Closing the Homework Gap with

Mobile Devices and Wireless Connectivity

A report prepared by:

PROJECT TOMORROW

www.tomorrow.org

For:

QUALCOMM

QUALCOMM EDUCATION, INC.

And:

ALVIN DUNN DRAGONS AD EST. 1959

In participation with:

AT&T

SAMSUNG

Acknowledgments

Project Tomorrow would like to thank the following, without whose help this project could not have been completed:

The staff and students of Alvin Dunn Elementary School, San Marcos.

Special thanks to:

Jennifer Carter, Principal

6th grade teachers:

Nancy Hayashi

Roseanna Sanchez

Terrance Vitiello

Adina Sullivan, Education Technology Coordinator,

and the staff of San Marcos Unified School District.

The staff at Qualcomm Education, Inc.

The staff at AT&T, Samsung, and Connected Nation for their support.

Qualcomm® QLearn™ Mobile Education Platform: Alvin Dunn Elementary School Project Report

Executive Summary

During the 2014-15 school year Alvin Dunn Elementary School in San Marcos, California, participated in a technology project to evaluate the impact of mobile learning and anytime, anywhere Internet access with a goal of addressing the *"homework gap."* The *homework gap* as described by Federal Communications Commissioner Jessica Rosenworcel, is the lack of consistent, reliable Internet connectivity outside of school which results in some students being deprived of the opportunity to complete digital homework assignments. While the digital divide has long described the disparity between families that have Internet access and those who do not, the homework gap zeros in on the impact of that inequity on students' abilities to extend learning beyond the school day.

While other projects and studies have provided students with mobile devices for use at school, the key focus of this project was on providing connectivity outside of school through the use of mobile network connected devices (also referred to 4G / LTE). The Alvin Dunn project sought to explore how anywhere, anytime Internet access via LTE impacted student learning opportunities, as well as influenced curriculum choices and homework assignments made by teachers. As schools and districts have become increasingly dependent upon the use of digital tools and resources such as tablets and e-textbooks within instruction, administrators' concerns over digital equity has also increased.

Specifically, this project provided each of Alvin Dunn's 77 6th grade students with Samsung tablets connected via AT&T LTE mobile broadband service. Students were encouraged to use the devices for completing homework, researching academic topics and communicating with their teacher and fellow students both within and beyond their classroom walls.

> *"Now in our 6th Grade we have true 1:1 technology….it's been a really positive learning experience."*
>
> - **Roseanna Sanchez, 6th Grade Teacher, Alvin Dunn Elementary School, San Marcos California**

The results of this project point to new and promising approaches to closing the digital divide, alleviating the homework gap and erasing educational inequities. Key project findings that can inform local and national discussions on this important topic include:

Closing the homework gap

- The homework gap at Alvin Dunn is real – 59% of the 6th graders reported that they did not have access to high-speed broadband connectivity at home
- Additionally, 38% of the students stated that prior to receiving the LTE-enabled tablet, they often had trouble completing their homework assignments due to the challenges of accessing the Internet outside of school
- As a result of this project, 100% of 6th graders gained access to high-speed broadband connectivity via their LTE-enabled mobile devices
- Students primarily used this access to complete school-related activities, reporting that they spent an average of 65 minutes each day using the tablet for those tasks

Student views on impacts to learning

- 96% of the students specifically impacted by the homework gap stated that gaining access to an LTE-connected mobile device helped them to become better students
- Students developed stronger self-efficacy as serious learners, with 55% reporting that they had more confidence in their abilities to be successful after introduction of the connected tablets
- 52% of students stated that they were more interested in what they were learning in class since using the tablet both at school and at home

Amongst students who said the tablet increased the likelihood that they would complete their homework assignments, benefit statements are particularly illustrative of the overall project impact on learning outcomes. Table 1 summarizes key benefits by outcome category for this specific student subgroup.

Table 1: Benefits of having an LTE-connected tablet to support learning

Benefits that increased student self-efficacy as a learner	Benefits that helped students develop specific skills	Benefits that enabled different learning behaviors
I am able to learn at my own pace (67%)	My technology skills have improved (84%)	I work together with my classmates more often (78%)
I have more control over my learning (61%)	My research skills have improved (74%)	I participate more in class discussions (55%)
I have more confidence in my abilities (55%)	I am developing critical thinking skills (74%)	My learning does not stop at the end of the school day (55%)
I am more interested in what I am learning in class (52%)		I spend more time mastering a skill or learning something (45%)
I am learning in a way that fits my learning style (51%)		

Impact on classroom activities and assignments instruction

Not wanting to put any of their students at a learning disadvantage, the teachers were reluctant to assign online homework prior to the pilot implementation. To compensate, they provided additional in-class time for Internet research assignments or opened up their classroom doors early for student access. By leveling the "out of school" digital access playing field, the teachers were able to assign more online homework and use technology more creatively in the classroom to support individualized instruction.

"I feel more passionate as an instructor…. [students] are continuing the learning at home."

- **Nancy Hayashi, 6th Grade Teacher, Alvin Dunn Elementary School, San Marcos, California**

-

Parent views

Parents identified three key benefits to their children having access to the LTE-connected tablets:

- Gaining at home Internet access
- Increased student engagement in learning
- Development of college and career ready skills

Project Background

Since 2003, Project Tomorrow's Speak Up Research Project has annually documented the views of K-12 students, parents and educators on the opportunities and challenges associated with digital learning. As schools and districts have become increasingly dependent upon the use of digital tools and resources such as tablets and e-textbooks within instruction, administrators' concerns over digital equity has intensified as well. While 78% of district technology leaders state that mobile devices such as tablets are transforming the instructional process in their classrooms, 47% indicate that ensuring that their students have access to technology and the Internet both at school and at home is still a major challenge.

This situation is not lost on the teachers in the classrooms either. Increasingly, teachers are endorsing digital learning through their use of multi-media in the classroom, the integration of Internet-based services such as Google Apps for Education, and the use of education-oriented social media tools to facilitate student collaboration and increased communications. However, teachers' concerns about digital inequities such as whether their students have access to a computing device at home, or the reliability of Internet access outside of school, often overshadows their abilities to fully embrace digital learning. Two-thirds (69%) of teachers stated in the Fall 2014 Speak Up survey that this concern is their biggest obstacle to using technology as part of day-to-day instruction.

Parents' perspective on this issue further supports the criticality of this challenge. A majority of parents of school-aged children (58%) believe that using technology outside of school for academic work can help their children develop the skills they need for future success in college and career. Thus, when teachers are reluctant or hesitant to assign digital homework out of concern for their students who do not have at home access, the **homework gap** impacts not only students who lack at home access, but all students in the classroom.

Based upon almost a decade of in-depth investigation of mobile learning opportunities and challenges through Qualcomm's Wireless Reach Initiative projects, Qualcomm Education deeply understands the homework gap that exists today in K-12 classrooms across the nation.

Qualcomm Education, in collaboration with AT&T and Samsung, sought to understand how anytime, anywhere connectivity could contribute to improving learning outcomes and developing stronger student self-efficacy. Additionally, the project also examined how the availability of anytime, anywhere access impacted teachers' classroom strategies, especially relative to homework and research projects.

To study these questions, 6th graders at Alvin Dunn Elementary School received equal access to digital educational content, resources and tools both during the school day and after school through individually assigned LTE-enabled Samsung tablets with AT&T mobile broadband service for off-campus access.

About the Project Site and Study Participants

San Marcos Unified School District was selected by Qualcomm Education for this project based upon the district's national reputation for innovation in digital learning. AT&T's provision of wireless service was for purposes of the project and independent of the specific school selection. The 6th grade teaching team at Alvin Dunn was specifically chosen as the implementation site due to the teachers' familiarity and interest in both blended learning and mobile learning models for improving classroom instruction. With a goal to extract findings from this project that can be generalizable to other schools, districts and communities interested in employing innovative mobile and wireless solutions, several characteristics of the school, the 6th grade teaching team and the 6th grade students are noteworthy.

Alvin Dunn Elementary School Demographics:

- 89% of the student population identify as Hispanic or Latino
- 89% of the students qualify for the federal lunch program
- 65% are considered English language learners

School Programs:

- School and district leadership is supportive of innovative digital learning programs
- A 1:1 iPad implementation is already in place in 6th grade classrooms – this implementation is not focused on closing the homework gap, due to the lack of a solution for providing consistent access to broadband outside of school, and these devices are not taken home
- School has implemented the International Baccalaureate (IB) curriculum, which focuses on inquiry, critical thinking and interdisciplinary studies

6th Grade Teachers (number of teachers = 3):

- Experienced, open-minded teachers who have received extensive training in mobile and blended learning strategies prior to this project through their school district professional development programs
- Teachers have implemented several mobile learning curriculum products (both web based and mobile based) to support instruction in their classrooms

6th Grade Students (number of students = 77):

- Due to prior exposure to digital tools within their school, these students were predisposed to place a high value on the use of technology to support their learning activities
- **38% of 6th graders noted that prior to receiving the LTE-enabled tablets, they often had trouble completing their homework due to a lack of connectivity outside of school**

Project Implementation Details

To best examine the impact of the software and hardware components of the project, the implementation was designed by Qualcomm Education in two phases.

In Phase 1, the Qualcomm QLearn application was added to the iPads that the students were using at that time in class to enhance the teachers' existing blended learning implementation. As noted earlier, the iPads were used only in the classroom and were not taken home. Thus, there was no change to students' Internet access or access to a mobile device outside of school during this phase.

The Qualcomm QLearn application provided students and teachers with the following new capabilities:

- Ability for students to connect directly to their teacher and classmates within the application
- Ability to review upcoming study assignments in an interactive timeline view

In Phase 2, students were assigned an LTE-enabled Samsung tablet with AT&T mobile broadband service that provided students with anytime, anywhere Internet access. The tablet was provisioned with the help of District IT staff so that it could be taken home by students. For many students, this access to an always available, LTE-connected device was a significant improvement over their previous access to online resources outside of school.

Workshops were held by the Qualcomm Education team with San Marcos District IT staff to coordinate the technical deployment of the project, and support and manage the roll out of the devices.

Through additional workshops with the teachers, the approved education content and expected student experiences were discussed. The QLearn application was updated for the spring semester so that teachers and students could leverage LTE connectivity for anytime, anywhere learning.

A key component of the implementation for the school district and teachers was their ability to manage and secure tablet usage for education content access both at school and at home. Working closely with the San Marcos District IT and the staff of Alvin Dunn Elementary School, Qualcomm Education undertook the following steps and activities specifically:

- Rolled out a 1:1 learning environment with anytime, anywhere connectivity through the personal assignment of LTE-enabled Samsung tablets with AT&T mobile broadband service
- Integrated Qualcomm Education software solutions on these devices to ensure that students could only access school-approved content, regardless of device location
- Met expectations for safe, CIPA compliant Internet browsing on and off campus through coordination with existing content filtering solutions
- Provided the ability for school leadership to designate and control access to certain features on the device such as camera and network settings
- Supported student device policy management and device configuration with the district's existing mobile device management system, plus additional features for off-campus policy management provided by Qualcomm Education solutions
- Enabled a "School Mode" that allowed students to access school-approved applications and safely browse the Internet to conduct limited open-ended research

- Enabled a separate "Rewards Mode" which allowed teachers to set policies for multiple student access levels – Rewards Mode allowed students to have access to school-approved games and other content that were deemed as "rewards"

The combination of the secured Qualcomm Education solution, in conjunction with teacher input on appropriate content types and access needs for 6th graders, resulted in a highly effective way to provide out of school secured access for educational purposes.

Detailed Project Findings:

To understand how this project closed the homework gap for 6th grade students at Alvin Dunn Elementary School, Project Tomorrow conducted a detailed research study examining the views of students, their teachers, and parents. Various data collection methods were used to collect the ideas of these key stakeholders during the spring semester including focus groups, surveys and interviews. The resulting data findings provide a rich tapestry of values and aspirations around both mobile learning and at-home access that can enlighten education policies and programs, as well as new product and service offerings.

- **Impact on Students**

At the heart of this mobile learning project were the 77 6th grade students attending Alvin Dunn Elementary School who had the opportunity to experience an enhanced learning experience, both at school and at home.

"I had to get my grades up… now I can finish my homework and start the work we were going to do the next day so I can get ahead."

- **6th Grade Student, Alvin Dunn Elementary School, San Marcos, California**

How did the LTE-connected tablets support student learning both within and beyond the classroom?

A primary goal of this study was to examine how the students used the devices and the extended access to close the homework gap, therefore, the focus on schoolwork tasks and time spent doing those tasks was important. In their own reflections on usage, students said that they used their tablets at school on average 116 minutes, almost two hours, per day. At home usage added approximately 65 minutes more per day according to the students.

Alvin Dunn 6th graders ranked the following tasks as their most important uses for the tablets:

1. **Looking up information on the Internet (at least a few times a week by 89% of the students)**
2. **Writing papers and doing homework assignments (84%)**
3. **Using the calculator (78%)**
4. **Working on projects with classmates (73%)**
5. **Taking photos of class assignments, board notes or classwork (63%)**
6. **Organizing my schoolwork assignments (61%)**
7. **Using the QLearn solutions to access assignment and readings (58%)**
8. **Watching online or YouTube videos to support assignments (55%)**

For some students, the tablets were important enablers for specific tasks. Boys were more likely than girls to use their tablets to look up information online *on a daily basis.* A majority of girls (58%) leveraged their tablet as a gateway to greater collaborations with classmates, while only one-third (33%) of the 6th grade boys did the same. These differences in usage underscore the potential of mobile learning both in and out of school to provide a more personalized learning experience for all students.

Closing the Homework Gap with Mobile Devices and Wireless Connectivity

The capstone learning experience for 6th graders at Alvin Dunn is the development of their end of year exhibition research project. An integral part of the Alvin Dunn 6th grade IB curriculum, each student is tasked with researching, preparing and delivering a 12-paragraph essay and digital presentation on a topic associated with social responsibility. Working in teams, the students used their tablets to research complex subjects such as prison reform, educational equity and renewable energy. Sharing of research data and first drafts of the essay was easily accomplished by students through Google Docs, both on and off campus. Teachers also had access to these materials and provided ongoing editing and direction. Students watched videos relevant to their topics and organized their project workflows from their tablets. **Not only did the tablets enable the students to do more in-depth research, but reliable at-home Internet access resulted in a much more efficient use of time and more effective student collaborations.**

"I like using the tablet to do research for my exhibition project because I was able to do the research at home…"

"The tablet was a lot faster to send or email my documents to the teachers or my classmates."

- **6th Grade Students, Alvin Dunn Elementary School, San Marcos, California**

What benefits did students derive from the tablets and the 24/7 connectivity?

Students' views on the most significant benefits of having the LTE-connected tablets to use for schoolwork are categorized into three primary outcomes:

- Increased self-efficacy as a learner
- Develop college and career ready skills
- Enable different learning behaviors that support academic success

Table 1 summarizes key benefits by outcome category for those students who specifically indicated that the tablet increased their likelihood to complete homework assignments.

Table 1: Benefits of having an LTE-connected tablet to support learning

Benefits that increased student self-efficacy as a learner	Benefits that helped students develop specific skills	Benefits that enabled different learning behaviors
I am able to learn at my own pace (67%)	My technology skills have improved (84%)	I work together with my classmates more often (78%)
I have more control over my learning (61%)	My research skills have improved (74%)	I participate more in class discussions (55%)
I have more confidence in my abilities (55%)	I am developing critical thinking skills (74%)	My learning does not stop at the end of the school day (55%)
I am more interested in what I am learning in class (52%)		I spend more time mastering a skill or learning something (45%)
I am learning in a way that fits my learning style (51%)		

While these benefit statements indicate how students perceived the impact of connected tablets on academic outcomes, equally interesting is how they connected specific features and capabilities of the devices to those transformative learning outcomes.

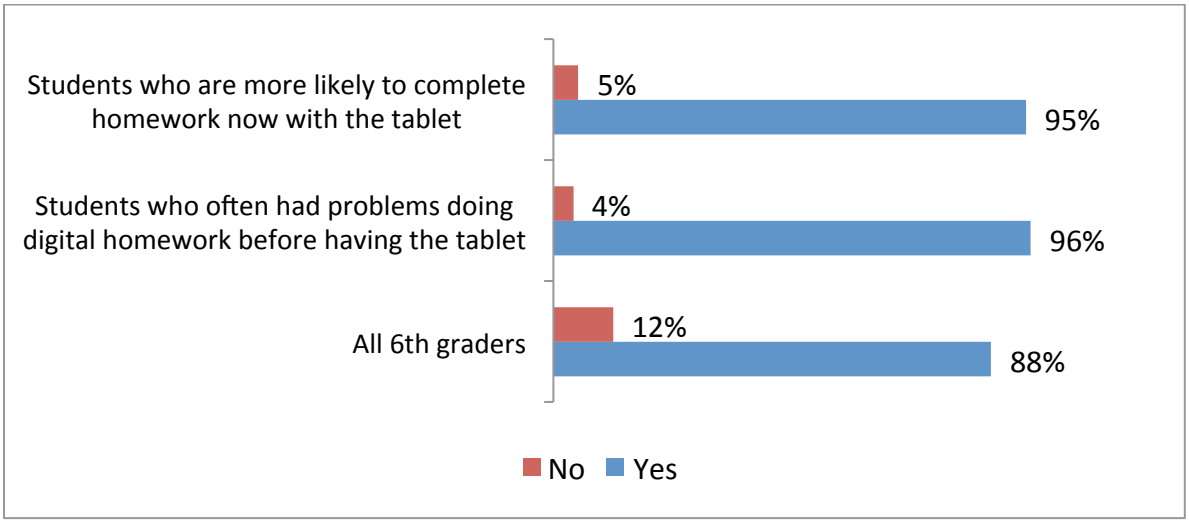
Four key attributes of the tablets and LTE-connectivity were identified:

- Ability to use the tablets both in school and at home, with 24/7 Internet connectivity
- Tablets are well suited for student self-directed research projects and homework
- Anytime, anywhere mobile-enabled learning promotes flexibility, as well as convenience and personalization in the learning process
- With a personally assigned and connected tablet, students did not have to share Internet connectivity with siblings or other family members, thereby increasing the efficiency of their learning.

What value do students place on mobile learning with 24/7 connectivity?

Overwhelmingly, Alvin Dunn 6th graders believe that access to an LTE-connected tablet both at school and at home has helped them become better students. While some educators may debate the value of homework, for these digital learners access to the device and ability to complete out-of-school academic work changed their perceptions of their own learning potential and their engagement with their academics. This belief in the relationship between access to the tablets and improved achievement was especially strong for those students impacted by the homework gap, and students who said that they were more likely to complete assignments after having access to the connected tablet. Chart 1 illustrates the intensity of the student beliefs in the value of the tablet experience.

Chart 1: Did having the tablet to use at home and at school help you become a better student?



"The tablet actually helped because right now I have been getting better grades than I used to."

6th Grade Student, Alvin Dunn Elementary School, San Marcos, California

Students understood that the new empowerment provided by the tablets was not limited to their own classroom. When asked if it was important for students like themselves to have access to a tablet with Internet connectivity that they can use both on and off campus, the students were very supportive of this idea. Again, the students who linked having the tablets to increased motivation to complete assignments expressed the strongest opinions on this topic, with 91% endorsing the idea that every student should benefit from similar learning experiences. Girls were also highly supportive of students having access to this type of a learning environment with 89% of respondents supporting the idea.

The students' valuation that the tablet can support greater learning and correspondingly better grades for themselves and other students is a reflection of how these students now view their self-efficacy as a learner. Because of having the tablet and being recognized by their teachers and parents as responsible digital citizens, the 6th graders now see themselves as serious students with a set of advanced educational tools that can support more self-directed, engaged learning. That combination of a new learner self-profile with the right tools can be a powerful agent for enhanced achievement and preparation for future success. Education leaders and policymakers striving to find new solutions to drive greater student achievement should not ignore how mobile devices combined with anywhere, anytime access can change a student's self-perception of his/her ability to be a successful student. Equally important in this formula is how the teachers utilize the devices in the classroom and leverage 24/7 connectivity to support student-directed learning.

Reflections of Teachers

Quite often in mobile learning projects, the "secret sauce" for creating high impact learning outcomes lies with how effectively teachers use mobile devices to transform the learning experience for their students. This was also the case with the teachers involved in the Alvin Dunn Project. Teacher impressions of how the tablets impacted student learning, as well as their own productivity, illustrates the potential of these solutions to open new doors for learning improvements.

As previously noted, teachers' concerns over digital equity often holds them back from assigning Internet-based homework or projects. Prior to this project, the 6th grade teaching team at Alvin Dunn subscribed to the same philosophy. Not wanting to disadvantage any of their students, the teachers were reluctant to assign online homework. To compensate for inconsistent Internet access at home, teachers provided additional in-class time for online assignments or opened up their classroom doors early for students. **With the assurance that every student has a personal device that enables them to complete online assignments, the Alvin Dunn teachers are assigning more educational interventions and learning extensions to all of their students.** They are now able to assign the same homework or projects classroom-wide without concern that some students may not be able to complete those assignments. This has enabled the teachers to think more creatively about projects and assignments. Significantly, teachers also believe the stress level of their students has decreased because access to homework and learning opportunities was no longer constrained by time or place. The LTE-connected tablets and anytime, anywhere access those connected devices have enabled has created an entirely new digital learning paradigm for 6th grade students at Alvin Dunn Elementary School.

With assurances now of a level playing field for their students, and a newfound ability to creatively plan for technology use throughout their instructional plans, the teachers noticed fundamental differences this spring in

how their students were approaching the learning process. Their reflections on these enhanced student outcomes demonstrate how mobile devices in conjunction with at home access can transform learning.

LTE-connected Tablets' Impact on Student Outcomes – Teacher Perspectives

- Students developed greater self-efficacy and an ability to advocate for their own learning
- Students took more risks within their learning and developed new capacities to do advanced problem solving and trouble-shooting
- Students provided more peer-to-peer support to each other especially with respect to writing
- Students became more critical consumers of digital content and applied new evaluation and critique skills to their classmates' writing and research
- Students developed a growth mindset and a new openness to learning beyond the basics; they self-directed learning both at school and at home
- Students had greater pride in their schoolwork and project deliverables
- Students self-modified, self-remediated and adopted new learning behaviors that complemented the capabilities of the mobile devices
- Through more engaged learning activities, students developed college and career ready skills such as collaboration, communication, creativity and critical thinking
- The quality of class discussions improved and students were more willing to engage in debate
- Special education students in particular leveraged the capabilities of the devices to adapt to highly personalized learning modalities that supported their needs

In a similar way, the 6th grade teaching team at Alvin Dunn has also observed changes to their teaching methods as a result of the project. While most projects and initiatives focus on the student outcomes, mobile learning benefits are only sustainable if the teachers also realize value from having tablets in their classrooms. For this teaching team, that value proposition equates to increased effectiveness and productivity as an educator.

LTE-connected Tablets' Impact on Teacher Productivity – Teacher Perspectives

- Teachers provided more individualized instruction to their students
- Teachers had a greater influence on the quality of student writing since they could review and annotate with suggestions on interim drafts, not just final products
- Access to online content and digital tools resulted in time savings and increased productivity for the teachers
- Teachers were better able to address unique learning needs of special education students and English language learners within their classroom
- Parents began emailing their child's teacher using the tablet, creating a new and enhanced school to home connection that supported teachers' goals

The teachers have multiple examples of how the LTE-connected tablets have transformed their classroom learning environment. For example, by using a multi-lingual vocabulary app, many of the 6th graders are able to develop their academic language in English as well as practice their first language, Spanish, in a more formalized

way. **The use of this mobile app has resulted in both high student engagement and attention to their language usage as well as serving as a unique conduit to student families.** Many students reported that they used the mobile app with their parents to help them develop a stronger English vocabulary. Through that process, the students are developing new competencies as both a learner and an advisor, as well as engaging with the tablets in a constructive, tangible way. This type of activity also reinforces buy-in of parents who can conceptualize for the first time the real value associated with use of the tablets within their child's education.

Views of Parents

Just like parents of school-aged children nationwide, the parents in the San Marcos Unified School District are concerned about their children's future success and how the local schools are providing a high quality education steeped in effective technology usage. In fact, 87% of parents within the San Marcos community say that effective use of digital tools, content and resources is important for their child's future success in college and beyond. In particular, parents highly value the use of mobile devices such as tablets to provide access to online textbooks (76%) and new ways for their child to review class materials outside of school (68%). Two-thirds of parents also see mobile devices as an effective tool for increasing student engagement in learning and improving school-to-home communications.

Given that context, it is not surprising that the mobile project at Alvin Dunn Elementary School has had significant parental support. **As a strong indicator of the commitment of 6th grade parents to their child's education, a majority of parents attended a parent meeting in December to learn more about the project and how the tablets and wireless connectivity would enhance their child's learning experiences.** That high level of support has continued throughout the project cycle. According to the teachers, they have received no parental complaints or concerns about the tablets, or their students' use of the devices at home. A parent focus group conducted in May confirmed teacher assessments.

Alvin Dunn parents identified three significant benefits to their children having LTE-connected tablets for use at school and home for learning purposes.

Access at Home: The ability to take the device home and access the Internet was particularly beneficial to their children. Within the focus group, even for those families with home access, the parents indicated that it is sometimes difficult for each member of their family to have quality time using a single home computer. By having their own tablet and personal Internet access, parents felt that their 6th graders had more time to complete homework without interruption or having to wait for another sibling for access to the home computer.

"I have other kids at home. So, when she (the 6th grader) arrives home, she does not have to wait for someone to be done on the computer to do her homework."

-Parent of 6th Grade Student, Alvin Dunn Elementary School, San Marcos, California

Increased Learning Engagement: Parents felt strongly that having the tablet not only made their child feel special, but it provided them with additional motivation to become more focused on their school work. Several parents indicated that they have been surprised when their 6th grader has come home from school and immediately taken out their tablet to start on homework. Parents were pleased that their children were more

serious about their schoolwork. Student perceptions underscore this parental benefit. Amongst students for whom the tablet is a motivator for them to complete their homework, 50% say that their parents and family now see them as a more serious student. Parents also noted that the project has had an impact on their other children. One parent noted that his high school student developed a greater understanding of how tablets could impact learning from watching her younger sibling use the device for schoolwork.

"Since my daughter has the tablet, she is more focused on her schoolwork."

"Having the tablet to do homework is like having an extra hand or another eye to help out my child."

- **Parents of 6th Grade Students, Alvin Dunn Elementary School, San Marcos, California**

Development of College and Career Ready Skills: Understanding the demands of high school, college and the job market, the parents were particularly interested in how the tablets enhanced their children's technology skills. They recognized that as a result of this project, their children are acquiring the types of skills that will be important for their future success, what many are calling college and career ready skills. Parents acknowledged that fluency with technology, such as using a tablet and wireless connectivity is an essential life skill today. Parents also noted that their children were reading more and developing better literacy skills since having the tablets to use at school and at home. Given that English is not the first language for most Alvin Dunn families, this benefit of increased literacy is especially significant. At home Internet access also opened up opportunities for their children to collaborate with classmates outside of school. Parents were impressed with how often students helped each other with projects and homework.

"Technology is the base for everything today. So, it makes sense that their homework should be technology based too."

"Having the tablet has improved my child's research skills."

"Knowing how to use technology will help my child do better in college or a future job."

- **Parents of 6th Grade Students, Alvin Dunn Elementary School, San Marcos, California**.

Data Usage Insights

While data usage on its own is not necessarily an indicator of effective or efficient use for educational purposes, the data usage statistics do provide some interesting insights into the device usage patterns of students, both in school and at home. Notably, the analysis of the statistics indicates these key results for this study:

- Usage increased as students and teachers became more comfortable with the devices
- Predominant usage days were weekdays, indicating that most student access was likely in support of homework and school assignments
- Overall student usage Internet connectivity outside of school varied by student; some were heavy users of Internet connectivity, others were not

Alvin Dunn 6th graders had access to the LTE-connected Samsung tablets from March to the end of the school year. During that time period, average monthly data usage increased from 2.3 to 3.3 gigabytes (GB), a growth of 43% (see Table 2). This growth can be attributed to increasing familiarity with the devices, the increasing frequency with which teachers assigned Internet-based homework, and the predominant role of the tablets in the end of year research project.

Table 2: Average Monthly Data Usage by Alvin Dunn Students

	March	April	May	Average
Monthly	2.3Gb	2.6Gb	3.3Gb	2.7Gb
Weekday	1.4Gb	1.4Gb	1.5Gb	1.5Gb
Weekend	0.9Gb	1.2Gb	1.0Gb	1.0Gb

(data provided by AT&T)

It is also interesting to note that during the same period, students consumed more data on the weekdays than on weekends, with an average difference of 400 MB. Though it is impossible for us to identify the usage of specific students due to data confidentiality and privacy measures, we do know that students told us that they typically used the tablets for about an hour a day after school to do homework. Thus we can draw a reasonable conclusion that the higher amount of data consumption on weekdays was most likely due to daily homework being completed outside of school. Enabling the School Zone mode of operation that limited student access during these times to pre-approved academic content also contributes to this conclusion.

Further examination of the data usage by device indicates a typology of users based upon monthly consumption. As has been seen in other studies of students using LTE-connected tablets both in school and out of school, the users can be sub-divided into three categories: power-users with high monthly data consumption, moderate users, and low-level users. Given the short amount of time that the students had with the new tablets, it is surprising that 35% of these students already qualified as power-users with average monthly usage of over 1 gigabyte (GB). This statistic may indicate some pent-up demand for increased out of school access by these students as well as a high degree of interest in tapping into more digital tools and resources to support their own learning. These emerging trends are worthy of further study.

Ending Thoughts

K-12 schools are facing increasing demands to ensure that students are well prepared with the skills needed to fully participate in the global information economy and society. To address these new demands, many education leaders are implementing new initiatives to help their students acquire the college, career and citizenship skills touted as essential by business and policy leaders. A common denominator in many of these new initiatives is the effective use of digital content, tools and resources to bring additional relevancy and context to student learning experiences. While many districts are embracing the idea of a digital conversion within their classrooms to emphasize the importance of technology access in school, far too many students continue to lack high quality, reliable and consistent Internet access outside of school. This new digital equity challenge has created a "homework gap" resulting in some students being unable to complete or keep up with homework being assigned by many teachers.

The Mobile Learning Project at Alvin Dunn Elementary School aimed to explore how providing students with LTE-capable tablet devices and 24/7 Internet connectivity helped to address the homework gap. The resulting findings indicate that not only are students well served by improved connectivity, but teachers also benefit from the assurance that all of their students are on an equal playing field for extended learning outside of school. This enables teachers to more creatively use technology to help their students develop essential skills and life-long learning behaviors.

Given the national attention on closing the digital divide and the emerging homework gap, the results of this study can potentially inform policies and programs implemented by government agencies, school districts and educators at the national, state and local levels.

About Project Tomorrow

Project Tomorrow®, the national education nonprofit organization dedicated to empowering student voices in education discussions, prepared this program evaluation for Qualcomm Education, Inc. Project Tomorrow has 18 years of experience in the K-12 and higher education sector, and regularly provides consulting and research support to school districts, government agencies, business and higher education institutions about key trends and research in science, math and technology education.

The Speak Up National Research Project annually polls K-12 students, parents and educators about the role of technology for learning in and out of school and represents the largest collection of authentic, unfiltered stakeholder voice on digital learning. Since 2003, nearly 4 million K-12 students, parents, teachers, librarians, principals, technology leaders and district administrators have shared their views and ideas through Speak Up. Speak Up 2014 findings were used as benchmark data within this evaluation study.