

# Research on the Use of Khan Academy in Schools

Research Brief

March 2014

## Introduction

In recent years, Khan Academy has become one of the most prominent pioneers among a new generation of digital learning organizations in K-12 education. Khan Academy had about 10 million unique users per month as of February 2014, up from about 144,000 per month in early 2010. Around 65% of users are in the United States. The sheer volume of the traffic, as well as its rapid growth, indicates the worldwide hunger for quality online instruction, especially in math, and the value that Khan Academy provides to its users.

Khan Academy is working closely with schools to explore ways of transforming how instruction is organized, delivered, and experienced by both students and teachers.

Although it originally focused on helping individual users learn on their own, outside of formal institutions, Khan Academy is now also working closely with schools to explore ways of transforming how instruction is organized, delivered, and experienced by both students and teachers. This study examines how Khan Academy and a group of California schools collaborated to pilot innovative approaches to teaching and learning in classrooms. These approaches seek to accelerate, personalize, and deepen student learning. The study also examines how Khan Academy sought to use its collaboration with participating schools to create a product that better met both educator and pupil needs.

Today teachers around the globe have access to more online learning resources than ever before, and more products are in the pipeline as entry costs decline and public access to

high-speed bandwidth devices increases. With an ever-growing array of choices, educators need more and higher-quality information about which products can work best in different settings and for different students, the factors that support more effective use in schools, and the opportunity costs and challenges of choosing one product over another.

While Khan Academy is still used predominantly by individuals for informal study outside of schools, its use in schools and other institutional settings has been growing. In September 2011, the Bill & Melinda Gates Foundation contracted with SRI International to study the development and use of Khan Academy in K-12 schools.

Our two-year study involved nine sites, 20 schools, and more than 70 teachers over the course of school year (SY) 2011-12 and SY

**SRI Education**

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Our two-year study involved **nine sites, 20 schools, and more than 70 teachers** to investigate Khan Academy's use as a supplemental educational resource in the classroom.

2012-13 to investigate Khan Academy's use as a supplemental educational resource in the classroom. All of the sites were volunteers that elected to participate in the study. Four sites participated both years, and the other five participated in the research for one year. Pilot school sites were selected to represent a range of governance structures and school types—public, charter, and independent schools; and elementary, middle, and high schools. Students in grades 5 to 10 were the focus of the study with around 2000 students participating in each study year. A majority of the sites served students from low-income communities, and several were using Khan Academy specifically to support the math instruction for students with the greatest learning needs. One site, a public elementary school district, had the largest level of participation, involving 8 schools, more than 50 teachers, and over a 1000 students. In the other sites, participation ranged from a single school and teacher, to two to three schools and five to six teachers.

Our report's findings are based on data we collected from the nine research sites during SY 2011-12 and SY 2012-13. We collected data during site visits, including classroom observations; interviews with site administrators; and interviews and informal conversations with teachers, parents, and students. We also conducted teacher and student surveys, and analyzed available standardized test scores and user data collected when students worked on Khan Academy activities.

**A focus on implementation rather than impact on learning.** During SY 2011-12 and 2012-13, SRI conducted an implementation study rather than an evaluation of Khan Academy's impact on learning, given that implementation of Khan Academy varied

across sites, Khan Academy tools and resources evolved over time, and schools, Khan Academy, and researchers collaborated regularly. Ongoing communications and tight relationships between the participating teachers, students, and school leaders with Khan Academy and SRI International resulted in both a more useful tool for teachers and students, and a better understanding of the various ways Khan Academy can be used in school settings to promote student learning.

During the study, Khan Academy worked with schools participating in the study to update and refine its tools and resources. Simultaneously, teachers and students were using Khan Academy tools and resources in considerably different ways across the nine study sites, and some of the sites also changed the ways they used it during the course of the two-year study. For these reasons, it was methodologically unsound to conduct a rigorous evaluation of Khan Academy's impact on learning during the study period, including any use of randomized control trials, which would have required Khan Academy tools and resources to remain unchanged during the study and for teachers and students to use Khan Academy the same way. Moreover, at all but one of the sites, Khan Academy was principally used as a supplementary tool—not as the core primary curriculum—so the effects of Khan Academy cannot be separated from those contributed by other elements of the math curriculum.

## Report Overview

This research brief describes Khan Academy resources and functions; provides examples of how three of the nine study sites used Khan Academy; and summarizes what educators and students found both helpful and challenging about using Khan Academy, and how Khan Academy responded to that feedback. It concludes by briefly identifying issues that Khan Academy and other developers of digital products for schools should consider as they look to the future. More detailed information about the diversity of models used at the school sites; factors facilitating the implementation of Khan Academy; how Khan Academy's design evolved during the study; findings about the impact Khan Academy had on supporting teaching and learning; and implications for further research, are available in the study's implementation report, "Research on the Use of Khan Academy in Schools", which is available at <https://www.sri.com/work/projects/research-use-khan-academy-schools>.

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## About Khan Academy

Founded in 2006, the nonprofit Khan Academy is now one of the globe's most popular education websites, and describes its mission as providing "a free world-class education for anyone, anywhere." Khan Academy offers more than 5,500 instructional videos—of which approximately 3,500 are about math—and they continue to be extremely popular. However, Khan Academy is more than a massive repository of teaching videos; it also offers more than 100,000 practice math problems that students can complete at their own pace. In 2013 alone, users worked on more than 700 million problems. Khan Academy has expanded its initial focus on math, economics, and science to include other subjects such as art history and entrepreneurship. Additionally, Khan Academy is now partnering with a diverse array of institutions including museums, universities, and thinktanks.

Khan Academy also recently introduced additional "coaching" features developed with schools in mind but also available to home users for informal instruction. The coaching section includes materials to guide teachers, tutors, parents, and others in how to use Khan Academy to meet their students' learning goals. It allows these users to assign specific material to their students, automatically sends students electronic alerts about their new assignments, and provides dashboards allowing teachers and students to monitor student progress.

For more information about Khan Academy, please see:

<http://www.khanacademy.org/about>

<http://khanacademy.desk.com/customer-portal/articles/441307-press-room>

## How did the study sites use Khan Academy?

Participating sites used Khan Academy's resources for different purposes—a practice tool, an intervention, an enrichment activity, and an accountability tool to monitor student progress.

Variation in how schools and teachers implemented Khan Academy across the nine sites we studied was an important aspect of this research, affecting what each site learned as a result of its experience. Participating sites used Khan Academy's resources in many ways and for quite different purposes—as an additional practice tool, as an intervention for students who had fallen behind, as an enrichment activity for advanced students, and as an accountability tool to monitor student progress. Each school found varying ways to employ the Khan Academy instructional resources, with its choices relating to both its institutional goals and the goals of individual teachers within the school.

Each school began working with Khan Academy at a different starting point, including varying levels of teacher training and experience, student and teacher comfort in the use of technology, and access to computers. Use in some schools evolved as students and teachers became more at ease with using Khan Academy or gained access to more computers in their classrooms. Some teachers materially adapted their use of Khan Academy as they learned more about it. Use patterns also evolved as developers added new features and content in response to ongoing communications with educators. All of this variation affected student and teacher interaction with Khan Academy, and in turn each implementation model offered differing benefits and posed differing challenges.

Even though Khan Academy is primarily known for its video library and has been associated with the “flipped” classroom model (i.e., teachers assign students videos about new concepts

to watch as homework, and use class time to extend the video lectures with discussion and interactive activities), teachers participating in the research were more focused on exploring how online, personalized practice opportunities for students could be incorporated into their existing instructional activities. In most cases, when students used the videos, they did so in class to review concepts as they worked through the Khan Academy problem sets. Few teachers used the videos in their lessons to introduce new concepts and skills.

Students primarily used Khan Academy problem sets to practice and refine skills individually and with classmates, while getting immediate feedback that resulted in a range of observed outcomes across the research sites including:

- Learning new math skills
- Filling in gaps in learning and shoring up weak spots from past instruction
- Tracking and monitoring school work to hold themselves accountable for their performance
- Spending more time in peer teaching and collaborative work with their classmates
- Receiving more opportunities to direct their own learning, and
- Allowing teachers to spend more time assisting individual students or small groups of students.

The following pages provide examples of how three of the sites we studied used Khan Academy. They showcase three contrasting models of how schools are using this technology to support core instruction. Additional details about these models and descriptions of Khan Academy use in the other six sites are discussed in the study's implementation report.

## Site 2: Using Khan Academy to facilitate self-directed learning

**The site:** We examined an innovative 9th and 10th grade math program in these two small charter high schools that opened in fall 2011. The schools are collocated in a neighborhood where 45% of students qualified for free or reduced-price lunches. These trailblazing schools emphasize a self-paced learning model, in which students take on significantly more personal responsibility for directing and managing their own learning than is typical at a traditional school. Technology plays a significant role in facilitating this approach.

**How it used Khan Academy:** This site was by far the most distinctive of the nine sites participating in the study because of its emphasis on preparing students for college using a self-paced, self-directed learning model. The site's mission focused on helping students learn how to set learning goals, hold themselves responsible for meeting those goals, and evaluate their own progress continuously along the way. More broadly, these schools encourage students to learn how to advocate for themselves as learners. Its math program was designed to support students' simultaneous development of content knowledge, academic skills, and critical non-cognitive skills.

During the first year of the study, when use of Khan Academy was mandated for all students, the schools had the highest use levels among study sites, with students spending about 22% of their instructional time on Khan Academy activities, compared to less than 10% at all of the other sites. In the second year, this site's students used Khan Academy for fewer hours

than the first year, because the schools changed their math instruction model to an entirely self-paced, self-directed approach, and Khan Academy use was now entirely at the discretion of students. While students used it for shorter periods of time during the second year of the study, they used it in more independent and innovative ways. This approach was more tightly aligned with the site's mission, and may be helpful to schools investigating how to use technology to personalize learning and make it more student-directed.

Khan Academy was the primary resource used in the schools' heavily personalized learning environment for math instruction. Math took place during a 2-hour time block with up to 200 students from two grades all meeting in one large open classroom. Students spent a significant portion of the math block working on their own or in small groups, often at laptops. Student conversations were frequent, but much of their talk was about math, about finding particular learning resources, or about navigating the digital learning environment. Teachers primarily served as facilitators and sources of support, with far less emphasis on traditional forms of direct instruction such as lecturing at the front of the room. Instead, teachers and "learning coaches" met with students as needed in the large classroom, as well as in smaller settings in adjoining rooms. By spring, the site had divided the two-hour math block into one hour that was student-directed and one that was teacher-directed. During the student-directed time, the students had access to two teachers or adult volunteers with math backgrounds who answered student questions and provided tutoring.

Teachers developed digital "playlists" to help students direct their learning time. A playlist was a set of links to recommended online activities

and educational resources that were directly related to the topics students were studying. The amount of time it took a student to complete playlist materials could vary from a few hours to several days, depending both on the topic and on the student's pace of work. The playlists were not limited to Khan Academy materials, but our observations and interviews indicated that Khan Academy was the most frequently used resource, particularly the problem sets. A student's playlist might include Khan Academy videos and problem sets, as well as other digital resources, including other websites similar to Khan Academy, online textbooks (which include readings, videos, and problem sets), PDFs of teacher-created worksheets, and interactive graphing calculators.

Each student working on a topic was assigned the same playlist, but individual students chose their own pathways through materials. Teachers did not mandate the use of any materials, nor did they stipulate a specific order or pathway for using them. Students could work on whichever activities and use any resources they found helpful, selecting as many or as few as they needed. Students could identify additional materials related to the topic on their own and work on those if they preferred. Whenever students felt ready, they could take a school-created test on the learning objective. Once they answered four out of five questions correctly, they were deemed ready to move on to the next topic.

Time was set aside during self-directed work time (one hour of a two-hour instruction block) for students to identify their learning goals and plan what they needed to do to meet them, as well as to reflect on their progress toward those goals. Students spent the first 10 minutes of each self-directed session planning how to use their class time and identifying

which digital or other resources they needed to meet their specific objectives for that day. After they finished their work, they spent 10 minutes reflecting on what they had learned, including writing about that day's learning experience, completing a survey, or otherwise self-evaluating their progress. By the second semester, students who were not making adequate progress were required to fill out forms that described their step-by-step plans for catching up.

#### **Lessons the school learned during the study:**

The high use of Khan Academy at Site 2 in the first year, SY 2011-12, relative to the other sites and study years was supported by several factors: (1) anytime access to one-to-one computing (one computer for each student) in classrooms, (2) mandated completion of Khan Academy goals with consequences for failure to do so, (3) close teacher monitoring of progress toward goals, (4) a well-planned integration with the core curriculum and (5) extended instructional blocks (90 minutes dedicated to daily math instruction).

In the second year, the site wanted to focus on its goal of building students' ability to direct their own learning in other areas in addition to mathematics. By giving students more control over what resources they used and for how long, the schools learned that some students needed additional support to do this kind of independent work. As a result of the site's experiences using Khan Academy technology to facilitate this model, it is currently working to identify the best ways to serve those students who need more help in self-directing their own learning, including increasing the amount of face-to-face time teachers have with students, and refining its student data management system to allow staff and students

to better monitor progress against curriculum benchmarks, and to alert staff sooner if students are falling behind.

This site is still experimenting, and its unconventional learning structures are very much a work in progress, but it is planning to scale and spread the self-directed, self-paced learning model to other schools in its network.

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## Site 8: Using Khan Academy to support teacher-led whole-class instruction

**The site:** Site 8 is a high school serving a predominantly high-poverty population. More than 80% of its students qualify for free or reduced-price lunch, and 75% come from families whose primary language is not English. The school's staff felt that Khan Academy could help meet their urgent need to help students catch up, given the significant number of students who were several grade levels behind in math upon entering the school in 9th grade. These gaps in critical skills were holding students back and making learning grade-level content extremely difficult.

**How it used Khan Academy:** Khan Academy was used on a daily basis by two educators: one teaching an algebra readiness class for ninth graders and a learning lab class, and the other teaching a mixed 9th and 10th grade Algebra 1 class, a mixed 9th and 10th grade geometry class, and a 10th grade Algebra 2 class.

The school primarily used Khan Academy to support teacher-directed, whole-class instruction. During the daily math class, all

students focused on the same practice problem sets at the same time. Rather than using traditional worksheets, however, they worked online using Khan Academy exercises. This approach may be helpful to schools exploring how to use technology to give students more opportunities to practice their math skills in a way that is integrated into the existing curriculum and also reinforces their teacher-led lessons. The two teachers at this site primarily employed Khan Academy as a resource to help students devote more structured, productive time to practice activities designed to help them fill in gaps in their math knowledge and skills and reinforce skills covered by the teacher in their daily lesson.

The school's educational vision emphasizes building students' self-discipline, sense of individual responsibility, and overall work ethic. Teachers viewed Khan Academy as a practical tool that could help students hold themselves accountable for staying on top of their assigned work. Both the time students spent working on Khan Academy and the progress they made were automatically archived and easily monitored by teachers in real time. The students could also view the information easily. Teachers could use the data to show their students the tangible academic results that occurred when they completed their work—as well as what happened when they did not complete their work or spend enough time on a particular task.

By providing a digital platform that makes it easier to document and analyze student performance on specific assignments over time, Khan Academy helped teachers pinpoint not just whether students had completed assigned problem sets, but also whether and how well they were mastering specific math skills such as factoring or graphing linear functions. This made

it easier for both students and their teachers to visualize and track academic progress. In turn, the data helped students make a clearer connection between doing their work and improved academic performance.

Students also knew that there were specific consequences for not finishing assigned work. For example, if students did not complete their Khan Academy problem sets, they had to remain after school to finish them, thus receiving additional motivation to stay on task during the school day. As one of the teachers said, even “if students don’t care about their grades and they’re happy with a D, they do care about their time.” In addition, Khan Academy provided students more information about their performance, which helped students identify precisely what they needed to do to make progress. This combination of direct consequences with better information helped steer students in the right direction.

**Lessons the school learned during the study:**

The school found that tangible reporting of results brought home to students the direct connection between putting more time into their work and positive results in their math performance.

In addition, preliminary evidence suggests that the changes made to the school’s math instruction, including the use of Khan Academy, were associated with improved test scores. For a group of 9th grade Algebra I students who first began using Khan Academy in SY 2011-12 in a summer academic program and continued to use it as 10th graders within their geometry class, we found moderate to large, statistically significant differences in spring test scores compared to students who attended the school before the change in math instruction. While it is not possible to separate out the

effect of the use of Khan Academy from other changes made to the school’s math program, Khan Academy is clearly playing a central role in what appears to be a very effective approach to improving student achievement through improving student accountability. Additional details regarding this analysis can be found in the study’s implementation report.

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## Site 9: Using Khan Academy to facilitate small-group instruction

**The site:** This school opened several years ago with grades 6 to 8, and will eventually offer grades 6 to 12. The school’s mission emphasizes academic preparation for higher education because many of its students are seeking to be the first in their families to attend college. It serves a predominately low-income, Latino population. This profile highlights a model of Khan Academy use implemented by the school’s 6th grade math teacher.

**How it used Khan Academy:** This middle school used a “rotation” model for its 6th graders, largely because it did not own enough computers for each student to have one. There were only about a dozen netbooks—inexpensive laptop computers designed for Internet access and wireless communication—available for a classroom of about 25 to 30 students. The school devoted a 2-hour daily block of time for 6th grade math instruction, which typically began with a 20-minute whole-class warm-up period consisting of announcements and “mental” math exercises (problem solving without calculator or pen-and-paper). The class

then divided into three groups of 8 to 9 students for the rotation stations. Each group spent about 30 minutes at each of the three stations, one of which was Khan Academy. At a second station, students worked in a small group with a teacher who gave a mini-lesson, and at the third students practiced independently on math worksheets or took an assessment. One day of class each week was reserved for whole-group instruction, activities, or testing.

The school's 6th grade math teacher used Khan Academy to adapt her instruction to better meet the needs of individual students. The teacher assigned students to groups based on whether they were performing below, at, or above grade level in math. The teacher would alter her lesson accordingly. Khan Academy data was one information source she used for making these decisions, and she also used the Khan Academy data reports throughout the year to monitor students' performance and progress.

This school employed Khan Academy largely as a supplemental instructional activity, but its use was integrated into the weekly math lessons. At the start of the Khan Academy station time, students would log on to the online classroom management portal [Edmodo](#) to view the problem sets the teacher had posted for them. Each week, the teacher assigned students about three Khan Academy problem sets to solve. Usually, two problem sets focused on the specific math topics being taught that week. The third problem set varied, depending on the level at which a student was performing, and whether that student needed more practice in specific areas.

The Khan Academy stations enabled students to work at their own pace; students could easily skip content on which they had demonstrated mastery and move on to new material. Or, if

they were struggling with a concept and got stuck, they could use the "hints" feature to reveal, one step at a time, a sample approach to solving the problem. The value created by this immediate support contrasts with the experience of completing a pencil-and-paper worksheet: if students hand in a worksheet with many blanks or errors, they may wait a day or more before receiving feedback or extra help. Conversely, with Khan Academy, students learned right away whether their solution was correct and used the hints feature to clear up confusion and get themselves back on track rapidly and independently, without the need to wait for a teacher. This time-saving measure helped facilitate the efficiency of the small group rotation model.

By the second half of the year, the school had acquired additional netbook computers so that it had enough for half the class. At that stage, the teachers reduced the number of rotation stations from three to two: half the students worked individually on Khan Academy activities at the computers, and the other half worked offline in a group with the teacher. The groups traded places after about 45 minutes.

This school's approach can serve as an example for schools that do not have enough computers available for individual use in a class. Even schools with one-to-one technology could use this approach to create time for the teacher to work with small groups while part of the class is productively occupied with other math assignments on the computers.

**Lessons the school learned during the study:**

At this school, teachers found a rotation model to be a productive way to use Khan Academy without having one-to-one computing. This was facilitated by established routines that ensured the smooth moving of students from

their small group time with the teacher, to their independent time working on Khan Academy. The school planned to adopt this rotation model across grades 6 to 8.

Teachers at this school singled out the immediate feedback students received as the most important benefit of Khan Academy. The school was also considering supplementing Khan Academy with other online resources to provide students with a variety of digital learning experiences.

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## Summary of Findings

While it is still too early to expect transformative change at this early stage—given teachers’ lack of experience in integrating digital resources effectively in the classroom and the absence of broadly adopted research-based implementation models—our research has enhanced understanding about what schools and teachers will need for effective use of emerging personalized learning technologies such as Khan Academy. This includes how developers organize and align digital content for use in the classroom, and what kind of training and other supports teachers need to help them integrate the technologies into their daily lessons.

A summary of key research findings across all sites follows. More detailed information about the findings is available in the study’s implementation report “Research on the Use of Khan Academy in Schools” at <https://www.sri.com/work/projects/research-use-khan-academy-schools>.

Overall **71% of students reported that they enjoyed using Khan Academy, and 32% agreed they liked math more** since they started using Khan Academy.

## Benefits of Khan Academy Use for Teaching and Learning

### Student Use and Perceptions

- **Student perceptions of their time spent on Khan Academy was highly positive.** Overall 71% of students reported that they enjoyed using Khan Academy, and 32% agreed they liked math more since they started using Khan Academy.
- **Students’ engagement level was generally high during Khan Academy sessions.** A high level of engagement was evident during a majority of our classroom observations for all grade levels. In focus groups with students in the lower grade levels, they often commented that they enjoyed their “Khan time,” and the teachers we interviewed and surveyed confirmed that attitude. In SY 2012-13, 8 in 10 teachers surveyed reported that students liked the time they spent working on Khan Academy and, across all grade levels, that students were moderately (62%) or highly (25%) engaged when using Khan Academy.
- **Students perceived that use of Khan Academy encouraged greater independence in learning.** Immediate feedback, hints, and access to videos meant that if students were struggling with a particular problem in Khan Academy, they were not stuck for long and could experience success even when the content became challenging: 45% of student respondents said that with Khan Academy they were able to learn new things about math on their own without the help of a teacher.

Student use ranged from a low of 11 minutes per week for the median student at Site 1 in SY 2012-13, to a high of 90 minutes per week at Site 2 in SY 2011-12.

- **The amount of time students spent working on Khan Academy varied considerably across and within sites, and also by school year.**<sup>1</sup> Student use (measured as viewing videos and working on problems) ranged from a low of 11 minutes per week for the median student at Site 1 in SY 2012-13, to a high of 90 minutes per week at Site 2 in SY 2011-12. Few teachers expected their students to use Khan Academy outside of the regular school day. Median student use outside of the school day ranged from a low of a few minutes a week at several schools, to as high as 25 minutes per week at Site 8.
- **Teacher perception of Khan Academy's impact on students varied across different learning areas.** Teachers reported the strongest impacts on students' overall understanding of math topics taught, ability to work and learn independently, and acquisition of procedural skills. A strong majority of teachers, 85%, reported that the use of Khan Academy had positively affected their students' learning and understanding of the material overall: 37% reported a "strong positive impact" on student learning and understanding, and 48% reported a "somewhat positive impact."

## Teacher Use and Perceptions

- **A majority of teachers were happy with their Khan Academy experience and planned to use the Academy with their students in the upcoming school year.** Among the participating teachers, 86% would recommend it to other teachers, and 89% planned to use it with their students during the next school year. Educators reported that the fact that the resource was free was an important factor in their decisions to use Khan Academy, given limited budget resources for new technologies. Two other key factors facilitating Khan Academy use were the availability of one-to-one access to computers in the classroom, and the allocation of extended time for math instruction. (Four of the nine sites dedicated 90 minutes or more a day to math instruction.)
- **Teachers reported that integrating Khan Academy into their instruction has increased their capacity to support their students in a number of areas.** Across the two study years, the majority (91%) of teachers indicated that using Khan Academy increased their ability to provide students with opportunities to practice new concepts and skills they had recently learned in class. About eight in ten teachers also reported that Khan Academy increased their ability to monitor students' knowledge and ability, thus helping to identify students who were struggling or ahead of the rest of the class. Similarly, eight in ten teachers said it helped them expose advanced students to concepts beyond their grade level, while nearly two-thirds of teachers reported that it increased their capacity to help students who were behind to catch up.
- **Teachers who viewed the Khan Academy reports regularly found them useful.** Slightly more than half of the teachers (56%) said they reviewed the student performance data at least once a week. But about four in ten participating teachers at the pilot sites said they reviewed the data about once a

Among participating teachers, **86% would recommend it** to other teachers, and **89% planned to use it with their students during the next school year.**

<sup>1</sup> The phrase "working on Khan Academy" refers to the total time students spent in watching videos or working on problem sets. It excludes the time students spent on the website logging in and out or engaging in other activities (e.g., updating their profile page, searching for content). This represents a measure of the amount of time students spent actively engaged in a direct instructional experience on the website.

month or less or not at all. Of the teachers who reviewed the data a few times a month or more often, slightly more than half (51%) said it was “very useful,” in informing instruction and the remaining 49% found it “somewhat useful.”

## Student Outcomes

- **A positive association was found between more Khan Academy use and more problem sets completed and two outcomes: (1) improvements in student test scores, and (2) improvements in three of the four self-reported nonachievement outcomes – math anxiety, math self-concept, and academic efficacy (i.e., belief in one’s ability to succeed in academic endeavors).** Evidence from exploratory analyses of data available from two sites suggested that students who spent more time on Khan Academy and successfully completed more Khan Academy problem sets to proficiency experienced more positive than expected outcomes in terms of math test scores, reduced math anxiety, and had higher confidence in their ability to do math. Prior achievement tests and attitude measures taken in the fall were used to predict end-of-year outcomes for all students, and then the sample was split into those whose end-of-year scores were better than predicted, and those whose end of year scores were less positive than expected.

– At Site 1, we found that fifth graders with better than predicted end-of-year achievement test scores had spent an extra 12 hours over the school year using Khan Academy and that sixth graders exceeding their predicted achievement level had spent an extra 3 hours on Khan Academy, compared to grade-level peers with lower-than-expected end-of-year test

scores. Similarly, fifth graders with higher than expected achievement test scores had completed 26 additional problem sets (39% more), and sixth graders with higher than expected achievement had completed 20 additional problem sets (or 22% more).

- Likewise, students at Site 1 who reported lower than expected anxiety about doing math in the spring compared to their reports in the fall, higher than expected beliefs about their own math ability (math self-concept), and greater confidence in their ability to learn math even when the concepts become difficult (academic efficacy), had completed 10% to 20% more Khan Academy problem sets than their grade-level peers who showed less positive than expected attitudes in these areas.
- These analyses are exploratory, and the results preliminary; they cannot be used to make definitive claims about the effectiveness of Khan Academy resources. Other plausible explanations could account for these associations that the analyses did not consider. Although the results are not definitive, they do suggest associations that are worthy of future investigation using more rigorous designs to better understand the potential efficacy of the use of Khan Academy in the classroom.

Exploratory analyses in two sites suggested: students who spent more time on Khan Academy and successfully completed problem sets experienced **more positive than expected outcomes in terms of math test scores, reduced math anxiety, and had higher confidence in their ability to do math.**

The virtually instantaneous nature of the feedback provided to students while working on the problem sets was attractive to educators as well as students.

## What did the educators at the study sites find helpful about using Khan Academy in the classroom?

Over the course of the study, educators at the nine study sites shared their thoughts about the aspects of Khan Academy they found most beneficial in a classroom setting:

- **Using modular problem sets to provide additional opportunities for students to practice math skills:** Teachers told us that they liked the modular nature of the videos and problem sets. Because the materials were not presented in a predetermined sequence, teachers could use them separately and independently, arranging the materials as they needed into customized playlists. Rather than following a set order, students could focus their attention on areas they needed to practice more, or skip ahead if they were ready to move on.
- **Facilitated differentiation:** The modular aspect of Khan Academy resources also helped facilitate differentiation in instruction: during a class period, different students could focus on different skills at the same time.
- **Rapid feedback:** The virtually instantaneous nature of the feedback provided to students while working on the problem sets was attractive to educators as well as students. The feedback was provided much faster than the time required for a teacher to grade and return a set of textbook problems, or even the time associated with students trading papers to check each others' work. Many educators reported that it was this aspect of Khan Academy they found most valuable.

- **Self-directed learning:** Khan Academy gave students the opportunity to self-direct their learning, and build confidence in their ability to work and learn independently. Students could also use the expedited nature of the feedback to inform and drive their understanding, enabling them to assert more control and ownership over the direction of their learning.

## What challenges did educators using Khan Academy encounter?

Although many aspects of Khan Academy were helpful, teachers did encounter some challenges in classroom use, and some features were underused.

- **Alignment of content to grade-level curriculum:** Lack of alignment of Khan Academy content with core curriculum posed a significant challenge for integrating Khan Academy into the classroom. Two-thirds of teachers surveyed across study years reported that a lack of alignment between the Khan Academy resources and their school's curriculum had a moderate to significant negative effect on their ability to use Khan Academy effectively with their students. From a formal school curriculum perspective, content gaps existed in both the videos and the problem sets during the first year of the study, and to a lesser extent during the second year as well.
- **Organization of the content:** Teachers need online content that is curated, assignable, and clearly mapped to grade-level content

Two-thirds of teachers surveyed across study years reported that a lack of alignment between the Khan Academy resources and their school's curriculum had a moderate to significant negative effect on their ability to use Khan Academy effectively with their students.

standards. The Internet offers a vast amount of digital content, of which Khan Academy is just one resource, but teachers do not have time to curate all of this content. During most of the SY 2011-12 school year, many teachers expressed difficulty locating the videos and problem sets that were relevant for their upcoming lessons and were at the appropriate level for their students. During the study period, Khan Academy also lacked an assignability or “recommendation” function. Teachers could not easily specify the Khan Academy content they wanted students to work on, such as topics recently covered in a lesson or skills that students needed to develop or improve.

- **Data reporting functions:** Khan Academy's data reports are intended to give teachers better information to help improve how they monitor both individual and class understanding, adapt their instruction accordingly, and also provide better feedback and support to students. These data functions are being promoted as one of the primary benefits of these new technologies, but these features are being relatively underused, both in this study and our other studies on blended learning. As noted above, during our two-year study period, while a majority of teachers are reviewing student performance data captured by the system on a regular basis, about four in ten of the teachers participating in the study reviewed the Khan Academy student data infrequently (once a month or less) or not at all. Among those who never reviewed the data or who reviewed it infrequently, 70% indicated that they did not use the reports more frequently because they relied on information outside the system to gauge student progress, such as their own observations and formative assessments.

## As a result of these challenges, what product features did Khan Academy change?

In response to feedback from the educators at the study sites, Khan Academy implemented a wide array of changes, adding or adapting features to facilitate the product's use in the classroom.

In July 2013, Khan Academy launched a major redesign of its website with the release of its grade-level “missions” and a new “learning flow” and “learning dashboard.” The redesign was introduced to help students focus on working in the appropriate content area. From their dashboard, students can select a mission, and while in the mission, the system will only display the videos and problem sets mapped to a single grade level (e.g., the Grade Six Mission) or course content (Algebra I) along with videos and problem sets associated with any prerequisite skills.

Khan Academy also created considerable new videos and problem sets specifically designed for each grade level, mapped content to the Common Core State Standards (full coverage of the K-12 standards is currently planned for fall 2014), added search capabilities, created a problem set browser to help teachers find aligned content, and, by the end of SY 2011-12, reorganized its math content into “tutorials” intended to contain related videos and problem sets that teachers can use or modify to support an instructional unit on an important topic. It also gave users the ability to slow down and fast forward videos through playback, to make it easier for them to digest the content.

Khan Academy also revised its teacher reports to provide more simplified, customizable summaries of student data at both the class and individual levels, and created the ability for teachers to recommend specific Khan Academy content to their students. To ease the burden on teachers, Khan Academy now emails student progress reports to teachers.

For students, Khan Academy added a goal-setting feature, and other tools to help visualize progress within the new grade-level missions.

Academy in combination with close teacher monitoring and extended periods for math instruction can improve student learning. For now, these preliminary findings should be interpreted cautiously and should not be over-generalized. No single implementation model was used across all the sites, and Khan Academy was not used as the sole, or even primary source of math instruction at most sites, making it difficult to isolate its effects.

Teachers and schools leaders are attracted to using Khan Academy because it is available for free, offers a modular set of resources, engages students, provides immediate feedback, and offers opportunities for students to direct their own learning. At the same time, fundamental challenges remain that constrain how schools use Khan Academy. These challenges include accountability pressures, restrictions on instructional time, and limited access to one-to-one computing.

Taken together, the study's findings have several broader implications:

- The Khan Academy school pilot program demonstrated that a collaborative partnership between a lean technology startup and schools can result in substantive feedback from students and teachers which in turn leads to better learning and teaching experiences and improved digital education offerings.
- Schools and teachers adopting Khan Academy can benefit from detailed use cases, describing how Khan Academy can be implemented under different time and technology constraints and with different instructional goals.

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## Summary and Implications

Our implementation study focused on understanding and documenting the models that educators are experimenting with as they use Khan Academy's math resources in schools; considering the benefits and challenges of doing so; and examining how this can inform future decisions about whether and how to adopt Khan Academy for classroom use.

Overall, the study identified many positive findings relevant to educators, developers, and education leaders, and shows that the schools serving diverse student populations can make use of Khan Academy as a component in their mathematics instruction. Teachers in the pilot schools reported that they found value in using Khan Academy to support their instruction, that it helped their students, and that they planned to continue to experiment with different models for integrating Khan Academy into their math curricula. Students also indicated in focus groups and on surveys that they liked using Khan Academy. In addition, early evidence from one site suggests that a math instruction approach using Khan

Our learnings in this study made it clear that the teacher's role is still central even in the wake of the adoption of new technologies.

- Teachers like having a source of extensive, curated digital content but want to maintain responsibility for leading instruction, as well as control over students' use of the content.
- Most students are not yet used to acting as independent learners; as a result, teachers implementing Khan Academy typically need to intentionally orient their students to the types of independent learning practices and habits necessary for success in this learning environment.

the roles that non-cognitive student characteristics—motivation, persistence, resourcefulness—play in student success in these environments. Finally, experimental studies of the impacts of different Khan Academy implementation models and other digital learning tools like Khan are needed to determine effects not only on math achievement but also on students' attitudes toward mathematics and their capacity for self-directed learning.

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Research should be pursued to understand the roles that non-cognitive student characteristics—motivation, persistence, resourcefulness—play in student success in self-directed learning environments.

Our learnings in this study made it clear that the teacher's role is still central even in the wake of the adoption of new technologies. The achievable classroom benefits of using new technologies can include building stronger connections with students, and developing a clearer and deeper understanding of what students actually know. At their best, the new technology tools can enable teachers to do what they find most fulfilling: interacting with students to have a positive impact on their learning experience.

With this in mind, our study shows that teachers still need support in integrating online instructional resources into the curriculum; they need digital content that is curated and aligned with grade level standards, and models of use that demonstrate the resource's value with students like theirs. As we move toward greater classroom use of self-paced instructional resources, students will also need additional support to navigate this transition, which may vary depending on the fit between the individual student and the online environment. To understand the supports needed so that all students can excel in self-directed online learning environments, research should be pursued to understand

For more information visit:

- SRI Education's Khan Academy Project website:  
<https://www.sri.com/work/projects/research-use-khan-academy-schools>
- SRI Education: [www.sri.com/education](http://www.sri.com/education)

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