

The **Research Alliance** for
New York City Schools

Connecting Teachers and Ed-Tech Developers

Lessons from NYC's "Gap App" Program

Adriana Villavicencio

Nina Siman

Camille Lafayette

David Kang

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CHAPTER 1: INTRODUCTION

In recent decades, technological innovation has reshaped the global economy and changed the shape of many fields, including education. These advances have spurred optimism about the role technology can play in the classroom, in part by providing more personalized learning environments and expanding access to various kinds of resources for teachers and students. School districts across the country have tried to infuse technology into classrooms while pushing schools and educators to think creatively about how these new tools can improve their practice and better engage students. For example, in 2010, New York City’s Department of Education (DOE) established the iZone, an office whose role is to support the innovative use of technology to enhance teaching and learning in a network of about 250 schools.

In 2011, the iZone received support from the federal Investing in Innovation Fund (i3)¹ to create “Innovate NYC Schools,” an initiative designed to foster collaboration between educators and educational technology developers. The initiative aimed to increase the exchange of information among stakeholders and revamp the evaluation and procurement process for education technology. Innovate NYC Schools experiments with new methods of procuring and piloting education technology (ed-tech) tools for NYC public schools, with the goal of strengthening the alignment between teaching and learning demands on one hand and the supply of ed-tech tools and services on the other.

One of the first new procurement strategies tested by the Innovate NYC team was the “Gap App” competition, which invited developers to create and submit apps that “would help teachers more effectively manage their classrooms, tailor lessons to students with different ability levels, and increase student engagement in the classroom.”² The challenge was open to two types of apps: (1) teacher-facing tools designed to increase student engagement and (2) student-facing apps focused on personalized math instruction.

A group of apps from the competition was selected to be piloted in a set of NYC schools during the 2013-2014 school year. Over the course of the year, the educators who used the apps in their classrooms met with the developers to discuss their experience with the app and ideas for refining it. The Gap App program aimed to involve educators in the early stages of product development to better align the education technology tools that teachers have available with their actual classroom needs.

The Research Alliance for New York City Schools was asked to evaluate the development of the Gap App challenge and pilot program. Beginning in 2013, we undertook a study of how the program was implemented, including an examination of teacher and student perceptions and use of the Gap Apps and how they felt the apps had changed their experiences in school. We describe the key findings from this study in Chapters 3 and 4 of this report.³

While the Gap App program has ended, the Innovate NYC team has continued its work to help ed-tech developers collaborate with educators in their classrooms. The report concludes with a set of lessons learned from the Gap App experience, which we hope are useful for the Innovate NYC team's ongoing work, as well as other school districts exploring new ways to bring technology into classrooms.

The DOE's Innovate NYC Schools Initiative

Innovate NYC Schools seeks to improve upon the DOE's traditional Request for Proposals (RFP) process, which many consider outdated and incompatible with the fast pace of technological change (Maas and Lake, 2015). Because the RFP process is lengthy, technology that was brand new when an RFP was released is often outdated by the time it reaches classrooms. In addition, DOE staff have noted that the "red tape" associated with the traditional RFP system can leave many developers with a negative impression, and may discourage smaller, newer vendors with limited administrative infrastructure from working with the DOE. Innovate NYC Schools was intended to provide a faster, more efficient way to procure ed-tech tools. Its staff also hoped to create a positive working experience for developers, while helping educators become more informed about ed-tech tools, with an eye toward encouraging future collaboration between the two groups (see <http://izonenyc.org/?project=innovate-nyc-schools>).

In addition to the Gap App program, Innovate NYC Schools has launched various initiatives designed to bring software developers and educators together to develop products that meet the needs of NYC educators and support student learning, for instance:

- In Fall 2013, Innovate NYC Schools partnered with the Office of Student Enrollment to offer a challenge looking for tools to better support families and students through the high school selection process. The **School Choice Design Challenge (SCDC)** began with a process that elicited the experiences of families and students, which then informed developers' product designs. The SCDC consisted of a two-month engagement with six teams. After two rounds of user feedback, four apps were released on the DOE's website at the end of the 2013-2014 school year. By the end of December 2014, the apps had nearly 20,000 profiles created and nearly 100,000 pageviews.
- With additional funding from the Bill and Melinda Gates Foundation, Innovate NYC Schools launched the **Short-Cycle Evaluation Challenge (SCEC)** in the 2014-2015 school year. Instead of starting with an open software challenge, the SCEC began by asking school-based teams of educators to apply and define a problem of practice that technology may be able to solve. The DOE team then matched the strongest educator teams with an existing ed-tech tool, based on their defined need, to conduct a pilot.
- **#SharkTankEDU** is a monthly engagement that brings three ed-tech startups to demo their product in front of a panel of seven education stakeholders (teachers, administrators, students, or parents). It provides an opportunity for startups to receive feedback. It also allows the developers and education stakeholders to test assumptions about each product, including whether the problem the product is intending to solve is really a problem for schools.

CHAPTER 2: STUDY SAMPLE AND METHODS

Our evaluation of the Gap App program addressed three related questions: 1) How was the program implemented in schools? 2) Did participating teachers' use of, opinions of, and proficiency in technology change over the course of the program? And 3) Did students in classrooms with math Gap Apps change their attitudes toward math over the course of the program? As described below, we used a combination of interview and survey data to answer these questions.

To provide context for our evaluation, we first describe the participating schools, along with the teachers and students that comprise our study sample. We then provide a brief summary of the data collection and analytic processes used to answer the research questions listed above.

Gap App Schools, Teachers, and Students

Schools

A total of 13 schools participated in the Gap App program, though one discontinued the program when its app no longer fit its needs (see Chapter 3 for further details). Of the 12 remaining schools, 10 were middle schools (initially, the Gap App challenge focused on middle school instruction) and two were high schools. Participating classrooms in seven of the schools received student-facing math apps, while classrooms in the remaining five schools received teacher-facing apps designed to increase student engagement.⁴ (See Table 1 below.)

Table 1: App Types and Number of Participants at Gap App Schools

	Middle Schools										High Schools		Total
	A	B	C	D	E	F	G	H	I	J	K	L	
Math App		X			X			X	X	X	X	X	7
Engagement App	X		X	X		X	X						5
Number of Participating Teachers	2	2	3	2	2	3	4	2	2	2	2	2	28
Number of Participating Students	24	93	94	42	51	99	207	61	75	118	29	61	954

Table 2 below provides further details about the 12 schools included in our evaluation. The recruitment process (discussed in more detail in Chapter 3), though restricted to schools in the DOE’s iZone, resulted in a diverse set of participating schools, whose teachers and students were demographically similar to the population of NYC schools. The 10 middle schools and 2 high schools were comparable to other schools in the City, as measured by location (all five NYC boroughs are represented), size, demographics, and student achievement across 6th-8th grades in recent years. Students in Gap App schools attended school at a higher rate and were proportionately more female (one Gap App school is an all-female school), more likely to receive special education services, and more likely to have at least one poverty indicator. The 10 Gap App middle schools were also, as a whole, smaller than the average NYC middle school.

Table 2: Background Characteristics of Gap App Middle Schools and Other NYC Middle Schools, 2012-2013

	NYC Middle Schools ^a	Gap App Middle Schools ^b
Female (%)	48.3	51.8
Race (%)		
Latino	40.6	40.8
Black	25.6	32.1
White	14.6	18.3
Asian	18.2	8.2
Other	1.1	0.5
Receive Special Education Services (%)	18.1	20.8
English Language Learners (%)	26.2	21.0
Poverty Status^c (%)	84.5	88.6
Average NY State Test Scores^d		
Math	0.02	-0.17
English Language Arts	0.01	-0.11
Attendance Rate (%)	93.2	92.5
Average Number of Students per School (6th-8th Grades)	584.6	456.8
Number of Schools	242	10

Source: Research Alliance calculations using data from the NYC Department of Education.

Notes: a. Middle schools are schools with students in grades 6-8 excluding the Gap App schools. b. Characteristics are shown only for Gap App students in grades 6-8. c. Indicates that a student qualified for free or reduced price lunch, was enrolled in a school that provides free lunch for all students, or received any sort of public assistance. d. Test scores are z-scores normalized by grade with the district-wide mean and standard deviation.

Teachers and Students

Twenty-eight teachers and 954 students participated in the Gap App program. It is important to note that, because principals in half of the schools selected the participating teachers and classrooms (i.e., they were not randomly selected), they are not necessarily representative of their school or comparable to the broader population in NYC schools. Table 3 shows a few key characteristics of participating teachers in our sample, specifically gender, race/ethnicity, and number of years teaching. Table 4 presents information about participating students. It shows that students were predominantly Black and Latino, about 90 percent of students received free and reduced priced lunch, and that over a third of students in the two high schools received special education services.

Table 3: Background Characteristics of Gap App Teachers, 2013-2014

Characteristic	
Female (%)	61.9
Race (%)	
Latino	19.1
Black	28.6
White	42.9
Asian	3.6
Other	6.0
Years Since First NYC Hire	6.9
Number of Teachers	28

Source: Research Alliance calculations using data from the NYC Department of Education.

Table 4: Background Characteristics of Students in Gap App Classrooms, 2012-2013

Characteristic	Middle	High Schools
	Schools	
Female (%)	52.7	38.9
Race (%)		
Latino	39.2	41.1
Black	47.5	55.6
White	7.4	2.2
Asian	5.6	1.1
Other	0.4	0.0
Special Education Services (%)	22.0	34.4
English Language Learners (%)	9.6	3.3
Poverty Status (%)	89.9	91.1
Attendance (%)	94.1	85.8
Schools	10	2
Total Number of Students	864	90

Source: Research Alliance calculations using data from the NYC Department of Education.

Notes: a. Indicates that a student qualified for free or reduced price lunch, was enrolled in a school that provides free lunch for all students, or received any sort of public assistance.

Data and Analysis

For the first phase of the Gap App program evaluation (2011-2012), the Research Alliance team collected data through interviews and document reviews. Two researchers from the Research Alliance interviewed eight people at the NYC DOE (one in the procurement office and seven in the iZone), as well as eight people employed by Innovate NYC's partners (IDEO, ChallengePost, CUNY, and Harley & Co.). We asked questions about key components of Innovate NYC Schools, as well as its goals, theory of action, main challenges, opportunities, and recommendations for moving forward.

We also reviewed documents and other materials produced around the program, such as project narratives, working papers, and video footage from IDEO. Finally, we documented the competition through which apps were selected (run by a company called ChallengePost). We tracked the number of people "following" the post on the ChallengePost website and through email subscriptions, and we monitored the competition's discussion page. We also tracked Twitter mentions of the competition.

For the second phase of the evaluation, our study focused on how schools and developers implemented the Gap App program and what challenges they faced in collaborating with each other and rolling out the apps to students. Over the course of four months, starting in December 2013, we: 1) observed all three Gap App workshops (forums hosted by Innovate NYC for developers to meet teachers from their matched school), 2) interviewed 12 of the 13 participating developers (one declined our interview request), 3) conducted one interview and one focus group with four members of the Innovate NYC team, and 4) held focus groups with two to four teachers from each of the 12 participating schools. Interviews used semi-structured protocols (see Appendices A, B, and C). All interviews and focus groups lasted about 45 minutes, and were audio recorded and transcribed.

Interviews

We analyzed interview data through an iterative process. After each school visit, members of the research team wrote reflection memos on specific elements of the interview (e.g., communication between the teachers and developer, usage of the Gap App in the classroom). Each member then read all of the reflection memos on a given element to create an analytic memo about that element. All research team members read and discussed the analytic memos, and used them to co-develop a set of 29 codes, which we then used to analyze each transcript. We used data from the

coded transcripts to identify the most salient codes across schools and developers. Based on the codes we identified as most prominent, we focused our study of the interview data on three aspects of implementation: usage, teacher-developer partnerships, and student experience. We then used the transcript data related to each of these topics to create detailed outlines of key findings.

We also distributed a brief questionnaire to the teachers using a Gap App to gauge frequency of use and other quantifiable implementation data (see Appendix D). For example, we asked teachers to identify how often they thought they were supposed to use their app (as specified by their developer), relative to how often they actually used the app. Findings from the questionnaire can be found in Chapter 4. Finally, we reviewed app usage logs, but only six of the 12 developers provided these logs, so we do not report those data here.

Teacher and Student Surveys

In order to further understand the role the Gap Apps played in classrooms, we surveyed teachers and students. We administered a survey in Fall 2013, before the Gap App program had started, and the same survey again in Spring 2014, after at least three months of Gap App use.

One of the Gap App program's goals was to increase teachers' use of and opinions about technology by putting them in close contact with developers. Thus, we surveyed teachers about their general attitude toward technology, how often they used technology in the classroom, and their proficiency with technology (see Appendix E). Twenty-eight teachers completed both the fall and spring surveys, a response rate of 100 percent.

Another goal of the program was to improve students' learning experiences through technology, particularly in math. Thus, we designed a student survey for all 12 participating schools to examine whether students' opinions about technology, critical thinking skills, problem-solving abilities, and attitudes about math changed after participating the Gap App program. For the schools using apps specifically related to math, we asked additional questions to determine whether students' math self-efficacy and interest changed over time in the Gap App classrooms.⁵

A total of 874 Gap App classroom students took our fall survey, and 820 students took the spring survey. The response rates were 87 percent for the fall survey and 83 percent for the spring.⁶ In both cases, students were spread across 46 classrooms.

Further Context for the Findings

The interviews and focus groups we conducted allowed us to compile a balanced array of perspectives from school personnel, students, and developers, as well as DOE staff and their partners. This allowed us to identify important patterns and better understand the experiences of users and developers. We did not encounter any issues with the use of our interview protocols nor in our procedures for recording, transcribing, or analyzing data.

Our surveys, specifically designed for evaluating the Gap App program, included a wide variety of questions about math and technology in the classroom. The use of pre- and post-treatment surveys allowed us to capture changes in perceptions among teachers and students following their participation in the Gap App program.

The study does not include direct measures of students' and teachers' usage of the apps chosen for their schools and classrooms. Although we requested usage data from all Gap App developers, many apps were not set up to collect this data, and so we only received usage data from half of the developers. Therefore, our only consistent measurement of usage levels is based on teachers' responses to a questionnaire. It is important to note that these self-reports may differ from actual usage.

Overall, this report focuses on the implementation of the Gap App program and provides insights into how the attitudes of participating teachers and students toward technology and math changed over the course of the pilot. It is important to note that the findings in this report are not able to shed light on the extent to which the Gap App processes, or the apps themselves, *caused* the observed changes in teachers and students perceptions or use of technology in their classrooms. A forthcoming data brief will provide findings from a non-experimental assessment of Gap App impacts on student and teacher perceptions and on students' math achievement. The remainder of the current report highlights findings from our implementation analysis and discusses broad lessons that emerged in the course of our evaluation.

CHAPTER 3: PLANNING AND DEVELOPING THE GAP APP PROGRAM

The Gap App program was designed to procure apps for personal computers or mobile devices to address specific learning challenges in NYC schools. The project began with an open call for software developers to submit apps to a competition. Then, a select group of competition entrants were given the opportunity to pilot their app in a school and receive feedback from teachers whose classroom used it.

The Gap App program aimed to advance the two main goals of Innovate NYC Schools: first, facilitating a better match between schools' needs and developers' tools, and second, improving the procurement process for both developers and schools. This chapter describes the planning and early rollout of the Gap App program, up to the piloting phase (which is described in Chapter 4).

Identifying Learning Challenges

Beginning in the spring of 2012, the Innovate NYC staff and various collaborators spent a good deal of time identifying the proper focus for the apps that would be developed through this program. Initially, the Innovate NYC staff planned to focus on learning challenges that deter students from enrolling and succeeding in science, technology, engineering, and mathematics (STEM) coursework. Over the next year, this focus would shift three times as program leadership changed. Ultimately, the scope of the learning challenges was broadened to encompass anything that inhibited students from learning math in middle school, which might include more general obstacles that limit teacher effectiveness. This change was intended to give developers more creative license in developing solutions.

Innovate NYC staff also began to emphasize a design-based, bottom-up approach to problem identification. They hired a design firm, IDEO, to identify specific learning challenges within the two focus areas by conducting informal interviews and focus groups with educators from eight middle schools.⁷ The interviews and focus groups used a semi-structured protocol largely focused on the challenges of teaching middle school math.

IDEO identified key learning challenges affecting both students and teachers, including different levels of proficiency within a classroom, word problems not being relevant to students, and lack of parental engagement.

The Innovate NYC team, along with staff from ChallengePost (an online platform specializing in software development competitions, which hosted the Gap App challenge), translated the learning challenges into two sets of guidelines for app content. The first set, called Math Instructional, was for apps that would make math relevant for students by linking it to their lives and enabling students at different ability levels to work together. The second was for Administration/Engagement apps that would help teachers meet individual students' needs (e.g., help students understand where they were struggling) and connect with other teachers.

Soliciting Solutions: The Gap App Challenge

Once the guidelines were in place, ChallengePost designed and conducted a three-month long competition known as the Gap App Challenge, which launched on January 7, 2013. The competition invited developers to submit apps that met one of the two sets of guidelines. Developers were allowed to submit either existing apps or ones created specifically for this challenge.

The challenge had several noteworthy rules. First, the competition results were decoupled from pilot participation—meaning that apps that did not win the competition were still eligible for piloting. This gave more developers incentive to participate, as they would have a chance to pilot regardless of whether they won the competition. Second, in order to invite even more participation, alignment with Common Core State Standards was recommended, rather than required. Third, the competition targeted smaller software companies, only allowing submissions from companies with fewer than 100 employees. Finally, because of existing DOE and school resources, entries had to run on Windows computers, Apple computers or iPads, or through a web browser (this disqualified Android apps, which were incompatible with DOE systems).

Over 200 apps were submitted via the competition, and ChallengePost deemed 167 eligible for a prize.⁸ A panel of judges, including NYC educators, members of the Innovate NYC Schools staff, and leaders in the technology community, selected 39 apps as eligible for piloting. Criteria for selection included how much judges thought that teachers would want to use the app in their classroom, the quality of user experience, the quality of the idea, and the potential impact of the idea. Some of these 39 finalists were “winners” of the challenge, who received cash or Amazon

web service credits. Separately, the Innovate NYC team worked to match app developers with educators for the Gap App program.

Recruiting Schools

In mid-April 2013, the Innovate NYC team started recruiting schools for the piloting phase. They initially targeted middle schools already participating in the DOE's iZone initiative (these schools were already actively engaged with technology) with the goal of piloting two waves of 12-15 schools in the fall of 2013 and another two waves of 12-15 schools in the spring of 2014, for a total of 48-60 schools. Eventually, the DOE decided to target only 12-15 schools for the entire 2013-2014 school year, including both middle and high schools, so that they could provide more support to individual schools (each member of the Innovate NYC team was assigned to be a "facilitator" for three to four schools).

The Innovate NYC team recruited schools by emailing, calling, and visiting them. Recruitment efforts focused on explaining the Gap App program and what the apps were created to do, what would be expected of participating schools and teachers (including technology requirements), and building buy-in and commitment to the Gap App program. Schools expressed interest in two stages, by submitting an interest form followed by a commitment form. Importantly for our evaluation design, school leaders—and not specific teachers—were the ones who expressed their interest and commitment on behalf of their educators.

Ultimately, 13 schools (11 middle schools and 2 high schools) committed to the Gap App program and were considered by the DOE to have sufficient technological capacity by the DOE to participate.

After a few months, one of the 13 schools dropped out of the program because the developer decided to change the app in a way that did not meet the needs of the teachers. We have not included data from this school in our analyses.

Matching Apps with Schools and Classrooms

After the schools were selected, administrators and teachers in each of the 13 schools were asked to review the 39 finalists and select their five preferred apps. Notably, the teachers who reviewed the apps were not necessarily those who would participate in the Gap App program. They made their selections based on two-

minute videos about each app that had been a required part of developers' competition submissions.⁹

The Innovate NYC team used these preferences to match each school with an app. At the end of this process, 11 of the schools (85 percent) were matched with one of their top three choices; the other two schools did not receive one of their five choices. No two schools were matched with the same app. (See Table 5 on the next page for descriptions of the apps).

Two to four teachers from each school were selected to use a Gap App in their classroom.

Summary

The planning and development stages of the Gap App program met several of the initiative's goals. For example, over 200 developers submitted to the ChallengePost competition, which suggests that the program successfully engaged this community in a new procurement approach. The Gap App program was also a step toward Innovate NYC's goal of involving teachers in decision making when it came to selecting an app for their school.

At the same time, there were some significant challenges associated with this attempt to create a user-driven, teacher-centered development process. Changes to the project's overall learning goals, as well as some leadership changes, delayed the launch of the program and left less time than planned to recruit schools. More importantly, the degree to which the process of selecting learning challenges was actually user driven is unclear. IDEO's problem-identification process only involved a small number of teachers, and they were not the users who would actually be incorporating these tools in their classrooms. Similarly, the teachers who ranked the apps for a school were not always the ones using the apps in their classrooms.

Some of these limitations—including the lack of interest on the part of some teachers and the lack of interest in getting feedback on the part of developers—will become more apparent in the next chapter, where we document the implementation of the Gap App pilot and its implications for teachers and students.

Table 5: Description of the Gap Apps

App and/or Company Name	App Description	App Type (Math/Engagement)	Audience (Teacher/Student Facing)
BuzzMath	BuzzMath is an adaptive learning web and mobile application designed to strengthen math skills for middle school students.	Math	Student
Doceri by SP Controls	Doceri is an interactive whiteboard that allows teachers to guide and record lectures through a remote desktop control feature.	Engagement	Teacher
eMath	eMath is a customizable adaptive learning math program designed for instructor-led differentiated teaching and student self-paced learning.	Math	Student/Teacher
Gap App: Fractions	Gap App: Fractions is web and mobile math application designed to help students practice fluency in basic mathematics (adding, subtracting, multiplying, dividing, and comparing fractions).	Math	Student
Gradeable	Gradeable is a digital database and collaborative professional development tool designed to store, track, and analyze student assessment data to determine best practices for a school.	Engagement	Teacher
Hapara Inc.	Hapara is a knowledge management system designed to organize teacher files by creating student and classroom portfolios in tandem with the Google Apps for Education platform.	Engagement	Teacher
Metryx	Metryx is a digital assessment tool for teachers designed to track, collect, and analyze data on student learning progressions to inform instruction.	Engagement	Teacher
Live School	LiveSchool is a school-wide digital management and reward system designed to track student behavior.	Engagement	Teacher
WootMath	WootMath is a web-based math application designed to support students' conceptual understanding of rational numbers, fractions, and pre-algebra through differentiated learning.	Math	Student
Mathalicious	Mathalicious is a math curriculum database designed to support teachers in helping middle and high school students master Common Core standards through a real-world context.	Math	Student/Teacher
Know Re	Know Re is an adaptive learning math application, aligned to Common Core standards and designed to support differentiated learning, problem solving skills, and critical learning for students learning algebra and geometry.	Math	Student
Fluid Math	FluidMath is a math application designed to convert handwritten algebraic and calculus expressions into digital texts and graphs.	Math	Student/Teacher

CHAPTER 4: HOW WAS THE GAP APP PILOT IMPLEMENTED IN SCHOOLS?

A central goal of our evaluation was to document the implementation of the Gap App program in participating schools, and to evaluate whether the program was executed as its designers intended. As described in Chapter 2, this phase of our study drew on a variety of data sources, including interviews and focus groups with teachers and developers, a detailed questionnaire about app usage completed by every participating teacher, and a survey about teacher and student attitudes towards technology and student attitudes towards math.

We used three of the program's primary goals as a guiding framework to evaluate implementation within each school. Specifically, we examined:

- **Usage:** To what extent did teachers use Gap Apps and other technology in their classroom?
- **Teacher-Developer Partnership:** Did developers and teachers form strong working relationships and collaborate on the use of and improvement of a Gap App in the classroom?
- **Student Experiences:** Did the use of apps in the classroom improve learning opportunities for students?

The following sections examine these questions in detail.

Usage

For the Gap App program to succeed, clearly, the apps had to be used. We examined for how long and how often teachers and/or students actually used an app, relative to expectations. These expectations were set in September 2013, at the Gap App program's kickoff workshop, where participating developers and teachers met their matched partner for the first time. Developers and their teacher partners (2-4 per school) were asked to work together to come up with a usage plan that specified how the app would be used, the overall purpose of the app, how frequently it should be used, and how to best incorporate the app into classroom instruction. These plans enabled us to compare the expected use of each app with actual reported usage.

Based on interviews and teacher questionnaires, combined with our workshop observations, we learned that expected app usage varied, due to the design of each app. For example, many of the math apps, which were designed to support skill development, recommended daily or semi-daily use in 15-20 minute increments throughout the class period. On the other hand, many of the engagement apps (which were largely teacher facing) did not have recommendations that were as specific for how long or when the apps should be used.

We learned from the teacher questionnaire and interviews that for a majority of apps, actual use fell below developers' prescriptions, for a variety of reasons. In fact, 72 percent of teachers reported using the apps less than planned. The primary limitation teachers reported stemmed from difficulty integrating the app into classroom instruction. As one teacher described, it was not always clear how to align the app with the curriculum and lessons teachers had planned:

You don't want to just use them to use them. You want to use them because they're the best tool. Often, it didn't feel like the tool is applicable to everything that we cover. It's hard to know when to use it.

In addition, several teachers reported not having the technological resources needed to use the app, despite being part of the iZone. Schools in the Gap App program were screened to ensure that they had the appropriate technology (i.e., laptops, tablets, internet access). However, teachers in eight schools reported issues ranging from Wi-Fi connectivity problems to a lack of computers, laptops, or iPads. Teachers in some of these schools were under the impression that they would receive the equipment they needed for the program from the DOE Gap App team or their developer partner. One teacher stated that there was confusion about what resources the school would need to participate, as well as who would provide these resources to the school:

I think the schools need to realize that they're getting this program. They need to make sure that they have the resources before they're accepted. I think that would have been helpful too. If we had known [that] in order to do this [program], we would need this, this, and this. In other words, what are the tools that are going to help us? That would have made it a little easier...I think it was also portrayed to our administrators that whatever tools would be needed to make it work would...come from Gap App.

In a few cases, a DOE facilitator or a developer was able to provide the needed technology to schools, but only after the program had started.

A third possible reason for the difference between expected and actual usage was lack of clarity about usage guidelines. From our interviews, we found that, after the first workshop, teachers and developers rarely discussed the frequency of app use. Based on the teacher questionnaire, even within schools, teachers had different understandings of how frequently they were supposed to use the tool. Only in two schools did teachers agree on how often they were supposed to use their app and actually use it for the amount of time recommended by the developer. A majority of teachers in the other 10 schools did not agree on how often they were supposed to use the app, and none used the app as often as they reported they were expected to by their developer partners.

Our survey data adds another dimension to the low usage reported by teachers in interviews. As described in Chapter 2, we surveyed participating teachers in the fall, before the program began, and in the spring, after at least three months of using a Gap App. To measure “usage,” we asked teachers to indicate on a five-point scale from “never” to “always” the frequency of use in their classroom or school of 17 different tools, including SMART Boards, tablets, educational websites, subject-specific programs, and tools for tracking student learning. Table 6 shows that in the fall, only seven percent of participating teachers indicated that they used technology

The Role of the Innovate NYC Team

The Gap App pilot program was supported by a three-person team from the NYC DOE. Their primary role was to support and facilitate relationships of teacher-developer pairs.

DOE facilitators communicated intermittently with teachers using email, video conferences, and site visits. Facilitators aimed to visit schools once a month to observe the Gap Apps in use; however, they found it difficult to visit multiple schools every month throughout the six-month pilot, so, in fact, visits were less frequent.

Facilitators primarily communicated with developers by email. They also met during school visits, talked by phone and, in a few cases, video conferences. Communication between developers and the DOE primarily focused on logistics such as updates on workshops, forms to complete, obtaining materials or tools, and assistance in initiating purchase contracts. Discussions about app content were less frequent. Some facilitator-developer pairs spoke weekly or bi-weekly, while others said they spoke once a month or every other month.

The DOE team facilitated three workshops for developers and teachers to work together. These provided a space for DOE support staff, teachers, and developers to communicate in person.

“sometimes,” “often,” or “always.” By the spring, this rose slightly to 11 percent, but the increase was driven entirely by one school. While the surveys did not specifically ask about the Gap Apps, they show that most teachers who participated in the program used technology in the classroom no more frequently than they had before the program started.

Our teacher survey also asked teachers to characterize their level of comfort and proficiency (as “below average,” “average,” “above average,” or “outstanding”) with 13 different uses of technology, including “creating multimedia presentations,” “using technology to manage student data,” and “helping students learn to solve problems in an education technology environment.” This allowed us to compare teachers’ self-reported levels of usage with their sense of proficiency. One might expect to find a positive relationship between usage and self-described proficiency—that is, the more a teacher uses technology, the more proficient they feel. Conversely, greater exposure to technology might cause an individual to feel and report even lower mastery as they struggle with a new tool or work through new information (West et al., 2014). In our study, while teachers reported low usage fairly consistently, their views of their own proficiency varied more widely.

Table 6 shows that proficiency stayed relatively stable from the fall to the spring (with about 50 percent of teachers identified as “above average” or “outstanding”), which aligns with our finding that usage remained stable. But, when we examine responses by individual school, we see that self-reported proficiency increased in three schools, decreased in four schools, and stayed the same in five schools (see Table 7). Again, the survey did not ask about the Gap Apps specifically, so we cannot be sure if these changes are related to the Gap App experience, but it is certainly possible that the variation reflects differences in how the Gap App program played out across schools, as further explored in the next section on teacher-developer partnerships.

Table 6: Percent of Gap App Teachers Responding Positively to Survey Questions about Technology, 2013-2014

	Fall	N	Spring	N
Frequency of Use	7.0%	28	11.5%	26
Opinions about Technology	100.0%	28	92.9%	28
Proficiency with Technology	53.6%	28	50.0%	28

Source: Research Alliance calculations using data from surveys administered in Gap App schools.

Opinions of technology started off notably high (100 percent positive) among participating teachers and remained at that level with the exception of one school. It does seem that despite their lack of proficiency, teachers retained favorable opinions about the role of technology in the classroom.

Table 7: Percent of Gap App Teachers who Self-Identified as Proficient With Technology, by School

	Fall	N	Spring	N
School A	0.0	2	0.0	2
School B	100.0	2	50.0	2
School C	50.0	2	100.0	2
School D	50.0	2	50.0	2
School E	50.0	2	50.0	2
School F	0.0	2	50.0	2
School G	50.0	2	50.0	2
School H	66.7	3	100.0	3
School I	100.0	3	66.7	3
School J	75.0	4	50.0	4
School K	0.0	2	0.0	2
School L	50.0	2	0.0	2

Source: Research Alliance calculations using data from surveys administered in Gap App schools.

Teacher-Developer Partnerships

A second major goal of the Gap App program was to create an opportunity for teachers to communicate regularly with developers about how they were using the apps and problems they encountered. More importantly, teachers were expected to provide developers with feedback that could make the app more useful for classrooms. We found that most pairs communicated at least once a month, and four set of partners communicated at least once a week. Only one pair reported that they did not communicate regularly. Our findings about the extent to which developers incorporated feedback were somewhat more mixed.

Communication about Usage and Troubleshooting

In interviews, teachers reported that developers were accessible when questions arose. Most teacher-developer partners communicated by email, Skype, Google Hangout, and/or text message. They also met at the three Gap App workshops, and some developers visited their partner schools a few times to gain a better

understanding of the school environment and to strengthen their rapport with participating teachers. One developer stated that the distance between his office and the school limited their ability to provide tangible support to teachers:

Unfortunately, we're located at different states. They're in New York and we're in Rhode Island. I wish we were closer so I could go and check in more often and be more available onsite to help as needed... We can drive there every month or so to check in with them... the distance is definitely a challenge as to how often we can meet.

Nonetheless, teachers in most schools noted that developers were quick to provide support for urgent issues or technical challenges, such as how to access an app on different types of devices. One developer added a function to the app that allowed students to report technical issues or offer feedback.

Developers also provided technical assistance, training, and in some cases, suggested strategies for incorporating the app into classroom practice. Several developers facilitated professional development sessions for their partner teachers on how to use the app, which provided another opportunity to discuss challenges teachers or students were experiencing in using the app.

Sharing and Integrating Feedback

The Gap App partnerships were also intended to create a conduit for teachers to provide feedback about the apps, so that developers' products would be more responsive to the needs of NYC classrooms. Teachers and developers told us that most of the teachers in the program provided feedback, and many (though not all) developers were able to modify their apps in response.

Some teacher feedback addressed ways to make apps more user-friendly and better organized. In one school, teachers provided feedback on how to improve the process by which students could access other software, such as PowerPoint, through the app. In another, teachers pointed out that since students often share iPads and tablets, storing individual data was challenging. That school's matched developer redesigned the platform to give each student a user name and password so that individual data would be archived, even if students shared devices. Other examples of this type of feedback included asking developers to add features (e.g., a notebook or calculator in a math app, or a way to view all student data in one location). Other, smaller, suggestions from teachers included altering display window color and button functionalities.

Some teachers provided deeper feedback about an app's content and function. For example, in two schools, teachers suggested changing the content in math apps to align better with the Common Core State Standards.

It seems that teachers and developers had different expectations about the role of teacher feedback. In interviews, teachers in half of the 12 schools reported that developers were open to modifying the app based on their suggestions. Meanwhile, 10 developers reported changing their app based on teacher feedback, but many of these examples were similar to the surface-level changes described above.

While many teachers were under the impression that developers would be able to incorporate substantive suggestions, some developers did not expect to make large changes. In fact, several developers expressed concern over incorporating feedback that would require content-related changes. Two developers found that the pilot was too short to make the changes the teachers wanted (one specified that the pilot was faster than what they were used to). Other developers reported that the suggested adjustments would exceed their dedicated budget for this initiative.

Another challenge related to the matches between teachers and developers. One pair in particular struggled to collaborate. The teachers felt that the relationship was not productive, that they were not benefiting from the program, and that because the app was not Common Core aligned, the product was not beneficial for students. Teachers suggested ways to make the app more relevant to their students' needs, but the developers elected not to implement these suggestions. Notably, this app was already well established, and the developer felt the app was beyond a point where user feedback from a small sample of teachers would be helpful. One teacher said, "It seems like they don't really need us to develop the software. They're already doing it independent of us."

In a few other pairs, developers believed the feedback they received from teachers did not align with their company's goals. One developer was participating in another pilot program and was receiving competing feedback from the two groups. In another case, the developer already had a strategy for how the app would mature, and didn't feel that the teacher feedback contributed to their plan. This developer indicated that, for their already popular product, feedback from a small group of teachers was not enough evidence to deviate from their existing plans:

[The] Nature of this pilot doesn't make sense for a product like ours... The things [the teachers] were [giving] feedback on were already in the midst of long-term change. [The app] already have lots of points of feedback, so adding two people doesn't add that much. From a business perspective, probably not a program we should have done.

Finally, a company's age and its leaders' degree of experience seemed to be important factors in its ability to modify an app. Relatively new companies found it difficult to incorporate teacher feedback over one semester, while well established companies or those with more developed apps had less incentive to make changes based on this program. Companies that lay somewhere in the middle were best positioned to respond to teacher feedback.

Teacher Perceptions of Student Engagement

A third goal of the Gap App program was to expose students to apps that would increase their classroom engagement and/or math achievement. We asked teachers about their perceptions of students' experiences using these apps.¹⁰ While there were seven student-facing math apps and five teacher-facing engagement apps, this section of our analysis focuses on survey responses from students and teachers in classrooms using a math app.

Teachers reported that the program's most notable success was students' reaction to the apps. In all seven schools, teachers reported that students had positive reactions to the apps, such as being more engaged with classroom instruction. Some teachers found that their students were more motivated and were retaining content at a higher level as a result of using their Gap App. Some teachers noted students becoming more confident in their math performance as a result of consistent opportunities to practice math skills on the app. One teacher stated that app usage was helping her students overcome their fear of math:

I do expect them to do better on that State test, but to not only do better, but to enjoy math. A lot of the students are afraid of math, and they're not comfortable with it. They've been that way from the time they were younger. For some reason, something about [this app] makes them excited about it. They're not afraid to complete challenges or to try something new, so I expect their math levels to go up.

A few teachers reported that their students showed so much enthusiasm for the apps, that they were using them at home.

Survey responses from students in math app classrooms provide some support for these reports of increased student engagement. Table 8 below shows that students' responses to questions about math self-concept, math self-efficacy, and math interest all increased between the fall and spring surveys. Students were asked to rate statements related to each measure on a four-point scale from "not at all true" to "very true." Math self-concept statements included "I am confident that I can learn anything taught in math" and "Even if a new topic in math is hard, I am confident that I can learn it." Math self-efficacy statements included "I have always done well on math assignments" and "Math work is easy for me." Finally, math interest statements included "I enjoy learning about math" and "the activities we do in math class are fun." (In Tables 8 and 9, "responding positively" indicates that a student responded with "somewhat true" or "very true".)

When we examined responses to these statements by individual schools (see Table 9), we see increases (or relatively unchanged scores) in math self-concept, self-efficacy, and interest across all schools with the exception of one. (In this school, one of the two participating teachers was not able to use the app because of a lack of computers.) While we cannot attribute these increases to the Gap App, these findings are intriguing, particularly since they echo teachers' perceptions that the apps helped promote students' interest in math and belief in their ability to do well in their math class.

Students' opinions about technology varied more widely than their math-related responses. Our survey asked students at all 12 schools to respond to statements including "I pay more attention in class when technology is used" and "using technology in class helps me learn better" (also on a four-point scale). On this set of questions, the percentage of students who responded positively ("somewhat true" or "very true") increased from the fall to the spring in half of the participating schools. In the other six schools, the percentage of students who responded positively actually decreased.

Table 8: Percent of Students Responding Positively to Survey Questions About Math and Technology

	Fall	N	Spring	N
Math Self-Concept	58.3%	475	66.4%	437
Math Self-Efficacy	44.1%	472	49.2%	437
Math Interest	47.2%	475	48.5%	435
Opinions about Technology	62.3%	874	68.5%	820

Source: Research Alliance calculations using data from surveys administered in Gap App schools.

Notes: Math-related responses are only presented for the seven schools using a math app. Opinions about technology are presented for all 12 schools.

Table 9: Percent of Students Responding Positively to Survey Questions about Math and Technology by School

	Fall	N	Spring	N
Math Self-Efficacy				
School A	13.6%	44	28.1%	32
School B	47.6%	84	55.6%	63
School C	47.2%	72	47.1%	68
School D	34.3%	35	44.1%	34
School E	58.3%	115	56.3%	119
School F	43.3%	67	47.6%	63
School G	36.4%	55	46.6%	58
Math Self-Concept				
School A	31.8%	44	50.0%	32
School B	53.6%	84	63.5%	63
School C	58.9%	73	60.3%	68
School D	55.6%	36	70.6%	34
School E	82.6%	115	9.0%	119
School F	48.5%	68	55.6%	63
School G	49.1%	55	58.6%	58
Math Interest				
School A	6.8%	44	18.8%	32
School B	54.8%	84	57.4%	61
School C	65.8%	73	60.3%	68
School D	33.3%	36	35.3%	34
School E	57.4%	115	47.1%	119
School F	48.5%	68	52.4%	63
School G	29.1%	55	48.3%	58
Opinions About Technology				
School A	69.1%	42	54.8%	31
School B	78.3%	83	65.5%	58
School C	70.4%	71	76.1%	67
School D	62.9%	35	57.6%	33
School E	75.5%	106	79.5%	117
School F	56.3%	64	61.7%	60
School G	71.2%	52	70.7%	58
School H	66.7%	90	67.1%	76
School I	69.9%	73	75.0%	68
School J	61.1%	208	67.2%	198
School K	63.3%	30	56.3%	32
School L	60.0%	20	59.1%	22

Source: Research Alliance calculations using data from surveys administered in Gap App schools.

Notes: Math-related responses are only presented for the seven schools using a math app. Opinions about technology are presented for all 12 schools.

Teachers in three schools reported that developers provided students opportunities to offer feedback about the apps. For example, in one math app school, the teacher stated that students often provided feedback around design and content suggestions:

[The students] have to benefit too, so I make sure my kids actually know how to send the suggestion. I tell them, 'Send the suggestion.' They'll say, 'I really want this. Can you do this?' They'll send it right away. I don't even know some of the things they say because they just do it. They're very independent like that.

In another example, one engagement app functioned as an interactive whiteboard that allowed teachers to record their lessons and archive videos for students to reference. Students provided recommendations for how teachers could use the app to better structure classroom lectures and presentations.

Summary

Our study focused on three essential elements of the Gap App program: the level of app usage, the collaboration between developer and teacher partners, and student engagement. Based on interviews and a teacher questionnaire, we learned that while some teachers and developers showed enthusiasm for the program, there were several barriers to strong implementation.

First, teachers and developers did not share clear expectations about how much each app should be used. In addition, some teachers who were eager to use the apps more in their classrooms were hampered by inadequate technological resources or infrastructure.

As with many classroom interventions, there was a difference between the concept of the Gap App program and its implementation. As one teacher said, "I definitely like the idea of having access to technology in the classroom in theory. In practice, it's been a little bit more difficult." Teachers' responses on our survey also show that while opinions about the use of technology in classrooms remain high among these educators, their self-perceived use of and proficiency in technology was still much lower.

Teacher-developer partnerships ranged from very successful to challenging. Most teachers reported strong communication with their developer partners, who were often readily available to troubleshoot, talk about how to use the app, and create

usage plans with teachers. Fewer teachers reported that they were able to play a meaningful role in providing feedback to developers about their apps.

Despite these challenges, teachers in about half the schools reported that using the apps in the classroom increased student engagement in the subject or class. While not necessarily attributable to the Gap App program, student responses on our survey did show an increase in math self-concept, self-efficacy, and interest (with the exception of one school, where one classroom could not use the app due to technological limitations). In a few cases, students were able to provide feedback about their experience with using the apps in class and at home. These activities seem like positive byproducts of the Gap App program.

CHAPTER 5: LESSONS FROM THE GAP APP PROGRAM EVALUATION

Innovate NYC Schools aimed to create dynamic and adaptable procurement systems, able to respond quickly and incorporate improvements as needed. Its goal of moving ed-tech procurement to a nimble model that reacts to the needs of practitioners is ambitious. With the Gap App program, the Innovate NYC team explored one avenue for reaching this goal by involving teachers in the process of identifying a problem, utilizing an innovative platform to solicit app-based solutions, and piloting apps in schools. The Innovate NYC team and participating schools encountered a variety of challenges implementing the Gap App program, some of which acted as barriers to successfully using the apps.

Our evaluation highlighted a number of obstacles that districts, developers, or educators may face in similar initiatives. Based on our findings, we propose a few strategies for overcoming these barriers when bringing ed-tech professionals and educators together in collaborative partnerships:

- **Establish clear goals and expectations early:** One prominent challenge in the Gap App program was a lack of clarity among some developers and many teachers about the goals and expectations for participation. Because school recruitment and ranking of the apps did not involve the same teachers who would take part in the pilot, many participating teachers had little understanding of the program until after the first workshop. Similarly, some developers reported confusion about what participation entailed. While the Gap App program was designed to allow for partnerships to be relatively independent, providing more parameters and a few well established goals could help create more cohesion between developers and teachers as well as across partnerships.
 - **Set and enforce criteria for participation:** All schools in the Gap App program were iZone schools, and thus should have had adequate technological resources. Yet many teachers reported that they lacked access to the tools they needed to use their app. To give apps a fair test, it is important that participating schools and classrooms have access to the required hardware, software, and infrastructure. Thus, districts should ensure that participating schools have adequate technological capacity in each classroom. This is also true of the teachers who are involved; educators should have a strong level of interest or
-

buy-in as well as the skills needed to implement the apps as designed in their classrooms.

- **Be attuned to the fit between developers and schools:** A majority of schools were matched to one of their top selections of developers, which was an important part of ensuring fit. But other factors were also important, in particular the app's level of development and the developer's appetite for feedback. Through preliminary questionnaires and brief interviews, district teams can ensure that teacher-developer partners are in a good position to inform one another's practice. Many teachers were under the impression that developers would be able to incorporate their feedback and suggestions for improving the app in real time, whereas many developers reported they were either too far along or not far enough in the app's development to do. Assessing the degree to which teachers want to be involved in improving a tool, and to which developers are interested in their opinions, will allow for a better match to developers who can apply that feedback.
- **Use shorter evaluation cycles:** Our evaluation was designed in 2011, when the DOE submitted its initial proposal for an i3 grant. Given the needs of the federal evaluation (namely, including an impact analysis), we were not able to significantly restructure the study, even as the program went through multiple iterations. For example, we might have changed our outcome measures based on the changing expectations of the DOE team, or we might have been more involved in the recruitment of schools to ensure random assignment. Our impact analysis was also hampered by the small size of and variation within the sample (e.g., differing grade levels, types of apps, and teacher selection process). While long-term impact evaluations are important, a shorter, more flexible evaluation cycle would allow researchers to contribute formative feedback to the district, developers, and teachers in real time. This would allow each stakeholder to make mid-course corrections to the process and substance of their work and collaboration. Ongoing mini-assessments of the outcomes most closely aligned with the program's goals may have captured changes the larger study did not. The Innovate NYC team has already begun to implement this strategy.
- **Ensure that the program remains focused on specific challenges.** Recent research on the effectiveness of education technology underscores the importance of tools being able to complement teachers' existing plans (Cheung and Slavin, 2013). This allows teachers to provide personalized instruction to a

larger number of students, increasing their efficiency. The original aims of the Gap App program were in tune with this idea. However, over time, the learning challenge became broader and vaguer. This led to questions about how a diverse set of apps would address a single challenge, or how our evaluation would be able to compare apps, especially across different grades and types of classrooms. Focusing on a more specific challenge would foster closer alignment between the problem and proposed solutions, as well as between classroom needs and new education technology tools.

The Gap App program was one of several Innovate NYC efforts designed to transform procurement and improve the way that ed-tech professionals work with schools (a forthcoming paper will describe some of these other efforts). Even with the program's challenges, a few of the teacher-developer teams established strong working relationships. In fact, in one case, the developers and teachers decided to extend their working relationship past the end of the program. In addition, some of the participating teachers reported that their students were more engaged in their classrooms because of their use of the math apps in particular.

Despite challenges with this specific program, many of the educators we spoke to were actively looking for new opportunities to use technology to improve their practice and better serve their students. As one teacher said, "It doesn't always work out like what we end up doing, but I think there's a lot of willingness to push ahead and always be at the forefront of what's happening in technology." We hope that this study will provide helpful insights for the Innovate NYC team and other districts working to meet educators' demand for ed-tech tools relevant to the work they are conducting in the classroom.

Endnotes

¹http://www2.ed.gov/programs/innovation/index.html?utm_source=rssutm_medium=rssutm_campaign=the-u-s-department-of-education-announced-the-start-of-the-134-million-2014-investing-in-innovation-i3-grant-competition

²<http://izonenyc.org/?project=innovate-nyc-schools>

³ Many of the findings in Chapter 3 are adapted from a memo we produced for the NYC Department of Education in February 2014, based on analyses we conducted prior to the beginning of the pilot phase. Our evaluation also included a study of impacts on student and teacher perceptions of technology and on students' math achievement. Results from this study will be presented in a forthcoming data brief/working paper.

⁴ Three of the math apps were actually for both teachers and students.

⁵ See Appendix E for a list of the individual questions that make up each scale.

⁶ Students were not required to identify themselves on surveys; these are estimated response rates based on completed surveys and class rosters.

⁷ IDEO conducted interviews with principals, assistant principals, math teachers, math coaches, and students at three schools, and hosted a focus group with teachers from five additional schools.

⁸ See criteria for selection:
<http://nycschools.challengepost.com/rule>

⁹ See the videos at:
<http://nycschools.challengepost.com/submissions>

¹⁰ We did not interview students.

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**The Research Alliance for
New York City Schools**

285 Mercer Street, 3rd Floor | New York, New York 10003-9502
212 992 7697 | 212 995 4910 fax
research.alliance@nyu.edu | www.steinhardt.nyu.edu/research_alliance

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