this is something that could work, but you don't want to sacrifice class time to 'My Internet's not working. Help, help, help.'" Another teacher explained that she abandoned blended learning because technical problems arose too frequently, and she did not want to use class time to deal with them.

For a variety of reasons, teachers at this school received less ongoing support from the various blended-learning support providers. After TA Provider 2's departure, this school had no full-service technical assistance provider. This school also received less support from other sources, perhaps because of a perception that they had ample support onsite (e.g., they had other partnerships and supports available in the school). Another reason they did not receive as much support may be that because of technology issues they were only minimally implementing blended learning. In response to a question about professional development, a pilot teacher answered: "Because our technology wasn't up and running effectively, it was hard for us to have any kind of conversation about curriculum or how to use programs…I think [our professional development provider] could have been more helpful if our technology wasn't our issue."

Selection and Use of Digital Content

Online programs offer a variety of instructional features in a range of formats, such as interactive game-based activities, instructional videos, nonfiction articles, and open-ended questions, among others. A critical step in establishing a blended-learning environment is teachers' selection of digital content suitable to their classroom contexts and the strategic use of that digital content to meet classroom needs. The pilot teachers' experiences with blended learning point to the importance of establishing a clear vision of blended learning in the classroom prior to implementation: which programs to use, when to use them, and whom they will serve. Establishing this vision requires thoughtful consideration for the role of online instruction in the classroom and a thorough understanding of the features of available digital content providers, an often overwhelming and time-consuming process. Pilot teachers reported a variety of challenges associated with the selection and use of digital content and a range of comfort levels with the integration of digital content; however, an increased understanding of programs' affordances and constraints enabled purposeful and strategic use of those programs for specific instructional purposes.

Pilot teachers faced a variety of early and critical decisions when integrating digital content: which and how many programs and what role those programs would play in instruction.

In determining which and how many programs to select for their blended-learning model, teachers needed to consider how they planned to leverage online instructional programs for their specific classroom contexts. The decisions they faced about the role digital content would play in instruction included (1) assigning digital content or leveraging adaptive features of particular programs, (2) using digital content for remediation or introduction of new content, and (3) determining which students to target with which online programs.

Assignable versus adaptive digital content. Some digital programs offer adaptive features (see Exhibit 4 below), differentiating the content presented to students based on diagnostic assessments and ongoing achievement within the program. Thus, teachers faced a decision to leverage the adaptive features of certain digital programs or to assign specific content within those and other programs. Leveraging content adaptability allows for facile differentiation of content tailored to individual student performance levels. Assigning content, however, allows for alignment of online instruction with the teachers' curricular objectives. In reference to her decision

about which online programs to use, one middle school teacher explained, "I was very split. I had no idea what I really wanted. I didn't know if I needed an adaptive curriculum or a content-related curriculum. So, I actually went with two different curriculums—one's adaptive, one's content related—in order to basically make sure that I could cover all my bases."

Remediation and practice versus introduction of new concepts. By design, online programs allow students to practice skills and learn concepts without teacher mediation. Thus, teachers also needed to determine whether to use digital content primarily for students to practice previously covered skills and build procedural fluency or to introduce new concepts to students and build conceptual understanding. A middle school pilot teacher explained, "It just made me think about…what are you trying to do? Are you trying to support the lessons that you are teaching in class, or are you trying to remediate skills that students don't have that you really don't have time to teach? So it depends on what your goal is."

Which students to target. Digital programs are also designed to provide instruction and practice to a range of student levels and types of learners. Teachers needed to determine which students would benefit from which online programs: all students or specific subgroups, such as low-performing or high-performing students or English language learners. They also needed to consider whether they might use the digital content to serve different purposes for different students.

When selecting online instructional programs, many teachers expressed feeling overwhelmed, especially at first, by the sheer number of products on offer. Teachers were uncertain how they planned to use the online programs and which were the best fit for their classrooms. Moreover, many teachers made their ultimate choice of digital content with limited knowledge of the programs and their features.

Over the course of the year, pilot teachers used a range of digital content for a variety of instructional purposes.

Pilot teachers selected a variety of programs (Exhibit 4) on the basis of their awareness of, access to, and comfort with the programs. Selection of programs typically involved some level of collaboration among school leaders, pilot teachers, and external support providers. Thus, teachers at the same schools often used similar sets of programs in their classrooms.

In addition to online instructional programs, teachers at two schools also used online programs for creating and administering assessments (Exhibit 5). Although these pilot teachers considered these programs part of their blended-learning model, the programs are distinct from digital content for blended learning (Exhibit 4), in that they allow for assessment and immediate feedback but are not designed to provide instruction.

Exhibit 4. Summary of School Participation and Variation

Digital program	Subject	Description of content provided*	Pilot teachers' understanding and use of content**
Achieve3000	ELA	Comparable programs for each school level (e.g., KidBiz3000, TeenBiz3000, Empower3000) to target content area literacy skills Adaptive content All assignments provided in the same format to routinize literacy and critical-thinking skills Routine assessments with immediate results for students and teachers	Teachers used this program in ELA for reading and comprehension, writing, and vocabulary practice. Elementary teachers were the primary users of this program. Most teachers leveraged the adaptive features of this program. Some teachers perceived it to target higher-level reading and comprehension skills, while others were skeptical of the rigor or relevance of content.
i-Ready	ELA, Math	Diagnostic and instructional tool for grades K–8 Adaptive content Instructional tool that provides students with animated, scenario-based questions Provides teachers with instruction recommendations based on student progress and downloadable resources	Several elementary teachers reported use of this program in ELA; some of these teachers also used it for math, although less frequently. All pilot teachers using this program explained its value in intervention with low-performing students.
Khan Academy	Math	Contains a library of content, including interactive challenges, assessments, and videos Assignable content Offers "hints" for students, which break down the solution to the problem Provides teachers with immediate class- and student-level data	Middle school teachers used this program to assign concepts and practice problems to students. Teachers found this program more instructive than the other programs they used. One teacher noted that this program is best for self-motivated students because of its instructive features.
ST Math	Math	Game-based instructional software for K–5 and secondary intervention Interactive animations that visually represent math concepts and target conceptual understanding and problem-solving skills Adaptive and assignable content Program provides visual representation of solutions to problems following students' completion of activities Provides teachers with student data reports	A few elementary pilot teachers reported using this program, although less frequently than other digital content programs. Curriculum designed for math intervention in grades 3–8 and high school support classes Adaptive content Provides narrated and illustrated instruction and practice problems Provides teachers with student data reports

* Descriptions of digital content are derived from program websites. Note that all digital content providers also describe their content as aligned with the Common Core State Standards.

** Based on interviews with pilot teachers.

Exhibit 4. Summary of School Participation and Variation (Continued)

Digital program	Subject	Description of content provided *	Pilot teachers' understanding and use of content**
iLearn iPASS	Math	Curriculum designed for math intervention in grades 3–8 and high school support classes Adaptive content Provides narrated and illustrated instruction and practice problems Provides teachers with student data reports	Middle school teachers used this program primarily for review, remediation, and practice with previously covered math topics. Some teachers leveraged the adaptive features of the program.
Revolution Prep	Math	Math instruction and practice for 6th grade through Algebra II Provides a breakdown of the question if answered incorrectly Classes of students work to build a digital city with every correct answer Tracks student actions and provides immediate data to teachers	One middle school pilot teacher who reported using this program believed it to be best for diagnosing which part of a question the students don't understand, as it provides a breakdown of the questions for students.
Mangahigh	Math	Animated, game-based math instruction Assignable content Offers instructive videos and games for practice Tracks student progress through points earned in games	Two middle school pilot teachers reported using this program and noted that it was engaging because of the competitive nature of the games. One teacher did not believe it focused on higher-order thinking skills or was well aligned with the CCSS.
LearnZillion	ELA, Math	Math instruction for grades 2–12 Assignable content Offers narrated instructive videos	One middle school pilot teacher who reported using this program found it most successful with her independent and high-level learners.
McGraw-Hill ConnectED	All	Provides content through an e-book containing visuals and text Assignable content Allows teachers to create weights for grading and customize standards covered Tracks student results and provides teachers with data reports	One middle school pilot teacher reported using this program for ELA instruction. This teacher found it effective for providing practice with text-based questions but ineffective for improving comprehension and the ability to craft an argument.

* Descriptions of digital content are derived from program websites. Note that all digital content providers also describe their content as aligned with the Common Core State Standards.

** Based on interviews with pilot teachers.

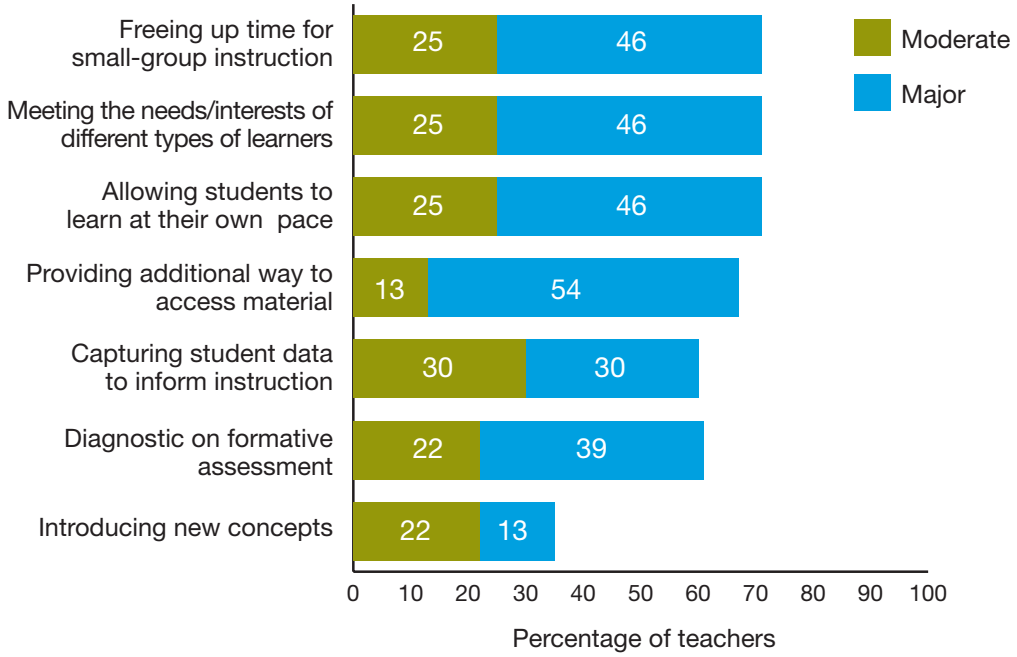
By the end of the year, teachers used digital content for a variety of purposes (Exhibit 6). A majority of pilot teachers reported using digital content to free up time for small-group instruction (71%), to meet the needs or interests of different types of learners (71%), to allow students to learn at their own pace (71%), to provide additional ways for students to access material (67%), to capture student data to inform instruction (61%), and as a diagnostic or formative assessment (61%).

Exhibit 5. Teacher-Developed Assessment Systems

Online program	Description of content provided *	Teachers' understanding and use of content
MasteryConnect	Allows teachers to create, upload, and share assessments for any subject and of various types: multiple choice, rubrics, oral assessments, writing assessments Provides additional resources, such as curriculum maps and standards links Automatic and immediate grading for single-answer questions Tracks student results with a breakdown by standard	Elementary and middle school pilot teachers reported using this program to upload and administer ELA and/or math quizzes. Teachers used the quick data output from this program to assess student progress. A few teachers used data results to publicly track student progress on individual standards.
Juno Ed	Allows teachers to create/upload and administer assessments for any subject and of various types within the program: multiple choice, multiple answer, true-false, matching, sorting, and write-in Provides additional resources, such as online curricula and textbooks for purchase Automatic and immediate grading for single-answer and write-in questions Tracks student results with a breakdown by question and assignment type	One middle school pilot teacher reported using this program to assess students in math and gather data to track progress.

* Descriptions of digital content are derived from program websites.

Exhibit 6. Pilot Teacher Reports on Roles of Digital Content in the Classroom



Note: Numbers in graph may vary slightly from numbers in text due to rounding.

Pilot teachers most often used online programs for remediation and practice; teachers tended not to use the computer-based programs to introduce new concepts, nor did they find the programs well suited to helping students develop higher-order thinking skills. Still, the majority of pilot teachers reported online programs to be of high quality overall.

Most teachers used digital content for remediation and practice of concepts already covered in class, rather than as an introduction to new content or topics aligned with the day's learning objectives. Only about a third of pilot teachers (35%) reported using digital content to introduce new concepts (Exhibit 6). One middle school pilot teacher stated, "I think that the computers are better at remediation, because, simply put, there is no class time to do remediation." This teacher valued that online instructional programs allow students to work at their own pace and provide alternate ways to understand previously introduced content. In addition, some teachers believed that introduction of new concepts via online programs is effective only for independent or highly motivated students. One teacher explained that only her most independent learners would successfully gain an understanding of content by watching online instructional videos; this teacher chose to leverage digital content primarily for skill-building and practice problems.

Pilot teachers using digital content for skill-building purposes valued the large amount of practice that the programs allow. A pilot teacher explained that some of her students had completed three or four thousand practice problems during the year. She emphasized that she would not have been able to provide them with the same resources on paper. Another pilot teacher referred to the digital content as an "incredible resource" because she always has practice problems on hand without having to search for them or create them herself.

Although pilot teachers valued online programs as a resource for skill-building and believed computer-based small groups to be more engaging for students than non-digital small-group activities, teachers questioned the rigor of the programs. The extent to which digital content addresses higher-order thinking skills is particularly relevant as districts transition to the Common Core State Standards. Although all digital content providers claim their content to be aligned with the Common Core, few teachers, especially math teachers, were satisfied with the digital content's ability to sufficiently target and assess applied and higher-order skills called for by the new standards. One teacher agreed that her students were more engaged while on computers but felt the students were being "babysat" rather than intellectually challenged. Some math teachers expressed concern over the lack of conceptual understanding required in math programs, describing the programs as "drill and kill." One middle school math teacher voiced concern over the limited strategic thinking required by the online programs. She explained, "In most cases, I would say that the technology piece is mediocre. There is still a lot of work that all these online content providers need to do to make their product something that is truly beneficial for our students."

Despite pilot teachers' concerns about the rigor of online programs and alignment with the Common Core, a majority were pleased with the quality of the online programs. 81% of pilot teachers who use online programs in math and 52% of pilot teachers who used programs in English language arts reported the programs to be of good or great quality. This finding largely reflects teachers' expectations of digital content and its purpose in the classroom. Teachers leveraging digital content as a resource for remediation and skill-building are likely to be more pleased with the quality of the content than those hoping to use online programs to introduce new concepts or to target higher-order skills.

Teachers faced a variety of challenges with integrating digital content. As they became more knowledgeable about the affordances and constraints of digital programs, their comfort with digital content increased.

Pilot teachers reported a range of barriers associated with integration of digital content (Exhibit 7), including time constraints and insufficient professional development, and expressed a need for ongoing supports. Many of these reports varied by school.

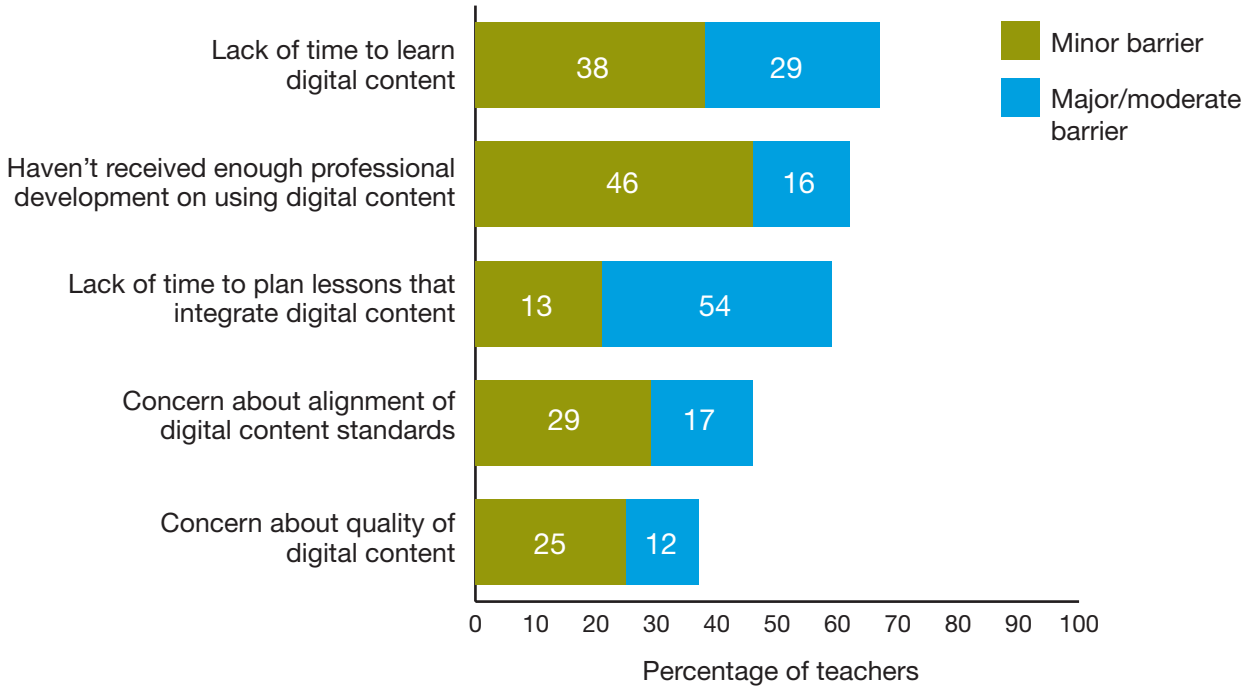
Becoming comfortable with learning the digital content and planning for its integration required time. Two-thirds of all pilot teachers (67%) saw lack of time to learn the digital content as a barrier to using digital content, and more than half of teachers (58%) found lack of time to plan lessons to integrate digital content to be a barrier. Moreover, pilot teachers reported in interviews that planning lessons that align online instructional programs with the daily objectives is more time-consuming than setting aside time for students to work on adaptive programs. With regard to aligning online programs with daily objectives, one pilot teacher explained, "That's one of those things if I had the time, I'd do that."

In addition to time constraints, nearly two-thirds of all pilot teachers (62%)—approximately one-half to three-quarters of pilot teachers at each school—identified insufficient professional development on using digital content as a barrier (Exhibit 7). Moreover, a vast majority of all pilot teachers (87%) and a majority of pilot teachers at each school reported that additional support in what digital content is available and how to choose it will be important or very important moving forward. In addition, 62% of teachers identified additional supports in operating and navigating the digital content as important or very important. This finding varied markedly by school: at one school, no pilot teachers found this to be important or very important, whereas a majority of pilot teachers at the other three schools reported this to be important. In interviews, one pilot teacher described the significance of thoroughly understanding each online program in order to be strategic about how and when to implement the programs.

Variation in comfort with digital content, perceived barriers to integration, and desired supports reflects variation in individual teachers' eagerness to engage with the content and to learn about the programs independently. Teachers' eagerness varied in part because the way teachers were brought into the pilot differed across school sites. At one school, where teachers did not have the chance to opt in or out of the pilot, teachers sought more guidance on all aspects of integration of digital content and were hesitant to "dive in" before fully understanding the programs. Teachers at other schools—who opted in to the pilot—were open to trying new content and learning about the various programs with less scaffolded support. Individual interest in learning about the programs allowed teachers to feel comfortable and

more expeditiously begin routine integration of online instruction. This finding speaks to the importance of understanding individual teacher needs and providing differentiated support to teachers implementing a blended-learning model. It also suggests that teachers who are not the early-adopter type are likely to need substantially more support than their peers who are more interested in making the transition to blended learning.

Exhibit 7. Pilot Teacher Reports on Barriers to Integration of Digital Content



Note: Numbers in graph may vary slightly from numbers in text due to rounding.

Implementation of only a select few digital programs enabled teachers to develop a thorough understanding of the programs and use them strategically.

Teachers reported purposefully minimizing the number of programs they used for instruction as a strategy for gaining a more thorough understanding of the ones they did use. One teacher explained the need to scale back the number of programs she incorporated into her class at the beginning of the year. She found it difficult to manage a variety of programs every day and felt that she integrated programs without much consideration for the specific benefit of each program. As a result, she simplified and systematized her weekly routine: she used two digital content programs every day (one for ELA and one for math) and used MasteryConnect every Friday for weekly assessments. She explained that the content is more "infused into the

practice" with this streamlined routine. Similarly, another pilot teacher prioritized two online instructional programs and a computer-based assessment system. She incorporated iPASS to allow for adaptive learning for all levels, while LearnZillion provided her higher-level learners with an opportunity for more independent instruction. Weekly MasteryConnect assessments supplied this teacher with routine data on student progress.

Establishing a clear vision and purpose for blended learning in the classroom emerged as a theme for ensuring smooth implementation. Many teachers reported not having a firm grasp on what blended learning would look like in their classrooms at the start of the school year because they had limited knowledge of the programs and no clear plan for leveraging online instruction for their individual class contexts. Some were able to develop that vision throughout the school year as they gained understanding of the various programs, but many reflected that establishing a vision of blended learning prior to implementation is a critical first step to transitioning to a blended environment.

Classroom Management

For the most part, the blended learning pilot supported the implementation of a "station-rotation model" in which students moved from stations in which they worked online to stations in which they worked directly with their teachers in small-group settings; in some cases, students also went to independent-work stations, off the computers. We found that many teachers struggled to manage multiple learning stations simultaneously such that students were appropriately engaged and benefiting from each one. As a result, pilot teachers sought support from a second adult and established new systems and routines to ensure student accountability (e.g., time on task), monitor student progress toward mastery, and increase opportunities for student choice.

Introducing and managing a rotational model was challenging for many teachers.

As with any disruption to the status quo, a blended-learning approach presents new classroom management challenges. Switching to a small-group rotational model, as is encouraged in blended learning, demanded that teachers revisit their established pedagogy and think differently about classroom logistics, behavior management, and lesson planning. In identifying barriers to the use of digital content, 50% of pilot teachers noted that "using computers introduces too many management challenges," while 63% selected "it is difficult to monitor what students are doing on computers."

Teachers worked through these challenges at different paces and with varying strategies. Many made substantial progress, but some teachers were ultimately unable to implement part or all of the blended-learning model because of the challenges. An elementary school teacher decided to forgo regular small-group rotations because she could not manage the behavior issues that came with using a small-group rotational model. She noted that her students were not "mature enough" to work independently and required support and monitoring.

Teachers had the added challenge of supporting students so that they could be successful in a blended-learning classroom, including help with basic computer use and troubleshooting as well as self-regulation necessary for independent learning.

Students who had not had much exposure to computers before the introduction of blended learning were learning some basics: typing, mouse use, how to open and close programs, how to save their work, etc. Even those students who had more experience with technology needed time to learn how to navigate technology challenges and familiarize themselves with the digital content. Students also were learning to spend focused educational time on a computer. One middle school teacher spoke about how her students had to build up the stamina to be successful in a blended classroom. She explained that in the beginning of the year her students could not sit down and focus at a computer for 30 minutes, but after a year of blended learning her students wanted to continue working when their 30 minutes were up. Similarly, teachers spoke about how their students built up perseverance over the year, developing better work habits and coping skills when dealing with frustrations. Students became frustrated less often, and when they did, they had acquired strategies to work through the problems and were more likely to help each other, producing more independent and collaborative learners.

Facilitating small-group rotations and easing students into independent learning on the computers were more easily accomplished when teachers had help. In many classrooms where implementation went smoothly, a second adult was in the classroom.

Keenly aware of the management and technological challenges that teachers may face, RFF provided two blended-learning specialists to support the pilot teachers. These specialists supported three of the four pilot schools but spent the most time at the school with the greatest number of participating teachers. Although having a second adult in the classroom was not common, many teachers had some level of support from these blended-learning specialists, an aide (mostly in special education classes), student teachers, or AmeriCorps volunteers. These support staff spent their time supervising students who were not working directly with the teacher (i.e., students at computer and independent-work stations) and responding to technical difficulties (e.g., login issues, frozen computers). Teachers found their help to be very useful and maintained that blended learning was difficult to implement when they were on their own. One teacher who had support from a blended-learning specialist for 8 hours per week explained that she felt “stranded with nobody to help” when she was the sole adult in the room. Similarly, another teacher agreed that it was “much easier” to implement blended learning when she had the help of an AmeriCorps volunteer.

Even teachers who had a second adult in the classroom felt the need to establish new routines and systems to facilitate smoother implementation of blended learning.

The types of new routines and systems that teachers established varied; however, the four most commonly cited strategies were (1) setting clear expectations around computer use and independent work, (2) practicing routines, (3) setting up systems for technology troubleshooting and computer maintenance, and (4) using visible (i.e., posted on the classroom wall) tracking systems that were tied to students' grades. These strategies served the combined purposes of holding students accountable, monitoring their progress, and facilitating student choice (see text box for more detail on tracking systems). Teachers emphasized the need to explicitly and deliberately teach these expectations, routines, and systems. One teacher recommended posting visuals around the classroom with helpful tips for troubleshooting technology issues. She also suggested providing labeled diagrams of common computer geography, such as the Google toolbar. Another teacher, who was focused on behavior management, explained, "We spent a lot of the beginning of the year just practicing like, 'Now we are going to do transitions, you have to move in 30 seconds, what does that mean?'…[I] decided that I needed to have everything very specifically thought through." Another teacher realized late in the year that she had not spent enough time teaching the routines necessary for her students to use the digital content effectively. With this realization, she reverted to whole-class instruction in order to focus on procedures and scaffolding around how to think critically while working independently.

When teachers successfully implemented new strategies and students were comfortable with the procedures and routines, both on and off the computers, teachers were able to let students make more choices. However, giving students more independence came with its own set of management challenges.

Teachers found that the first step toward increasing student self-direction was increasing students' access to information about their own progress. With the help of individual and class trackers, students were seeing their achievement data in relation to data from their peers, which some teachers reported added a competitive edge to learning. Students seemed to respond positively: some teachers noted increased use of office hours, more resourcefulness among students, and more student-initiated student-to-student tutoring. However, interpreting data (even low-tech trackers that monitor progress) is difficult for anyone, and students are no exception. One teacher pointed out, "It's hard for a kid to sift through it all and pinpoint exactly what specific activity is holding them back or what specific skill they are missing out on to prevent them from being more successful."

Teachers found that they needed to explicitly teach students how to interpret their progress data and decide what to do with that information. One teacher aimed to have her students choose what they needed to work on based on their own progress data, which, she acknowledged, will require a lot of training. Another teacher experimented with giving her students more freedom with their class activities. She identified learning goals and objectives for the class but then let the students decide how to accomplish them by selecting from a limited number of choices. She admitted that her students were not quite ready to employ this model successfully, but they were heading there.

How one teacher blended her classroom

One middle school math teacher experimented with different ways to most effectively integrate blended learning so it worked for her and her students. She consistently asked for her students' feedback and viewed the integration as a dynamic process, understanding that finding something that worked this week may not be right in a month as she and her students grew and adapted to this new way of teaching and learning. She worked on new routines in the beginning of the year, with the goal that her students be able to transition between stations in under 2 minutes. This teacher worked closely with another math teacher, whom she called her "thought partner." They talked often, brainstorming and supporting each other. Together, the two math teachers identified student-directed learning as one of their main goals and came up with ways to scaffold that process for their students throughout the year, gradually releasing more responsibility to them as time went on. This teacher strongly believed in the value of using visible tracking systems to hold students accountable and keep them motivated and able to identify their own strengths and weaknesses: "Anything that you want kids to care about on the computers, we need to track—visually with a class tracker and ideally with an individual tracker—and then you need to tie it to their grade." Around her room were multiple tracking posters, all tied to different standards, and she often referred to them when teaching or talking with students. She added that the teacher should set expectations and train students to update the trackers to ease the burden on the teacher. By the end of the year, she and her students had developed a system that relied heavily on students' self-assessments. She would ask the students to assess themselves on the material with a simple thumbs-up thumbs-down and then would choose her grouping for that period based on how comfortable the students thought they were with the material. She generally ended up with three groups—students who needed more direct instruction from her in a small-group setting, students who wanted independent practice on the computers, and students who were ready to take the test. This system allowed for real-time differentiation while empowering the students to practice and trust their metacognition.

Using Data, Digital Content, and Small-Group Instruction to Personalize Teaching and Learning

Fully realizing a vision of personalized blended learning involves differentiating students' learning experiences based on more, better, and faster data. Taking this step requires relatively easy access to meaningful data and strategies for providing students with tailored learning experiences, based on good information about what they need next. This section begins with an overview of the new data and data systems to which pilot teachers had access and considers the constraints and supports teachers reported in interpreting available data. Next, we discuss the range of ways teachers made use of data to differentiate instruction. Here, we begin with a focus on the two most common forms of differentiation used by pilot teachers: the use of adaptive computer programs and small-group instruction by performance level. We then present differentiation strategies that were less commonly observed, but that hold particular promise for blended learning's core goal of personalized learning experiences.

What New Data Do Teachers Have Access to and What Constrains and Supports Data Use?

Teachers implementing blended learning had access to some combination of three kinds of digital data platforms: individual platforms from each online program; a "data dashboard" that aggregated across programs; and assessment platforms that enabled teachers to create, score, and analyze their own assessments.

Teachers had access to somewhat different data systems and varied considerably in the extent to which they made use of them.

A key feature of the online content programs in use across the pilot is access to real-time data about student performance. Exhibit 4 above gives an overview of the different programs in use at the four schools. Given that each program offers its own approach to which aspects of performance are measured (e.g., speed, accuracy, complexity, progress toward a standard) and its own interface for accessing those data (with its own login), the diversity of data available and the number of ways to reach those data have the potential to impede the use of

data. As one teacher explained, “There is a lot of data that’s available to me, and that I have been advised to access on a regular basis, but whether I can go into three different programs for 90 kids and monitor that, I have to set some priorities.”

One response to the complexity of multiple data platforms is a “data dashboard” that seeks to integrate data from a variety of content providers into an easily accessible and readily interpretable report on student progress. The two schools that worked with TA Provider 1 had access to an aggregated data dashboard. However, few teachers regularly used it to access student data, citing a combination of initial technical difficulties and limited confidence in the information it provided: an early, central concern was that content provider data were not reliably showing up in the dashboard. Accordingly, the perception of initial limitations may have impeded later adoption once the platform was up and running. As one teacher revealed, “I don’t use [the platform] very often…at the beginning of year…the dashboard wasn’t up or something like that. So, I started my kids on Khan Academy [and began accessing its data] because I had a grasp of it.” As this teacher indicated, another solution to the problem of too many data sources was to gain comfort with one or two online programs and use them exclusively.

While digital content providers offer tools to facilitate interpretation and use of data, few teachers have become comfortable using these tools regularly to inform instructional decisions.

Given the large body of new data available, becoming comfortable to make rapid decisions about which data to use, and in which situations, is a challenge. While teachers identified a range of concerns about accessing and using data from online systems, a few important themes emerged:

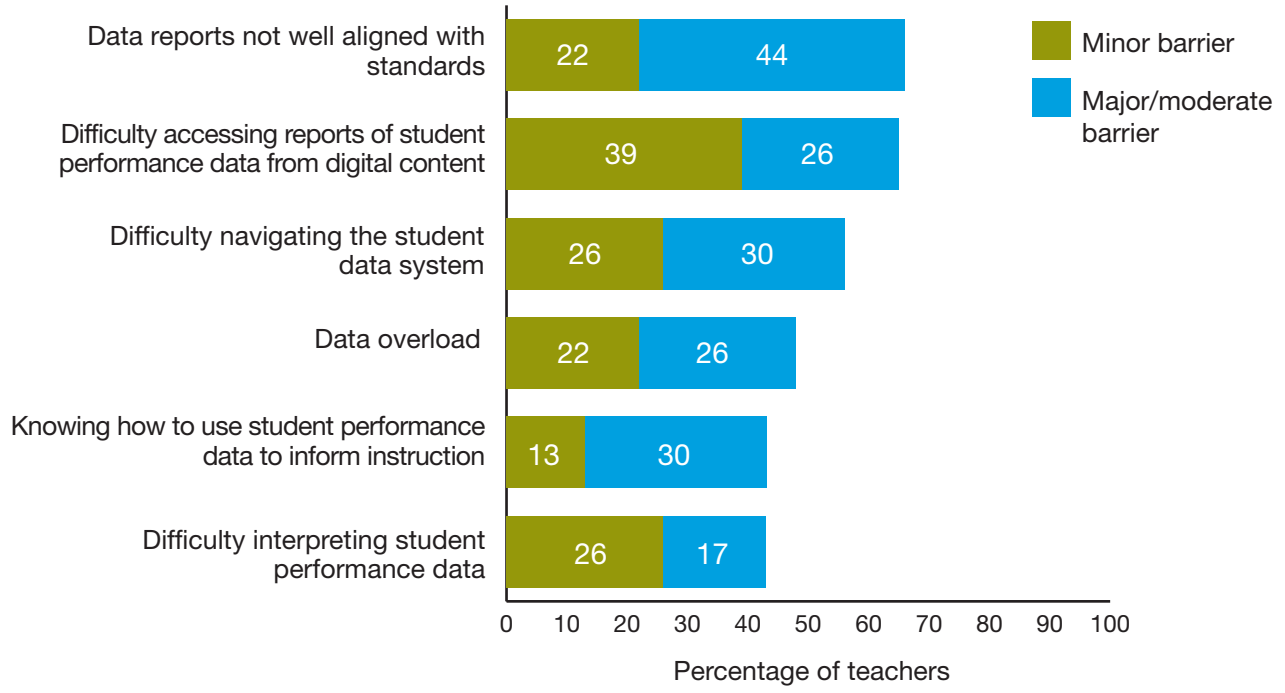
- The majority of pilot teachers have yet to become comfortable accessing and interpreting data from online platforms.
- Data from provider-generated learning tasks and assessments were widely seen to be poorly aligned with current standards and curricula.
- Even among teachers who regularly used data, making sense of the data in ways that might guide future instruction proved challenging.

Across schools, only 30% of pilot teachers reported finding data from digital content systems to be “very useful.” Importantly, perceptions varied markedly by school (ranging from 10% to 100%). Teachers’ concerns about the data from the online programs typically included a perception that data are not well aligned with current curricula and standards. In fact, 65% of pilot teachers cited alignment concerns as a barrier to data use (Exhibit 8). Not only was this the most commonly reported barrier to data use, a majority of pilot teachers at each of the four schools identified this barrier (ranging from 57% to 100%).

In light of concerns about alignment, teachers were far more likely to trust, and draw on, data from systems that were based on teacher-generated assessments, such as MasteryConnect. Interviews suggest that teachers found data from such systems to be more meaningful precisely because the data were derived from content the teachers themselves developed and thereby aligned with their curricular goals. Some teachers also expressed a general distrust of the data from digital platforms and, more specifically, concerns about conflicting information from digital and traditional data sources. A principal who cautioned against an overreliance on computer-based assessment data relayed a conversation with a teacher: "[The teacher indicated that] her kids really don't know their math facts this year…and they're getting little medals and trophies saying that they know their math facts [but] when it comes to paper-and-pencil timed tests they don't know their math facts."

At one school, a major challenge was "data overload": at this school, 80% of pilot teachers identified "data overload" as a barrier. This finding suggests that teachers who use multiple online programs and must pull data from individual programs, as was the case here, frustration with what to do with all the data is a pressing issue. At this school, teachers were concerned about the overwhelming amount of data they were encouraged to access, the lack of support provided on how to compile and use data effectively, and limited time to review data. As one teacher explained, "We are still just overwhelmed with data right now that we don't completely know what to do with."

Exhibit 8. Pilot Teacher Reports on Barriers to Their Use of Data



Note: Numbers in graph may vary slightly from numbers in text due to rounding.

Pilot teachers seek rapidly interpretable snapshots of student progress toward content standards; some also emphasize information to help monitor students' on-task behavior.

Much is made of online learning's affordances for rapid access to actionable data on student progress. However, critical to fully leveraging these affordances is a better understanding of what kinds of data teachers perceive as most actionable, and thereby most useful. Through teacher surveys, interviews, and insight from classroom observations, we may begin to articulate the kinds of data teachers seek to guide instructional decisions and help them work toward the goal of personalized learning for all students.

Pilot teachers who used data frequently often referenced it as a resource for providing actionable "snapshots" into student learning. As one pilot teacher explained, "I can get a real quick [look] at what the grades are and see if a lot of kids are doing [well]…or not." In fact, for some teachers, easy access to timely data about student progress became core to their instructional practice. For example, one teacher referred to himself as a "data conduit" and reported accessing data from online programs multiple times per day and conveying that information to students and parents frequently.

Digging a bit deeper, teachers revealed that data were most useful when they helped teachers track student progress toward mastery of content standards. For example, one pilot teacher described how she used data from an online program to identify gaps in student learning: "[iPASS] is a good diagnostic tool because I track it every week, and I can see if they didn't master a chapter. I can see which lesson they're getting stuck on. So if there are common lessons they're getting stuck on, that's a flag for me that I need to pull those kids."

The ability to rapidly monitor student progress contributed to a better use of professional time for several teachers. For instance, some teachers who made use of data from digital platforms were able to leverage time saved by the quick access to data and allocate a greater proportion of time to planning and adjusting instruction. As one pilot teacher explained, "I'm spending a lot less time grading and more time actually looking at the data and planning for reteaching lessons. So it's like I shifted my time."

This time shift from grading to planning was most commonly associated with the use of MasteryConnect, perhaps owing to its familiarity (as a teacher-generated system) and explicit connection to content standards. For example, a pilot teacher reported that her data use was similar to that in previous years, but that she was able to be much more efficient in her groupings, thus freeing up more time for follow-up planning: "It's the same cycle that I [did]

last year…now it just happens a lot faster because I use MasteryConnect, so I could have them through a course in a week and have instant data versus me having to grade all of that." Another pilot teacher explained, "Having that time to take like 5 seconds to create my groups [using data] and then the work we do is much more impactful in their learning in the small groups because I'm not still struggling to figure out what to teach them."

While the *instructional* use of data was commonly discussed by pilot teachers who routinely used data, some teachers also expressed a desire for data to facilitate classroom management. Particularly for teachers skeptical of the learning experiences offered by the online programs, data that helped teachers monitor student time on task were also reported to be useful. For example, pilot teachers at the two schools where skepticism about the use of digital content was most apparent reported using data to identify the amount of time students wasted while on the computers. In fact, some of these teachers seemed hungry for more and better tools to support this use of data. For example, one teacher mentioned that her students often exploited the "hint" button within Khan Academy, which would ultimately provide them with the answers. She was interested in having access to more data to track how many times students used the "hint" button. Her hope was that such data would help her distinguish between students who were actually engaging with the content and seeking support versus those who were not putting forth enough effort.

How Are Teachers Differentiating Instruction?

Teachers across the pilot were increasingly using data to differentiate instruction. This was happening primarily through the creation of leveled groups for teacher-led instruction, with a reliance on adaptive digital environments for individually tailored learning experiences. A few pilot teachers were actively experimenting with ways to personalize learning experiences for their students, including more fine-grained grouping strategies, strategic use of different online programs for different students, tracking systems to help teachers and students monitor the learning progress, opportunities for student choice, and enrichment activities to accelerate the learning of high-performing students.

Interviews with pilot teachers revealed different interpretations of what it means to tailor lessons. Some considered grouping by level, with minimal adjustments to instruction for the different groups, to be differentiation. Others used teacher-led small-group instruction as a way to slow down the pace for struggling students, while accelerating the pace for higher-performing students. Other teachers tailored lessons regularly based on student performance on assessments or learning tasks. For example, at least three pilot teachers at one school established differentiation days, where teachers identified low performers on the weekly quiz or standard and worked with them to review key concepts, while the rest of the class worked largely independently on tasks reflecting their level of mastery.

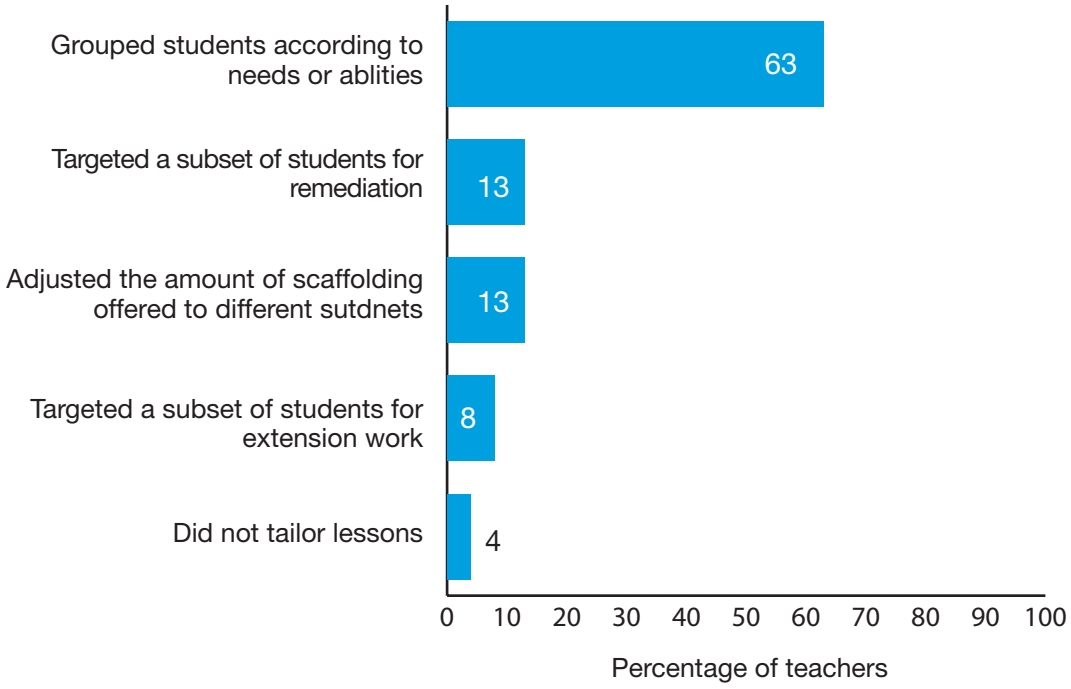
While conceptions of differentiation varied, the two most common forms of differentiation among pilot teachers were the use of small-group instruction by performance level and the use of adaptive computer programs for individualized learning experiences.

Teacher-led instruction was typically adjusted at the group level, with groups consisting of half or a third of the students in a class formed on the basis of diagnostic tests, and with instruction adapted primarily by varying pacing across the groups. In the spring, 63% of pilot teachers reported grouping students by needs or abilities as a primary differentiation strategy (Exhibit 9). Within this model, teachers were sometimes able to work one-on-one with students while the rest of the group worked independently. However, except for a few teachers, such individualized attention was largely an ad hoc strategy rather than an intentional plan to work with identified students.

Most teachers recognized that small-group instruction allowed for more personalized interaction with students, which they valued, but only a few reported employing more fine-grained differentiation strategies in teacher-led settings (Exhibit 9). For example, only 13% of pilot teachers reported adjusting the amount of scaffolding offered to different students. As one pilot teacher explained, her current struggles focused on how to use the data to best support the learning of students she had identified for extra help: "So it's just me trying to figure out how to most effectively [teach them], because I've figured out how to [form] that group [of students needing additional support], but now I'm figuring out how to teach them in a better way because I obviously taught them in the best way I know how the first time. So I have to think of a different way of teaching them." Thus, while the new data sources were appreciated as a diagnostic tool (to know which students needed help on which concepts), the data were rarely seen as a resource to inform adjustments to instruction. Moreover, the teacher-led small groups we observed overwhelmingly emphasized procedural knowledge and factual recall—again suggesting that teachers may need additional support if they are to make the changes that would allow students to realize the promise of blended learning in the sense of developing higher-order skills.

To facilitate individually tailored learning experiences, teachers typically leveraged the adaptive features embedded in the most commonly used online programs. These features included learning experiences matched to diagnostic testing, leveled texts, adaptive task complexity, and student-driven pacing through the material. For example, a middle school math teacher explained how the adaptive curriculum helped her support the wide range of students in her mathematics classroom: "They're working on what they need to work on…there are kids that are working on 7th-grade stuff and then there're kids that are working on 2nd-grade stuff. There's a huge difference and there's no way every day as a person I could make a worksheet for that many levels."

Exhibit 9. Pilot Teacher Reports on Their Most Commonly Used Differentiation Strategies



Although most pilot teachers relied heavily on fairly static leveled groups and the adaptive features of online providers to differentiate instruction, a few teachers were experimenting with strategies to provide more personalized learning experiences and help students monitor their own progress. For example, in at least one case, a teacher leveraged the student grouping feature embedded in TA Provider 1's dashboard, which enabled her to quickly group, and re-group, students in real time based on current performance data. In another example, one pilot teacher explained that she regularly grouped students by performance level and each group received a different assignment. She commented that "at any one time, there are three or four different groups working on three or four different things." Although these efforts were not regular features in the majority of pilot classrooms, and still largely inchoate where they were seen, they point to the promise of blended learning, and the technology that supports it, and merit attention.

Some teachers strategically employed a variety of online programs based on perceptions of fit between program and student performance level.

Teachers who demonstrated a thorough understanding of the benefits and constraints of different online programs seemed better prepared to use the online platforms strategically. These teachers identified certain programs as more effective for certain levels of student performance. For

example, one teacher explained that i-Ready reading was appropriate for her struggling readers because of its focus on phonics and vocabulary, as well as comprehension. Similarly, another pilot teacher explained that she started her low-performing students on i-Ready (for the same reasons as the previous teacher) but assigned her higher-performing students to KidBiz, which focuses less on phonics and more on comprehension. Once students demonstrated growth in reading and comprehension skills, she shifted them to work mainly on KidBiz.

In contrast, pilot teachers with more limited understanding of the learning experiences provided by the different online platforms tended not to use the programs strategically. For example, one pilot teacher who had just begun to use KidBiz in her classroom reported a growing but limited level of comfort with the program. She allowed students to choose between KidBiz and i-Ready, but the choices were driven entirely by the students; she did not attempt to guide students to a particular program based on fit with student performance level.

Teachers who regularly used data to differentiate instruction often leveraged strategies that support students to monitor their own learning through real-time feedback and progress tracking.

Some pilot teachers were using data to involve students in monitoring their own learning. For example, 38% of pilot teachers reported using student performance data to provide feedback to individual or small groups of students. Accordingly, a number of teachers credited blended learning with improved opportunities to provide feedback to students and/or help students to monitor their own learning. For example, some online programs enable teachers to offer real-time feedback to students through messages within the platform, and at least a handful of teachers reported taking advantage of this feature.

Further, one teacher emphasized that the abundance of data available allowed students to show progress, and see their own growth, even when they were far below grade level: “The reality is I will have kids who come to me at a second-grade level…I want them to also feel like they’re progressing because they are…I still have kids who are at a fourth-grade level but they started at a first-grade level, so it’s huge. They’ve made a lot of progress, but they wouldn’t show any mastery on [grade-level] standards, because they’re not there.” In contrast, she noted that these students were seeing the progress they were making on the online programs.

In a small number of cases, teachers paired strategies like mastery tracking, which support students to monitor their own learning, with student choice to encourage greater student ownership of the learning experience. For example, one pilot teacher incorporated a weekly free-choice day into her class, where students chose the standard and program they would work on that day. Another pilot teacher used data from digital content programs and her own assessments to provide students with

weekly slips of paper indicating their current performance level. In conjunction with this, she provided each student with multiple options to select as follow-up work: digital content, practice problems in the textbook, or a mini lesson with the teacher. The teacher then used a public tracker to display when students mastered the standards they were struggling with.

Students are interested in their data

Digital content programs provide many data points for students to track. Progress markers are continually updated and students are motivated by watching their reward points grow or jumping levels in a game-like learning environment. Students competed against their own past performance and felt good when they saw improvement. In focus groups, students reported being very aware of their academic standing in their blended classrooms. Students kept track of their progress by frequently checking their grades, paying attention to individual and class-level tracking sheets, and logging into the specific programs to inventory their reward points and medals. Students in focus groups reported feeling rewarded and empowered when their data showed improvement. The data helped them to make the link between hard work and learning. One student reported, "I feel good. I feel better because you're like, 'Wow, I worked so hard.'"

A few pilot teachers reported enabling higher-performing students to work on different content once they had mastered current standards.

While the first year of the pilot saw most teachers using differentiation strategies to better support the learning of struggling students, a few teachers were also experimenting with enrichment strategies for higher-performing students. In one middle school math class, students who had mastered the standard(s) for the week were allowed to select their own work two days a week, based on what they thought they needed to learn. The students who had not yet mastered that week's standard(s) were required to do the work their teacher assigned to them.

Another middle school math teacher allowed her students to try to test out of certain topics. She noted that her students were eager to retake quizzes multiple times in order to achieve proficiency, which she defined as scoring at least 90% on the unit test. Students who demonstrated that they had mastered the unit were pushed to do additional lessons that emphasized a more conceptual understanding of the material. This teacher also allowed her students to explore subjects on Khan Academy that were not directly related to what they were doing in class, but only if the students had finished their math work. She joked that she would often find her middle-schoolers watching videos about art history and theology when they had time to explore.

Perceived Benefits for Students and Teacher Satisfaction

Any intervention in schools ultimately aims to improve academic achievement for students, including Oakland's Blended Learning Pilot. However, because this was the first year of a pilot that encouraged substantial experimentation, coupled with the small sample size (i.e., four schools) and lack of a well-matched comparison group, SRI did not analyze student test scores. Instead, this section describes the teachers' and students' perceptions of the academic and nonacademic outcomes associated with blended learning, as well as teacher satisfaction with the pilot.

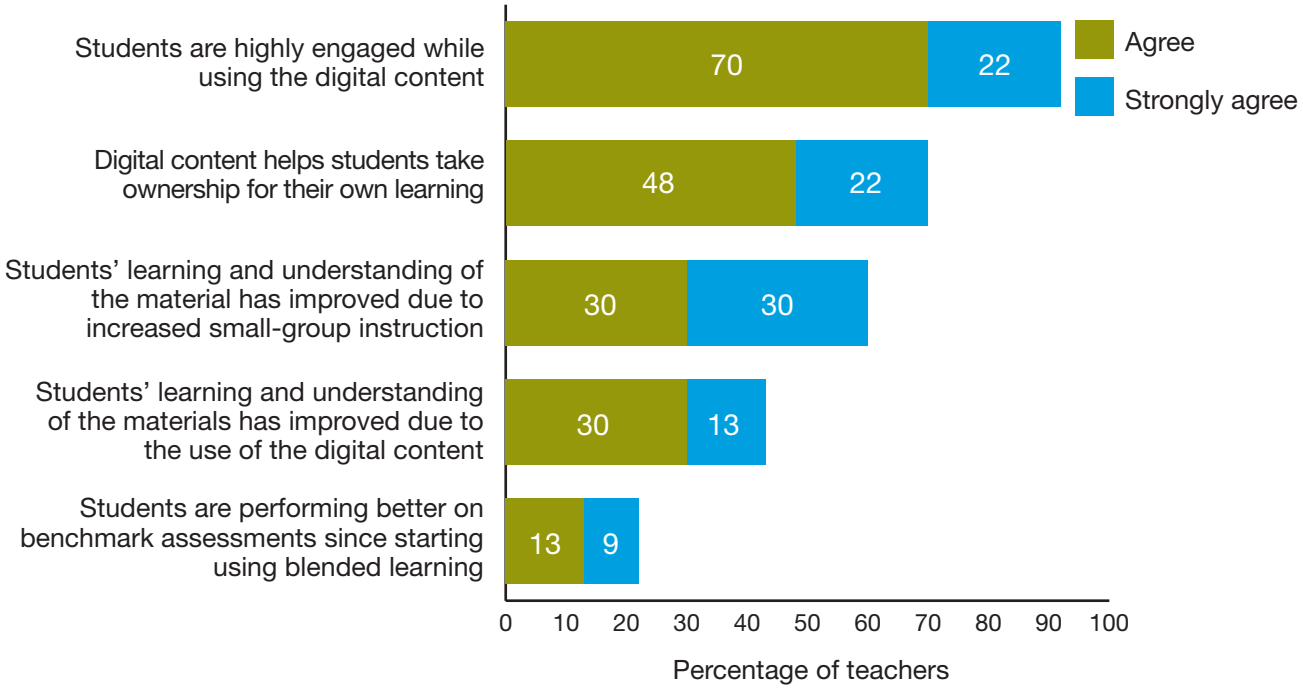
Teachers' perceptions of the extent to which blended learning has helped increase student learning are mixed.

Overall, 61% of pilot teachers agreed or strongly agreed that students' learning and understanding of material had improved due to the increased use of small-group instruction (Exhibit 10). However, perceptions varied by school. At the two schools where implementation went more smoothly, a majority of teachers strongly agreed that student learning improved as a result of small-group instruction. At the two other schools, half or more of the teachers were neutral about the impact of small-group instruction on student learning.

Similarly, close to half of all pilot teachers (43%) agreed or strongly agreed that students' learning and understanding of material improved due to the use of digital content. However, responses varied by school. In one school, a majority of teachers (71%) agreed that student learning improved due to the use of digital content; in the other three schools, no more than 50% of the teachers agreed with the statement. One pilot teacher felt positively about both aspects of blended learning but suggested that the benefits may not accrue to all students. She explained, "It was clear that blended learning helped certain students tremendously, either due to digital content or more small-group instruction." Whereas some teachers saw their more independent learners benefiting from a blended environment, others noted gains among lower-performing students. For example, one elementary school teacher described a student who struggled with reading: "I have one little girl who's really low…she's a beginning reader but it's giving her that confidence, and [she's] gradually going up and up…it's starting to make a big impact."

Interestingly, most teachers did not see learning gains translating to improved performance on benchmark testing. Fewer than one in four teachers (22%) agreed or strongly agreed that their students performed better on benchmark assessments since blended learning was introduced in their classrooms.

Exhibit 10. Pilot Teacher Reports on the Perceived Effectiveness of Blended Learning on Student Outcomes



Note: Numbers in graph may vary slightly from numbers in text due to rounding.

Most pilot teachers reported that using digital content increased both student engagement and student agency.

Observation, survey, and interview data all converge on the topic of student engagement. During each of SRI's 16 classroom observations (across four different classrooms), researchers documented high rates of student on-task behavior while at the computer stations (ranging from 82% to nearly 100% of students). Similarly, when asked on the survey, 91% of teachers across all four schools agreed that students were highly engaged by the online programs. Educators attributed this engagement to the prevalence of technology and gaming in students' lives outside of school. One pilot teacher explained, "I think it's a powerful engagement tool and kind of a motivator for a lot of students because, everywhere else in their world, they're

surrounded by screens all the time, so why not in the classroom, too? Otherwise, it's such a stark contrast to the world they see outside of school." Likewise, one of the blended-learning specialists spoke about how to use the game-like nature of the programs to their advantage: "We [are] repurposing their gaming and targeting [it] with an educational twist."

Students also agreed that the computer programs were engaging, fun, and educational. One elementary school student who participated in a focus group reported, "We use the computers to do math without even knowing it because it's so fun." Likewise, a middle school student said, "It's fun, and at the same time you're learning. It helps me a lot."

Although evidence of increased student agency was limited, the majority (70%) of pilot teachers reported that the digital content helped students take ownership for their own learning. Pilot teachers, students, and blended-learning specialists noted that rapid feedback loops and the range of data available (both of which are facilitated by the digital content) helped students take increased ownership of their own learning.

Blended learning increased students' comfort with technology and created some opportunities for collaboration.

Over the course of the year, students' IT skills expanded and their self-confidence around computer use grew. Teachers reported that students learned, both through explicit instruction and through trial and error, how to troubleshoot many basic technological problems on their own. Additionally, teachers noted that students' keyboarding skills improved over the course of the year. Students' development of these skills eased the burden on teachers, alleviated frustration among students, built a sense of community and collaboration in the classroom, and added to students' sense of self-efficacy and value. For example, a blended-learning specialist trained a group of middle school girls to refurbish older PC desktops. Not only did the students learn a valuable skill that they felt good about, it also allowed the school to scale up its technical capacity quickly and cheaply. Now, if a computer goes down, one of the students can bring it back to life.

In the classrooms, teachers capitalized on students with newly developed IT skills in various ways. One teacher used a class jobs system to rotate the responsibility of setting the computers up for a particular lesson and to fix any issues that popped up around technology. Another teacher admitted to being uncomfortable with addressing technology issues and relying on her students to troubleshoot them for her. The use of students for tech support was more evident in middle schools, possibly because of student maturity and teachers' allowing more student autonomy, but it occurred in elementary schools as well.

Students also had opportunities to work together while at the computer stations. Because teachers set up norms around small-group rotational models (e.g., do not interrupt the teacher when she is with a small group), students began asking each other for help with online content. When students were on task, the student-to-student interactions were rich and meaningful, including employing higher-order thinking skills when explaining things to each other.

Teacher satisfaction with blended learning varied. Overall, most teachers who participated in the pilot in 2012–13 would recommend blended learning to others (70%), thought that blended learning met the needs of their students (65%), and were eager to continue with the blended learning pilot program again in 2013–14 (79%).

Overall, teachers appreciated the pilot. A teacher at the more enthusiastic end of the continuum summarized much of the hope of blended learning: "I loved having the ability to teach to a smaller group of kids; every kid was more engaged, participated more. I did different things with different kids depending on their needs…I think technology has a wonderful place to play in the classroom, especially with differentiation. We have kids here who come in vastly underskilled and technology offers a great path to get them up to par."

However, the positive response to the pilot masks some variation by school, with teachers from one school consistently showing less enthusiasm. At three schools, at least 75% of teachers reported that they would recommend blended learning to others. At the fourth school, 50% of the teachers agreed or strongly agreed that they would recommend blended learning to others, while the other 50% were neutral. Agreement with the statement "Blended learning meets the needs of my students" also varied, ranging from 40% of teachers at one school to 100% of teachers at another.

In three of the pilot schools, 100% of the pilot teachers reported that they would like to continue with the blended learning pilot in 2013–14. In the fourth school, only a slim majority (55%) hoped to continue. Importantly, 70% of non-pilot teachers across the four schools wanted to participate in the pilot in 2013–14. Percentages also varied by school, ranging from 57% to 100%.

The first year of the blended learning pilot supported substantial experimentation and sought to support teachers during the earliest stages of implementation. When implementation matures and becomes more defined, it will be appropriate to conduct an impact evaluation.

When examining the impact of this intervention on student outcomes, it will be important to be able to clearly define the treatment in contrast to "business as usual." In other words, the blended-learning model will need to be further defined to reflect a more significant departure in instructional practice across the full range of participating classrooms if a difference in outcomes is to be found. Questions such as what specifically is different in a blended-learning classroom versus a traditional classroom and for whom it is different will need to be considered. It will also be important to identify the specific academic outcomes that the intervention seeks to influence. For example, is it reasonable to expect improved performance on grade-level assessments if the intervention does not focus on grade-level content? Moreover, the new Smarter Balanced assessments are expected to address higher-order skills in English language arts and mathematics. Would it be reasonable to expect improvements in higher-order skills and in both content areas?

Lessons Learned

As technology increasingly influences—and ideally enhances—teaching and learning in K–12 classrooms, the field must consider how best to support teachers and schools in making this transition. We know from decades of reform efforts that there are no silver bullets: it is very difficult for any education reform to meaningfully change teaching and learning (Tyack and Cuban, 1995). Leaders in the transition to blended learning are anticipating a significant "disruption" to the ways teachers teach and students learn. This disruption is grounded in the integration of traditional and computer-mediated instruction and is driven largely by teachers' use of technology to personalize student learning experiences and by students' monitoring and directing of their own learning. To ensure that blended learning becomes a strategy for supporting effective instruction and increasing student agency, rather than a replacement of paper assignments with digital worksheets, program developers and educators must be intentional about the role and purpose of online learning, leveraging the best of what it has to offer and adapting as the technology changes. Although current efforts to implement blended learning are in the early stages, lessons from the experiences of the pioneers may help others as they engage in this important work.

How teachers in Oakland were introduced to the pilot and selected to participate proved to play an important role in the extent to which teachers embraced blended learning. Introducing the pilot as an opportunity to rethink instructional practices—not just a chance to get more technology in the classroom—was an important frame for the work. Given the wide range of teachers' comfort with technology and experience with the instructional strategies consistent with blended learning, adopting blended learning is more of a leap for some teachers than for others. Those teachers who opted in to the pilot were more willing and eager to learn about the affordances of a blended-learning environment. Teachers who were required to participate were more hesitant and encountered more barriers to implementation. A lesson may be that it makes sense to begin any rollout with the more eager, early-adopter teachers and bring along the more hesitant teachers when others have already worked through some of the inevitable challenges and have positive experiences—perhaps even implementation models—to share. Given the early challenges and start-up support that was needed, starting with just four schools was a wise design decision. It also might have been beneficial to have narrowed the scope of the pilot by choosing to work initially in just one content area or at one school level (i.e., middle or elementary). Such narrowing would have enabled more sharing of ideas among teachers and allowed support providers to streamline their efforts.

Once schools and teachers are recruited, the first step to transitioning to a blended-learning model is to acquire the necessary technology infrastructure. This piece should not be underestimated. It is critical and requires a significant amount of up-front planning. In addition to considering Internet access, bandwidth, and hardware, the school building and physical space may need attention in terms of basic electrical capacity, the location of outlets, having a sufficient number of chairs, and overall classroom layout. Another piece is the single sign-on portal for students—a feature that was in place for students at two of the pilot schools, saving substantial time and nuisance. Finally, to feel comfortable integrating digital content, teachers need to have confidence that the technology will work, and, when it does not, they need to know that IT support will be prompt and have offline contingency plans.

After securing the appropriate technological capacity and setup to support blended learning, teachers require ample time and support to become acquainted with the digital content, determine its purpose in their classroom contexts, and select programs that effectively serve that purpose. As Oakland pilot teachers learned, less is more: committing to a few carefully selected programs allows teachers to gain a more thorough understanding of those programs and to implement them more strategically. Educators will also benefit from additional curating and vetting of materials that are aligned to grade-level standards and guidance from individuals who are knowledgeable about the ever-growing pool of online resources.

Pilot teachers valued the adaptive components of the digital content, but some teachers noted an abrupt disconnect between teacher-mediated content and adaptive computer assignments, since the online content typically was not aligned with daily objectives. If a goal is to use technology to support grade-level standards, it will be important for program designs to incorporate greater capacity for teacher assignability and, ideally, cross-mapping tools to facilitate alignment. Along these same lines, teachers found the capacity of online programs to target higher-order thinking skills to be subpar. As teachers transition to the Common Core, online programs focused primarily on procedural fluency will further increase the distance between the content of those programs and teacher-mediated instruction. Whether this is appropriate depends on educators' goals for online instruction. Of course, facilitating higher-order thinking will require attention to both sides of the 'blend.' In particular, teachers will need additional support to develop their practice with small group instruction, including responsiveness to the reality of small groups that are not so small.

To ensure that teachers implement the selected digital content effectively, teachers and their support providers need to plan for classroom routines and systems that support integration of digital content. Monitoring students in a blended environment is a complex task. Teachers must feel comfortable and confident that their students are on task and benefiting from their blended-learning experience at all times. While some teachers set up effective systems to

manage student behavior and transitions, others did not feel comfortable without a second adult in the classroom. Another component to ensuring that students are on task and engaged in online instruction is the extent to which students feel responsible for and direct their own learning. Students' ownership of their achievement and ability to use metacognition are prominent themes in 21st-century learning and are integral to a blended-learning model. To that end, teachers play an important role in encouraging and scaffolding students' self-accountability and agency; this includes developing systems to support students in monitoring and taking charge of their learning progress. Some pilot teachers used strategies to invest students in learning via digital content, but most classrooms had not yet reached a point where students were able to diagnose their progress and, particularly, direct their learning experiences. Yet, although teachers' success with implementation of small groups, student-directed learning, and systems around digital content use varied, pilot teachers rarely had the opportunity to collaborate and observe other pilot teachers' classrooms. Schools, districts, and others interested in implementing blended learning should consider providing teachers with well-structured opportunities to collaborate with and observe other teachers' classrooms and to share best practices for creating effective systems around the use of online instruction. Schools and teachers will also benefit from implementation models that have been field-tested with a variety of learners.

Using data to inform instruction is another important aspect of the blended-learning model. The vision of data-driven instruction relies on the idea of accessible data: teachers have faster access to student data that they can easily compile and use to inform instructional grouping and subsequent differentiation strategies. Among pilot teachers, data from digital content programs were largely underutilized, partly because of issues with accessing and interpreting data, concerns about the validity of the assessments, and the lack of alignment between data from digital content and grade-level content standards. Instead, some teachers came to rely on teacher-developed online assessments. Teachers must be confident that the data generated through the online programs are providing them with accurate and readily interpretable information about their students. In addition, the pilot teachers who regularly incorporated data into their practice typically used student results to inform groupings without significantly tailoring instruction within those groupings. Thus, another lesson is that teachers not only need to understand how to access and interpret data, they also must understand how to translate those data into targeted, differentiated teaching strategies that meet their students' specific needs and abilities. Program developers should consider this need and incorporate features into online programs that suggest how teachers can use their student data.

In sum, implementing personalized blended learning requires the coordination of many essential components: updated technological infrastructure, carefully selected online learning programs, new classroom routines that help students take responsibility for their own learning, robust data systems, and instruction that is tailored to meet the needs of a diverse student population. Over the course of the first year of this pilot, educators in Oakland made progress on all these fronts. Moreover, the pilot's ongoing emphasis on innovative and effective instruction, increased student agency, and the deliberate integration of facilitative technology holds promise for the future.

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