Blending Old and New Practices: Classroom Experiences of Schools in a One-to-One Laptop Program in Rural Argentina

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ABSTRACT

Much of the research on laptops and classroom experience has been done in wealthy countries and may not reflect the experience of schools in less-developed countries. Learning is situational and deeply embedded in context. This paper examines classroom practices in two Argentine schools that are part of a successful laptop program. Many of the examples of the ICT-enriched practices we observed involved a mixture of new digital tools into traditional Argentine pedagogical practices. We found that teachers were adapting old practices to work in the technology-rich context in ways that were provoking some fundamental changes in the learning environment. Five impacts we observed were: increased efficiency in classroom management; increased access to educational resources, creating more time on task; increased student ownership of the learning process; interactive resources offer more frequent feedback to students; and more fluid communication among teachers, students, and parents.

Introduction

One-to-one computing programs and laptop programs have been a popular approach to education reform in developing countries over the last decade. One motivation behind so many one-to-one laptop programs is the desire to use one powerful resource to overcome the historical lack of educational tools and resources available in developing countries. The research on laptop programs in developing countries often finds that these programs help bridge the digital divide and improve students' technical fluency, but the desired impact on academic achievement remains elusive [1-3]. A frequent problem identified in the research is that the laptops, once distributed to the children, may seldom be used in the classrooms. Previous research on laptop programs easily identified the challenges to their use in classrooms as teacher training, time constraints, or outdated teaching approaches; however, the research seldom delves more deeply into how laptops might be more completely integrated into daily classroom use [2, 4-8].

The technology tools provided to all students and teachers in a one-to-one program are arguably one of the most robust and multifaceted sets of resources that could be integrated into the educational process. Yet, when laptops arrive in a classroom, their use depends on how—or if—these new tools can be integrated with the existing set of resources, tools, and practices being used. If teachers are unable to fit these new tools into their current practices, the devices risk being abandoned in a closet or left on a shelf to collect dust [9].

Understanding how technology fits into the complex realities of classrooms was a critical factor for change in developed nations, yet little is known about how laptop computers could be used in the classrooms of the developing world. Our study sought to shed more light on the issue of ICT integration by taking a close look at how laptops were used in the classrooms of schools that were part of a successful laptop program—Todos los Chicos en la Red in San Luis, Argentina.

With a grant from Intel®, researchers from the Education Development Center (EDC) traveled to San Luis, Argentina in August 2011 to conduct research in three schools: two that were part of a provincial education program, Todos los Chicos en la Red (All Kids Online) and a third school that was an experimental school run by the Universidad de la Punta. This paper only reports on the data from the two All Kids Online schools[1]. All Kids Online is a one-to-one laptop program that provides all students with an Intel® Classmate PC—an affordable, durable, water-resistant netbook with full PC functionality, loaded with productivity software, education software, wireless Internet, and designed especially for students to provide a collaborative, interactive learning experience for access at home and at school. The program also provides the necessary technical support to maintain the machine. Along with a suite of other education-enrichment programs, the provincial government has utilized a whole-child approach to making education gains throughout the province.

EDC and Intel had been looking for a one-to-one program in a developing country that had achieved sufficient scale and that had external evaluation data showing the success of the program in

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[1]To read about the research in all three schools, see Light, Daniel, and Elizabeth Pierson. "Highlighting Changes in the Classrooms of a Successful One-to-One Program in Rural Argentina: Case Studies of Todos Los Chicos En La Red in San Luis ", 41. New York: Education Development Center, 2012.

improving student's academic performance. All Kids Online fit both criteria [10]. By 2010, the program had already distributed 7,500 laptops [11] and various evaluations and expert reviews had found an impact on academic performance [12-15].

The All Kids Online program is actually only one strand of a much larger provincial initiative to promote the long-term transformation of the province's economy and society. San Luis Digital, started in 2007, is an ambitious, province-wide digital inclusion initiative with its goals rooted in closing the digital divide through social and economic development [16]. In part, what enabled the successful development and implementation of All Kids Online, and all of the subsequent education programs, was the creation of an information superhighway. In 2008, connectivity was distributed for free to all villages with at least 20 inhabitants [16].

As an education reform program, the All Kids Online laptop initiative was part of a larger ecosystem of educational programs from the provincial government that impact the learning environment by providing educational opportunities and programs for students, resources for teachers to use with students, and training programs to provide teachers with new teaching strategies.

Contextual framework

Our exploration of the use of these ICT tools in the classrooms of San Luis is grounded in a socio-cultural theory of learning [17]. A socio-cultural perspective envisions learning as a social process, that individuals develop and grow intellectually in interaction with other people, and that tools play a fundamental role in mediating all human action. For Vygotsky and other theorists the term tool encompasses everything from human language and number systems to books, and automobiles. Tools are fundamental to supporting learning. We understand this to mean that teaching and learning utilizes a wide range of artifacts (i.e., pens, books, copybooks), semiotic systems (i.e., language, images, diagrams), social interaction (i.e., group work, teacher-student questioning) and institutional structures (i.e., education policies, laptop programs). Furthermore, these tools and teaching strategies mediate the students' engagement with the content. Tools are embedded in all classroom practice and they shape everything that happens. An important insight that grounds our work in ICT is that ICTs represent new sets of tools that replace, displace or combine with previous tools and strategies. The Classmate PCs and other new tools may be used in new ways, or they may be spliced into old practices. Teachers may use tools in the ways intended by the ministry or they may develop alternative ways to use the tools. New tools can improve or hinder learning or have no effect, but it is critical to understand how these tools are integrated into classroom practice.

Teachers develop instructional strategies around the tools they have available, so access to educational tools and resources is an important factor that influences the possibilities for creating engaging and supportive learning environments for students. Providing good educational resources is a concern for schools in all countries, but the difficulty this can present is a fundamental challenge of schools in developing countries. They frequently lack many educational tools and resources that schools in wealthier countries take for granted.

The lack of resources in the classroom manifests in many ways, such as a lack of reference

materials for students, no textbooks at all or only a few copies which students share, no writing paper for students, no paper or no ink for the printer, or no chalk—and the list can go on. The lack of such resources may mean that teachers cannot assign students important learning activities, such as doing independent research, or writing a long essay or story; neither can they print out student work to take home. Since these are the challenges educators face everyday, many of the teaching strategies and classroom management approaches in developing countries have developed to work within these limitations.

An attraction of one-to-one laptop programs is the hope that providing each student and teacher a laptop will help make up for the historic lack of educational resources available to most Latin American schools. The technology tools provided to all students and teachers in a "one-to-one" program are arguably one of the most robust and multifaceted set of resources that could be integrated into the educational process. Yet, when laptops arrive into a classroom, their use depends on how or if these new tools can be integrated with the existing set of resources, tools and practices being used. If teachers are unable to fit these new tools into their current practices, the devices risk being abandoned in a closet or left on a shelf to collect dust [9].

The integration of ICT tools must be seen as a process. Research indicates that the integration of technology into instruction occurs over time and follows a pattern (e.g., [18]. In their work focused principally on schools in developed countries, Zhao and Frank [19] have suggested that the process of technology integration is an evolutionary one, and that teacher's beliefs, pedagogy, and technology skills slowly build upon each other and co-evolve as technology is introduced and assimilated into the school culture (p. 14). Initially, teachers incorporate new technologies into existing practices. But if these new technologies are powerful enough, teachers may begin to see changes such as improvements in engagement, behavior, and learning which will motivate teachers to experiment with newer uses of technology to teach in new ways. In this study, we wanted to document one point in time for three Argentine schools involved in a one-to-one laptop program to see how these ICT tools were embedded into their classroom practices. We sought to explore how these tools were integrated not just with other technology resources but with other educational tools at the school level.

Methodology

This study used an instrumental case study approach [20] with a very simple focus: to observe the classroom experience of students and teachers in schools where students are using laptops daily and to document the types of practices emerging around these tools. Once the laptop program was identified, EDC then coordinated with the leadership of All Kids Online to select two exemplary schools where they knew the laptops were being used daily. In the end, All Kids Online suggested three schools – two typical public schools that represent different aspects of the educational context of San Luis – and a third school which is an innovative model school that the ULP has just opened.

The case studies were developed over two days of visits at each of the three schools. At each school we interviewed school leaders, the classroom teachers and other educators, and the professional development coaches provided by All Kids Online. We observed classes and conducted informal interviews with students during the school day

Table 1: School Visits

School	Subjects Interviewed					Classes Observed
	School leaders	Coaches	Teachers	Students	Parents	
El Manzanar	NA	1	1	2		2 full days*
Campo del Cóndor	1	1	5	5	1	6
Escuela Nicolás Copérnico	2	NA	3	5	1	10
Total	**3**	**2**	**9**	**12**	**2**	**16 + 2 full days**
* In a one-teacher school, the school day is not divided into class periods.						

In addition to talking with school-based educators, we also interviewed the leadership of San Luis Digital, All Kids Online, the ULP and the various affiliated educational programs that support or coordinate with the laptop program.

Table 2: Interviews with program staff

Organization	Program	Subjects Interviewed
ULP	Rector	1
All Kids Online	Director	1
	Alfabetización para el Futuro (ICT Literacy for the Future)	1
San Luis Digital	Zero Balance	2
	School Chess Beginners Program	2
	Contexts	1
	San Luis Knowledge Olympics	2
	Grupo Recursos Educativos Digitales (Grupo RED)	3
	Taller de Artes y Juegos (Art and Games Workshops)	2
	Information Highway Data Center	1
	Technology Support Team	2
Total		**18**

Although the two schools (the names of the schools have been changed) in the case study are each unique, they have both been in All Kids Online for at least three years and are both known to be schools where teachers and students use the technology resources daily.

EL MANZANAR—A ONE-TEACHER SCHOOL.

El Manzanar is a small, one-teacher school in a rural community about 30 minutes outside the capital of San Luis. There are 19 students, ranging from kindergarten to sixth grade, and students range in age from 5 to 16 years old. The school day goes from 8:30.a.m. to 12:30 p.m. The children get breakfast and a snack at school, and there is also a recess time for the students. The school has two adjoining classrooms—the inner classroom is for the younger children (kindergarten to third grade) and the other room is for the older students (fourth to sixth grades). There is an open doorway between the two rooms so that the teacher can easily see and hear all the students. There is a small office for the teacher, who also functions as the director. There is also a small kitchen and eating area where students eat breakfast and have snack time. There is a woman who serves as the cook and the custodian, maintaining both the kitchen and general public spaces. The school also has been assigned an instructional coach by All Kids Online; the coach spends two mornings at El Manzanar and one afternoon each week planning with the teacher. The coach also provides the same support to a teacher at a nearby school.

The population in this community is fairly dispersed and most students come a long way to get to school. Some walk a few miles to get there, but the school also has an arrangement with a local bus company to make a small detour from its normal route at the end of the school day to pick up students to be dropped off along the highway at locations a little nearer to their homes.

Technology Infrastructure

Every student had a Classmate PC netbook and the teacher had a laptop. There was also an interactive whiteboard in the upper grades' classroom and a printer/scanner in the office. The school had a wireless connection and all students had access to the provincial wireless network from their homes. El Manzanar also used the virtual learning environment created by the ULP. There was no library but each classroom had a bookshelf with a few books available: there were a few copies of the textbook distributed by the national government, and then a selection of children's books. In addition to the laptop, each student also brought a notebook or copybook (cuaderno escolar) to school everyday. Because students seldom have a copy of the textbook for their personal use, Argentine students traditionally fill up their copybook throughout the year with important information dictated by the teacher or copied from a textbook, and use it to take class notes as well as to do homework and exercises [21].

All the students at El Manzanar received their laptops in June 2008, and the pedagogical coach from All Kids Online started working with the teacher in September 2008. At the time of our visits, the coach had been working with the El Manzanar for two years. The pedagogical coach spent two mornings a week at the school working with the teachers and the students, and one afternoon a week

with the teacher planning and developing lessons.

Classroom Practice

The daily practices of a one-teacher school were different from the schools that had one teacher per grade level. Since a single teacher works with students from first through sixth grade and few students were at the same grade level, the teacher at El Manzanar was constantly dividing her time between students at different developmental stages and different levels of school readiness as well as different grade levels. Students were expected to work on their own frequently while the teacher cycled on to other students. Additionally, like many one-teacher schools, El Manzanar served poor, dispersed rural communities and students frequently started school with lower levels of school readiness (i.e. they may not know any letters of the alphabet or the colors), which means that the youngest students needed a lot of personal attention and support. Likewise, as they grew up, her students may have had little access to reading material in their homes before the arrival of the laptops. Through out the school day the teacher constantly moved between students and groups of students to work with one student while the others worked independently or waited for the teacher. A positive side effect of a one-teacher schoolhouse dynamic was that older students helped the younger ones quite a lot while the teacher gave her attention to an individual or a smaller group of students.

During the classroom observations almost every activity the teacher and students did involved the resources of All Kids Online (the laptops, the white board, the Internet or the virtual learning platform). Each morning the older students logged into their folders on the platform. From their folders they could hand in their homework, find current projects or download their next assignments. They could also find stories to read and links to other resources. As a result, the older students got started working in about 15 minutes, and the teacher could then focus on the younger students who needed more personal attention from the teacher. She would then work with the younger students, one-on-one or in small groups, with the day's lesson to get the younger students ready for an activity reinforcing the lesson for students to do on their own. At this point, the teacher would turn her attention back to the older students and to introduce new content with a whole group activity.

More efficient use of time provided more time for learning activities: Coordinating time and student activities in El Manzanar involved constant juggling. The school had two adjoining classroom spaces so the teacher divided the children by age to create smaller groups that work on their own. Before the arrival of the laptops, a lot of time was taken up in preparing or distributing lesson materials and getting the students prepared to work on their own. Because of the shortage of textbooks, workbooks and even paper to print up worksheets, providing lesson material to students meant that students would have to individually copy material or exercises from a shared textbook into their personal copybooks before they could even start to do the work. It might take considerable time to get the older children set up. Only when the older students were working, could the teacher start with the younger children who required much more personal attention. With this set up before the arrival of the laptops, the pedagogical coach reported the teacher would cover two subject areas each day.

The teacher and the pedagogical coach explained how the laptops, the interactive whiteboard and the learning platform substantially changed the dynamics of the class by saving time streamlining logistics and administration and providing access to resources to increase the time spent on learning

activities.   Once the teacher and the students were comfortable with the basic operation of the laptops and the learning platform, the logistics of the school were streamlined. The laptops gave the students greater autonomy and control of the educational resources making it easier for them to work on their own. Students could find all their work on the laptop, and once they learned to navigate the learning platform, the teacher could easily distribute new activities to them by placing new assignments in each student's folder. Instead of handing out a textbook for students to copy into their copybooks, students could go to their folder on the platform and start working. During our observations, in the morning the teacher was able to instruct the older students to open their folders and continue with the activities they had not finished yesterday, and then proceed to the next activity in their folder. She was even able to get the older students started while she was setting up the learning activities for the younger students. She lost much less time in logistics of getting her students set up to work. The pedagogical coach reported that the teacher now routinely covers three subject areas with her students in each day. During one of our observation days, the class worked on four subjects.

Increased access to other educational resources: The laptop with Internet connectivity gave the teacher access to a wide variety of resources online. Because all of the students have laptops, the teacher could use the wide offerings of online interactive resources to integrate into the class. She used resources from All Kids Online , but also from other websites that offered educational resources in Spanish such as the Junta de Andalucía (Government of Andalucía), Educ.ar and Zona Clic (Click Zone). The students might be assigned activities to do on their own, and other activities might be in groups.

The teacher explained that access to resources and the ability to pick and choose had changed how she planned lessons, combining the Government Issue textbook with other resources from online to better meet the needs of her students. For example, in language arts she felt the stories in the national textbook were not always relevant to her rural students, but online she was able to find a wide variety of stories and lessons relevant to her students' lives and needs.

More effective and efficient whole class instructional activities: The interactive whiteboard and the laptops shifted the teacher's ability to do whole class (or large group) instruction as well because the technology reduced the amount of time needed to display and share materials. In one example, we observed a class discussion based on a story the teacher found in a book her pedagogical coach had lent her. She scanned the story and was able to post it on the whiteboard and put it in each student's folder on the Sakai platform. The technology eliminated the waste of time for teachers to write things up on the board and for students to copy them down into their notebooks. In another example, the teacher was starting a unit on fractions with the students. She started the activity by reminding the students that they had studied fractions the year before, she had the students get on the virtual learning platform and open up their lesson from last year on fractions. On the whiteboard, she projected the same set of exercises that the students were opening. Together they reviewed the concepts of numerators and denominators, and then she set up an interactive webpage displaying different geometric shapes divided into sections with some sections colored in. The older students continued working as a group with the interactive whiteboard, while the teacher turned her attention

back to the younger students. The students had to write in the correct fraction. The page was projected on the whiteboard and also on students' laptops. The students were taking turns solving a problem at the board and explaining their answers.

Prior to All Kids Online, for a group activity in math, for example, the teacher might have written her lesson on the chalkboard with exercises for students and asked students to copy them into their notebooks. For reading, the teacher could have distributed the few textbooks for students to share while they read a story in a group and answered questions. With the technology resources, the teacher can now put the lesson up on the interactive whiteboard as well as share the materials to students' laptops over the virtual learning platform. She can use the interactive whiteboard to project her lesson notes, or resources such as story, image, or a math website with online activities. She can also make and distribute her own resources this way as well.

Impact on Students

Improved academic achievement: The teacher at El Manzanar said that she observed more children engaging in reading activities since the introduction of the computers. She noted that the students did not like to read from the few books she had available at the school, but now with material available on the computer, they enjoy reading. And the teacher was also able to find more topics and materials that would interest students. The instructional coach commented that she saw that access to and use of the laptops had improved students' communication skills. She also said more students were passing their classes.

Automated feedback increased personalization of learning: In addition to what the teachers said, we observed how access to interactive educational resources can personalize learning and increase student autonomy. The laptops have impacted the ways that students engage with learning content by enabling them to get immediate feedback and allowing them to cover more material. In a one-teacher school, students often work on an assignment alone and wait their turn for the teacher to give them feedback. In El Manzanar, the teacher was able to assign students interactive resources that would give them immediate feedback on whether their response was correct. So students were able to move faster through the material they understood and even do more work to reinforce their learning. Depending on the quality of the feedback, students might be able to master a concept on their own or, at least, the teacher would know where they were having trouble. For example, we observed a first or second grade student working on an interactive worksheet that a fellow teacher had created in Excel. The worksheet had pictures of animals and the student had to write the correct word below the picture, the worksheet would indicate if the word was correct or not, but it would not give the student the answer. As we watched, the worksheet indicated the word "pero" (for "dog") was incorrect, the child thought for a second, and realized he had left out a letter and retyped "perro". The worksheet gave him a green star and he moved on to the next picture. Now, as students work on their own they get immediate feedback that allows students to self-correct or move faster through the material. This dynamic appeared to be a fundamental difference from doing paper worksheets that got graded hours if not days later.

CAMPO DEL CÓNDOR*—A VILLAGE SCHOOL.

Campo del Cóndor is a village that is the center of a tourist region in San Luis. The school had a unique socio-economic mixture of poor rural families and urban middle-income families escaping the dense urban environment of Buenos Aires. These class differences caused some tension in the school early on. But the school principal felt that the laptop program had served to equalize some of those differences by giving all students the same set of resources. In general, though, most of the students who attend the public school live in modest circumstances and their parents move around a lot according to the seasons.

The school was well respected in the area; the school director reported that many families bring their children to this school specially. Campo del Cóndor is an elementary school from 1st to 6th grades. 2009 was the first year the school had about 120 students and was finally allowed to have a teacher for each grade. There are a total of 6 classroom teachers, a special education teacher and the director. An art teacher and physical education teacher also visit the school.

There is also a pedagogical coach from All Kids Online who works at the school three days a week. The role of the pedagogical coach in this school is a little different than in the one-teacher school because her time is divided across more teachers in the building. She plays a key role in coordinating the technology and keeping track of laptops coming into the building or leaving for repair, keeping peripherals working (i.e. cameras, projectors, printers) and troubleshooting.

The director and the teachers were committed to innovation and involved with a number of programs to improve the learning environment and provide more resources for their students. For example, Campo del Cóndor volunteered to be part of the Escuelas Inteligentes (Smart Schools) program where schools commit to promote project-based learning and set goals to increase student performance in language arts and math. In the program, schools commit to improving test results in a variety of subject areas, and as their scores improve, the schools earn extra resources, like the interactive whiteboards that Campo del Cóndor received.

The school participated in a number of different programs from the Universidad de la Punta that are affiliated with All Kids Online. The school participated in Contexts (a literacy program for young readers), Ajedrez (the chess program), Olimpíadas de Conocimiento (a province-wide series of student competitions), the afterschool art and music program, as well as Zero Balance (a school-community collaboration to balance out the village's carbon footprint).

The school is located in the center of the village and the students either walk to school or take a local bus to the village square and walk from there. The school day goes from 8:30am to 12:30pm. There are afternoon workshops in art and music that are offered through the ULP. The school cannot require students to attend, but it does encourage them to go and many students do.

Technology Infrastructure

The Classmate PC netbooks were distributed to the children in October 2008 making Campo del Cóndor one of the first schools in All Kids Online. But some technological difficulties and connectivity issues meant that the teachers did not really begin to use the computers in the school until 2009. All the students in the school have netbooks that they get when they are in first grade (or when they transfer into the school). Every teacher has a laptop from All Kids Online. And since 2010, every

classroom has an interactive whiteboard that the school won through the Smart Schools program. The school also has wireless Internet connection and access to the learning platform. Additionally, the teachers reported that all of the students live within range of a node of the provincial network and the students can access the network from anywhere in the village itself.

Campo del Cóndor also had access to the virtual learning environment, Sakai platform, but the teachers said they were just beginning to become familiar with the platform, so the students were not yet using it in many of the classes.

Like El Manzanar, the teachers at Campo del Cóndor had conducted parent workshops to help them learn about the laptop and get comfortable with the idea of letting their children have the laptop.

Classroom Practice

Unlike El Manzanar, each teacher had her own classroom working with the same 20 students all day at Campo del Cóndor. Over two days, we observed six classes at this school. At Campo del Cóndor, most of the classes observed were built around whole class activity led by the teacher, but technology still played a constant part of daily activities. All students had netbooks that they were expected to bring to class everyday. Even the first grade students had netbooks which they had received the week before and were just starting to learn how to use them.

More effective whole class instructional activities: The students used both their netbooks and their copybook (cuaderno) everyday, but the central technology tool tying together the classes was the interactive whiteboard and the teacher's laptop. The teachers spoke about how the interactive whiteboards really brought everything together and allowed them to bring the computers more centrally into their teaching because it gave them a way to present computer-based resources to the whole class, and then share them with each student. Prior to the arrival of the whiteboards, teachers found themselves in a paradox: the laptops gave them access to lots of new resources from interesting stories, to reference sites to interactive, but presenting these resources to the children or explaining how to use the sites was challenging. The teacher had to juggle between having 20 students huddled around one laptop screen to understand how to access the content. Now the teacher can do the instruction on the whiteboard while students follow along at their own computers.

Even though these teachers were using more student-centered learning activities, such as small groups class discussions and debates, and student presentations, the classes still used teacher-facilitated, whole class activities. In the classes we observed, the whole class activities were used to present new material or explain the new activities before students broke up into groups, worked individually or began their homework. For example, the second grade teacher used a combination of digital resources in a lesson about weights and scales. To start the lesson she used a simulation of a scale (a Roberval Balance) on the whiteboard and the teacher could place different size weights on either side of the scale. She was showing students what would happen as weights were added or removed and asked students "why". Then she moved on to having the students predict what would happen if they added a certain weight or removed a certain weight. When a student offered a prediction, the teacher would ask for other students' thoughts, thus creating a conversation among the students about what would happen and why. The students were enthralled by the discussion; even though they had the same website on their netbooks, they were all focused on the teacher, the

whiteboard and their peers. After this discussion, the teacher put up pictures of a variety of scales on the whiteboard to remind the students that there were many types of scales including the digital scale they probably saw at the food market. She then showed them the cover of an electronic book about kilograms ("El Kilo se presenta"). She had found the book online and sent it to all of the laptops. The students were asked to read the story at home.

In fact, we saw an example of the type of challenges teaches might face with using laptop-based resources without the ability to present them to the whole class when one of the whiteboards was not functioning properly during a fifth grade math class. While the teacher was able to effectively use the chalkboard to draw the relevant shapes, when it came time to watch a video, rather than watch one video on the big whiteboard screen, each child had to input the web address into his or her computer. This process was tedious, inefficient and rife with places for typing errors illustrating the amount of time that can be lost.

Increased access to resources: The use of digital resources and the whiteboard stood out when compared with the lack of books, manipulatives and other learning materials that would have shaped the learning process prior to the arrival of All Kids Online. The Internet, the computers and the whiteboards brought in a wealth of resources that teachers could not have accessed and used otherwise, and the teachers at Campo del Cóndor were making full use of them. One teacher, for example, commented that the government textbook was too centered on Buenos Aires, and many stories were not relevant for her rural students and she was happy to be able to find other stories.

The laptops and the whiteboard also give access to resources like specialized teachers. We observed a sixth grade class participating in the school chess project that was taught by a chess instructor 200 kilometers away. The PD coach was present to set up the technology and oversee the students. Using a specialized chess portal, the instructor had set up a particularly challenging situation on the whiteboard while her voice came through the coach's computer speakers asking questions, explaining her moves and giving students tips on strategy. The students, who were all logged into the portal, used the chat function to answer the teacher's questions and ask for clarification. The pedagogical coach walked around the room helping the students with the technology and giving them advice on game tactics. After 10 minutes of set up, and 10 minutes of instruction, the instructor, from across the province, initiated a class competition, pairing students up randomly to play against each other on their laptops. Students were paired up twice for two quick games. It was clear that the technology provided a number of affordances including access to specialized teachers and content as well as the ability to instantly set up the chessboard. Playing chess online gives students more time to actually play the game because less time is wasted setting up the physical game board and pieces. The coordinators of the School Chess program whom we interviewed at the ULP said that setting up traditional chess sets for a room full of children can take 20 minutes. Finally, the teacher does not have to worry about lost, stolen, or broken pieces, and no extra space is needed for storage.

Emergence of blended teaching and learning strategies: Similar to El Manzanar, the technology was changing the type of resources that teachers and students can access and the way they are using these resources.   Another classroom observation highlights the mix of old and new strategies and resources that was emerging in the classrooms with the technology resources at Campo del Cóndor.

The first grade teacher was reviewing numbers and teaching the students the numbers from 20 to 29. At the start of the lesson students were each given a photocopy of a math exercise of number lines with intermittent blanks up to 29 ("1,2,__, 5, __, etc") to glue into their copy books. The teacher moved around the room ensuring students were completing the task, then she started a presentation at the whiteboard. The teacher reviewed the idea that numbers are grouped in 10s. In the space of five minutes, the teacher was able to move between multiple representations of the number line grouped by 10s and pictures of things grouped by 10s. For the activity, the teacher put up on the interactive whiteboard a picture of a train pulling cars loaded with numbers and blanks ("20, __, 22, __, __, 25, …") and a list of numbers piled up on the station platform. Students would come up to the whiteboard and drag the correct number into the blank with their finger. The teacher was also able to go to variations of train activity once students completed the train up to 29. After this introduction and review, the students began to work independently on the exercise they had glued into their notebook.

This observation suggested a number of ways old and new practices blended to create a hybrid. First, even the traditional practice of having students create their own workbooks was facilitated and made more efficient by technology. The students could paste a photocopied exercise into their copybook, which in the past, the teacher would have written the exercise on the board and asked her students to copy it by hand into their copybook. Only then could students complete the activity. Now, the teacher designed an activity for her students, printed and copied it, and the students only needed to paste it into their books. Second, the review lesson utilized a number of different visual and graphic representations of the concepts the teacher was covering. This allows her to reach a wider range of students with diverse learning strategies. Finally, she used an interactive tool to allow the students to work through the new material together. And the teacher was able to clear old answers and refresh the interactive material more quickly than would have been possible if she had handwritten them on the whiteboard.

Impact on Students

Besides using them for homework and other school-related endeavors, students talked about using their laptops to go on the Web, play games, and chat with their friends. Because of the ubiquitous Internet, students are able to do all of these activities at school as well as in their homes. When asked directly about impacts on the students at Campo, stakeholders spoke about a number of academic, social, and behavioral changes since the introduction of the laptops and whiteboards in the school.

Increased academic achievement: Everyone we spoke to agreed that the students were more motivated and enthusiastic about school since the introduction of the laptops. The instructional coach noted an increase in technical knowledge where the students were now able to use Power Point and make videos as well as solve technical problems on their own. One teacher spoke about increased writing output because for students who don't like to write, typing is better for them, they can move faster. A parent we spoke with shared a similar anecdote about her daughter reading and writing her own stories now that she could use a keyboard rather than a pencil and paper. Students also like that since the computers, teachers are creating more collaborative lessons and giving them the opportunity to work with their peers on different projects.

Expanded horizons: The Director mentioned increased social integration among the different social classes of kids; in that way, the computer acts as an economic equalizer for students. The Aula 1a1 (One-to-one Classroom) software has a chat function as well as a discussion forum so that students can interact with their peers at Campo del Cóndor as well as at other schools. The laptops afforded great access to resources for students that came from the most rural areas. These children now had more access to music, news and other information helping expand their knowledge of issues both locally and beyond. Similarly students are now doing more learning while at home. One parent said her child was more motivated at home. She can play games, browse pictures, look up answers to questions, and use the education software that is included in the computer.

Personal growth: She reported that students also have more self-control, they understand that music and games are meant to be used at home and that while at school, they need to use the Web for more educational purposes. The coach talked about one child in particular who used to be painfully introverted who is now more comfortable interacting with other students. She mentioned another child who increased his motor skills since using the laptop. Teachers note that students' self-esteem has improved because the kids can see things that they have published on the Internet and that their work is valued. The work does not only live in the classroom, it is shown to a wider audience as well.

Discussion

In all three of these schools we saw how the laptops and the ICT resources had become a daily part of learning in the classroom through a mix of pre-existing teaching-and-learning strategies being enriched and modified by the technology. Some older strategies were slowly being displaced, and new ones were emerging.

In these classrooms, the Classmate PCs—embedded in an ecosystem of interactive whiteboards, a virtual learning platform, and universal wireless connectivity—were being used as frequently as typical Argentine students use their copybooks, and for many of the same purposes. In the absence of other resources, the copybook in Latin American schools is a combination homemade textbook, workbook, study guide, and notebook, as well as a portfolio of work so parents and teachers can monitor each student's progress [22-24]. This was why the students and teachers used their laptops every day as a vital part of their learning environment. However, the educational tools provided by All Kids Online were also fundamentally changing the learning process.

Ubiquitous computer and Internet access facilitated changes in five strategies or classroom practices, which make the teacher's job easier and more effective and could lead to substantial improvements in student learning.

INCREASED EFFICIENCY IN CLASSROOM MANAGEMENT.

The laptops and interactive whiteboards greatly facilitated critical classroom logistics, such as distributing resources to students and putting material up on the whiteboard, allowing teachers to spend more time teaching. The ease of distributing resources using the virtual learning platform to place materials directly into each student's folder also allowed teachers to personalize resources to

each student's level. In schools with a four-hour school day, time was a precious resource.

INCREASED ACCESS TO EDUCATIONAL RESOURCES, CREATING MORE TIME ON TASK

Both teachers and students were using a wider variety of resources to meet their learning needs with the laptop and other ICT resources. The Internet offered access to a wide range of resources from complex ones, such as interactive math activities, to videos and images, to simpler resources such as more varied stories to interest young rural readers. But the technology also allowed the teachers to make their own resources: Some teachers scanned reading material to share with students, and more technically proficient teachers created digital resources such as interactive worksheets. The biggest change for students was that they each had their own copies of all the materials they were using in school, and they could take these resources anywhere with them. In schools with insufficient textbooks, libraries, and other educational resources, this can make a substantial impact.

INCREASED STUDENT OWNERSHIP OF THE LEARNING PROCESS

Having full ownership of the laptop from All Kids Online, and universal access to the Internet, increased students' ability to have more autonomy and direct their own learning. With the laptop, they could more easily find their assignments and start working, and those students who were moving faster could do more activities or do extra work. Students also were able to do work at home or use the Internet to explore a topic. Shifting more control of their own pacing and progress through the material onto the students increased their autonomy and opened the possibility for them to push themselves harder.

INTERACTIVE RESOURCES OFFER MORE FREQUENT FEEDBACK TO STUDENTS

This change is connected to the one above. Across a range of basic skills and abilities, such as math and spelling, the introduction of interactive digital resources was a way to give students immediate feedback, enabling them to try something, assess, and redo on their own. We saw how activities as simple as an interactive worksheet helped a learner practice and problem-solve his spelling. This enabled teachers to make better use of their time with students, and allowed students to study outside of school.

MORE FLUID COMMUNICATION BETWEEN TEACHERS, STUDENTS, AND PARENTS

The laptop and Internet connectivity also changed how students, teachers, and parents communicated in a couple of ways. These schools did parent workshops about the laptops so that parents could learn how to review student work just as they do with the copybook. Some of the families had begun to use email. All of the students were using a chat tool like Skype or Messenger to be in touch with their friends, and most of them chatted with their teachers as well. Through chat, teachers were able to remind students about homework and students were able to ask teachers questions.

Summary

There are many pending questions about one-to-one programs in developing countries, given the varied success rates of many of these large-scale projects. In this project, we attempted to approach only one question—Why do many teachers not utilize the laptop resources?—by looking closely at schools and classrooms where the tools are being used in context. What we found was very interesting, and suggests that laptop programs in developing countries may want to think carefully about how these new resources can intersect with the existing educational strategies and tools in each country in ways that can begin to improve student outcomes, but also lay the groundwork for deeper reform.

All learning is situated and embedded in a context. Much of the research on laptops that focused on classroom experience has been done in wealthy countries. Learning experiences of teachers and students in the resource-rich classrooms of the industrialized countries are, obviously, different from those of teachers and students in under-resourced classrooms. These findings shed valuable light on how these ICT tools were positively integrated into the under-resourced classrooms typical of many developing-country schools.

Although some of the teachers we visited were experimenting with innovative practices, such as project-based learning, in their daily practice, however, teachers were not abandoning their old resources or teaching models nor were they resisting ICT. Rather, they were adapting old practices to work in their new, technology-saturated context. But by infusing ICT into their current practices, there were some fundamental changes in those practices, making them potentially more effective. Many of the examples of the ICT-enriched practices we observed involved a mixture of new digital tools into traditional Argentine pedagogical practices.

This research was only an exploratory examination what daily use of laptops looks like in a developing country context. But many of these mixed activities of older practices with new tools hold the potential to have positive impacts on student learning, since they align with known aspects of good practice: increasing time on task, allowing students more control over their work flow, giving students their own textbooks or reference materials, providing more and varied resources and activities for students. We do not mean to argue that there is no need for deeper pedagogical reform, but that these mixed approaches that transform current common practices may be a good place to start integrating ICT, improving education, and building for reform.

Acknowledgement

References

[1] O. Valiente, "1-1 in Education: Current Practice, International Comparative Research Evidence and Policy Implications" (OECD Publishing, Paris, 2010).

[2] R. Winthrop, M. S. Smith, "A New Face of Education: Bringing Technology into the Classroom in the Developing World" (Brookings Institution, Washington, DC, 2012).

[3] A. Zucker, D. Light, Laptop Programs for Students. Science, 82 (January 2, 2009).

[4] S. Akbaba-Altun, Complexity of Integrating Computer Technologies into Education in Turkey. Journal of Educational Technology and Society 9, 176 (2006).

[5] Comenius, "Informe Final - Enlaces Portátil: Abriendo Camino para un país digital" (Centro para el desarrollo de innovaciones en educación, Universidad de Santiago Chile, Santiago, 2008).

[6] K. Kraemer, J. Dedrick, P. Sharma, One Laptop Per Child: Vision Versus Reality. Communications of the ACM 52, (2009).

[7] D. Light, C. Rockman, in Evaluation of the Jordan Education Initiative. (Education Development Center, Washington, D.C., 2008), pp. 57.

[8] U. Vyasulu Reddi, V. Sinha, in Metasurvey on the Use of Technologies in Education in Asia and the Pacific, G. Farrell, C. Wachholz, Eds. (UNESCO-Bangkok, Bangkok, Thailand, 2003), pp. 245-252.

[9] I. Jara Valdivia, "Las políticas de tecnología para escuelas en América Latina y el mundo: visiones y lecciones" (Comisión Económica para América Latina (CEPAL), Santiago, Chile, 2008).

[10] A. Bañuelos, "San Luis, a Digital State: How we support the work of teachers and students students" paper presented at the International Conference on 1-to-1 computing in Education, Vienna, Austria, 2010.

[11] E. Severin, C. Capota, "Modelos Uno a Uno en América Latina y el Caribe: Panorama y perspectivas" (Inter-American Development Bank, Washington, DC, 2011).

[12] A. Bañuelos, "San Luis: Tecnología y Educación" paper presented at the Reinventar el Aula: Impacto Social y Educativo de la Incorporación de TICs en la Educación, Washington, Sept. 15, 2009 2009.

[13] I. Dussel, L. A. Quevedo, "Educación y nuevas tecnologías: los desafíos pedagógicos ante el mundo digital" paper presented at the VI Foro Latinoamericano de Educación, Buenos Aires, 2010.

[14] S. Finquelievich, A. Prince, El desarrollo de una provincia digital La Punta. (Universidad de La Punta, San Luis, Argentina, 2010).

[15] Fundación CEPP, "Evaluación del programa "Todos los chicos en la Red" – Informe de Resultados" (Fundación CEPP, Buenos Aires, 2008).

[16] S. Miranda, M. C. Odicino, "Todos los Chicos en al Red: Iniciativa de la agenda digital de San Luis" (Universidad de la Punta, San Luis, Argentina, 2009).

[17] L. S. Vygotsky, Mind Society: The Development of Higher Psychological Processes. M. Cole, V. John-Steiner, S. Scribner, Souberman.E., Eds., (Harvard University Press, Cambridge, MA, 1978).

[18] J. Sandholtz, C. Ringstaff, D. C. Dwyer, Teaching with technology : creating student-centered classrooms. (Teachers College Press, New York, 1997), pp. xx, 211.

[19] Y. Zhao, K. A. Frank, Factors Affecting Technology Uses in Schools: An Ecological Perspective. American Educational Research Journal 40, 807 (2003).

[20] R. E. Stake, The art of case study research. (Sage Publications, Thousand Oaks, 1995), pp. xv, 175.

[21] S. Gvirtz, S. Larripa, Á. Oría. (Buenos Aires, 2004).

[22] A. Almeida Costa e Santos, M. Proença Rebello de Souza, Cadernos escolares: como e o que se registra no contexto escolar? Psicologia Escolar e Educacional 9, 291 (2005).

[23] A.-M. Chartier, Os Cadernos Escolares: Organizar Os Saberes, Escrevendo-Os. Revista De Educacao Publica 16, 13 (2007).

[24] M. A. Tenutto, in Contexto Educativo: Reivsta Digital de Educacion y Nuevas Tecnologias. (Nueva Alejandria, Buenos Aires, 2000), vol. 7.