



**HIGHLIGHTING CHANGES IN TWO RUSSIAN SCHOOLS WITH
SUCCESSFUL ONE-TO-ONE LAPTOP PROGRAMS:
MOSCOW AND NIZHNY NOVGOROD CASE STUDIES**

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EXECUTIVE SUMMARY

In the Russian Federation and other Commonwealth of Independent States (CIS) countries, a focus of national education policy is to modernize the education system by integrating new technologies-that have emerged within education in Western Europe and North America (Pogosian, 2012). The current promotion of one-to-one learning in Russian schools is one of the strategies being used to achieve this goal of modernization. Despite efforts to provide technology to Russian schools, the research suggests these resources are still infrequently used (Nikolaev & Chugunov, 2012; World Bank, 2008). Understanding how technology is actually used by teachers in their classrooms is a critical factor for developing effective interventions in Western nations, yet little is known about how laptop computers are currently being used in the classrooms in Russia or other CIS societies. Our study sought to inform the conversation of how to promote one-to-one learning by taking a close look at how laptops are used in the classrooms of Russian schools that are using them on a daily basis. In April, 2012, the Education Development Center's Center for Children and Technology (EDC|CCT) traveled to Moscow and Nizhniy Novgorod to conduct research on two schools that have one-to-one laptop initiatives. Although both schools have developed their own laptop programs, the core of their programs are classroom sets of Intel® Classmate PCs, interactive whiteboards or projectors, wireless Internet access, and a virtual learning environment.

Intel Education Resources in Russia and CIS States

Over the years, Intel® has sought to be a trusted partner in the development of modern, high-quality education systems worldwide by offering a portfolio of educational programs to help teachers and students use ICT as a critical tool to support education (Light, Menon, & Shulman, 2007). The schools we observed were involved with a number of these Intel programs, such as Teach Essentials and Teach Getting Started, that provide their teachers with professional development in using technology and innovative pedagogical strategies. They also made use of an Intel curriculum for students, Skills for Success, that helped students to explore ICT by doing community research projects.

Intel works with Project Harmony to adapt their programs and materials for the Russian context. Project Harmony aligns the project ideas and resources to the Russian Federal curriculum standards and topics. Another uniquely Russian entity is Intel® Education Galaxy, an online professional community and set of virtual resources. Education Galaxy sponsors contests, offers online training courses, and

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supports an active community of Russian-speaking teachers sharing resources and strategies on how to use ICT to support their students' learning.

Additionally, Intel also licenses a low-cost netbook, the Intel Classmate PC, that is produced in Russia. Both schools in Russia used the Intel Classmate PC with their elementary, middle-, and high-school students.

Methodology

Our exploration of the use of these ICT tools in Russian classrooms is grounded in a socio-cultural perspective on learning (Vygotsky, 1978) that sees ICTs as 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.

We used an instrumental case study approach (Stake, 1995) 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 country was identified, EDC|CCT then coordinated with the Intel leadership to select two exemplary schools where they knew the laptops were being used daily.

The case studies were developed over two days of visits at each of the two schools. At each school we interviewed school leaders, classroom teachers, parents, and students. We observed classes both in person as well as over Skype. Intel program leaders were also interviewed in order to gain a deeper understanding of the overall context of the laptop programs. In addition to talking with school-based educators, we also interviewed individuals involved in the various affiliated educational programs that support or coordinate with Intel's laptop program.

Russian Education Context

Following the dissolution of the Soviet Union, the Russian education system entered a long process of reform and transformation. The reforms undertaken by the new Russian Federation focused on transforming a rigidly centralized Soviet education system concerned with meeting the needs of the Communist state into a system that was decentralized, more responsive to local and regional concerns, and built around the needs of learners and a market economy (Pogosian, 2012). Additionally, the reforms sought to “develop students' capacity for independent decision making, critical thinking and democratic citizenship” (Johnson, 1996, p. 122).

The current framework of reforms was launched in 2010 under the name “Our New

School”(Nikolaev & Chugunov, 2012). The initiative is built around six principal approaches to creating a more comprehensive education system, including adopting new educational standards, developing a comprehensive student-support system, improving school infrastructure, maintaining school children’s health, expanding individual schools’ independence, and cultivating talented teachers who are qualified to teach in these 21st-century schools.

The Schools

The two schools we visited were selected because they represented different contexts. One school is in a densely urban neighborhood in central Moscow and the other school is in an industrial town of 50,000 people in the Nizhny Novgorod region. Russian schools all follow federal curriculum standards and thus teach the same content, but the school sets the teaching processes. At both schools we observed teachers delivering complex and rigorous lessons and saw how computers are integrated seamlessly into the curriculum. The case studies outline in more detail the technology infrastructure and support, the classroom practices, and the impact on students and parents observed at each school.

Case One: The Moscow School: A big city school

The Moscow school is ranked as one to the best public schools in Moscow. The school’s director said they are known for their innovative learning environment and programs, one of which is the one-to-one laptop program for the elementary and middle-school students. Like most schools in Russia, the Moscow school spans from 1st to 11th grade. There are 800 students attending classes at the school, with another 400 students taking courses online through the school. There are 100 teachers in addition to the director and her staff of vice-directors and administrators. Classes start at 8:30 a.m. and go until 12:00 or 1:00 p.m. depending upon the grade level.

The school, located in a neighborhood near Moscow University, has one building for the elementary and middle grades and another building for the high-school grades. The halls and classrooms were spacious. The school buildings also had other physical spaces available to support the children’s learning, such as two libraries, two auditoriums, cafeterias, and gymnasiums, as well as open spaces in the hallways where the children could play during their breaks between classes. The school does have a computer lab, but it also has one-to-one laptop environments in the classrooms.

Case Two: The Nizhny Novgorod School: An industrial village school

The school we observed is located in an industrial village about an hour outside of Nizhny Novgorod, Russia’s third-largest city. The City Education Manager claimed that this school is one of the best schools in the district. There are 52 teachers for 900 children in grades 1–11. The school is known as a “School with Advanced Areas of

Study,” meaning that, in addition to being a regular school, they also offer more in-depth teaching in certain areas. The school day runs in two shifts, from 8:00 a.m. to 12:00 p.m., and then from 1:00 p.m. to 4:00 p.m.

The students at the school were all from the neighboring middle-class community. A teacher described the student body as “a mix of students from wealthy, poor, well-educated, not as well-educated, married, and not-married families.” While the other schools have computer labs, the Nizhny school is the only one with a one-to-one laptop program. At other schools, teachers use ICT in teaching and planning but they don’t have the same access at home, and neither do the students they are teaching.

The school is sited in one four-story building that has a large front yard with trees and grass for playing, as well as an ice rink and a soccer field in the back. The school also has a library, a gym, a computer lab, a large cafeteria that also serves as an auditorium, and a number of science labs. Many of the teachers and parents are alumni of the school and told us that they returned to the area because they wanted to continue to be a part of the strong school community.

Findings

In our observations in the classrooms of the Moscow school and the Nizhny school, we saw a number of teaching strategies that used the laptops, supported by other technologies, to engage students and support their learning in innovative and potentially powerful ways. Ubiquitous computer use and access to key Web-based educational tools facilitated changes in three important educational practices that in turn supported changes in the overall learning environment.

1. Increased independent student research. Teachers felt that independent student research was important for two reasons. First, because it gives students a new active role, making them responsible for their own learning. Second, teachers felt it was important for students to understand that there are many sources of information and many perspectives. Students must be able to find information and select the best for their own use. Independent research encourages students to pursue their own interests and interpretations of topics, which they then can share with their teachers and peers. The presentations we saw, which were based on student research and perspective, allowed students to share and debate issues.

2. Increased formative assessment and self-reflection. The laptops, combined with virtual learning environments (Prometheus or the built-in LMS), allowed both schools to integrate easy, computer-supported assessment and self-reflection into any lesson where the laptops were available. These online assessments provided students and teachers immediate feedback about strengths and weaknesses. The way teachers wove assessment and self-

reflection into lessons reinforced the traditional Russian goals of student self-regulation and management of their own learning (Alexander, 2001; Hufton & Elliott, 2000). After the assessments, teachers asked students to reflect on the results and to discuss what they could do to improve their scores the next time.

3. Increased student collaboration. The introduction of laptops and access to wireless Internet allows students to work together at school or from home. The technology facilitates group research projects and presentations and allows students to communicate freely. Students enjoyed the increased peer interaction even when they recognized the challenge of working with individuals with varying skill levels. One 4th-grade teacher described the changes she has seen: “Using computers brings the collaborative work into the classroom. In the past, students sat in rows listening to the teacher; before, they worked in pairs, but now they can work together anytime and anywhere.” The Intel Learn Skills for Success curriculum also has provided students with more opportunities to work together to solve problems and design projects.

The above three elements support transformations in three important aspects of the learning environment.

1. Creating a more personalized learning environment. The role of the students as researchers, as another source of knowledge, and as active participants presenting and debating information with peers helps each student know that they are seen by their teachers and fellow students as individual learners with unique perspectives. The ongoing assessment also supports the personalization, since the teacher can easily know how far each student has advanced. Teachers at both schools spoke about the ways in which the immediate feedback provided by the electronic formative assessments helped them adjust their lessons and vary their assignments to meet the needs of individual students. In the Nizhny school, teachers used the Classroom Management Software built into the laptops to monitor student focus and progress. They encouraged students whom they saw falling behind, and gave more challenging work to students who were speeding ahead.

2. Changing the relationship between students and teachers. The new learning strategies enabled by the technology were giving students new roles bringing in information and sharing knowledge. Students are more empowered to make choices about their own learning. Though the teachers continue to design and set the parameters for most of the learning activities, they no longer control every step. One 4th-grade teacher described the change in this way: “In the past, students did not have computers, their only source of information was the teacher. Now, the teacher is like a facilitator, a tutor that helps children to get information. Now, students can search for information themselves.”

Teachers also perceive that student relationships have changed as well. Now that the students are asked to work in teams and to collaborate in projects, students are more apt to support each other around academic, social, and technical problems.

3. Facilitating school-community connections. The e-record book, in particular, plays a key role in helping parents stay informed of their children's progress and enabling communication with teachers and among parents. In accordance with Russian ideas of education, community is very important and both schools were using technology to support that dimension. In particular, in Moscow the e-record book, email, and texting helped parents stay connected. Through the e-record book, parents in Moscow have more access to student progress and can be more involved in helping students reach their maximum achievement levels.

Conclusion

Our exploration focuses on the experience of two Russian schools that are using the laptops daily. The impacts of these tools can be seen in classroom practice, student engagement, peer collaboration, assessment, and communication with parents. This in turn has shifted the dynamic between teachers and students and has also helped foster a more personalized and humanistic learning environment.

Although both schools developed their own approaches to using the laptops, there are common elements supporting their success. First, the emerging ICT-rich practices are the result of careful instructional decisions being made at the school level. Both schools are taking advantage of external resources and training, but the actual classroom practices are supported by principals and carefully tailored and embedded into the classroom by the teachers. Successful integration is a deliberate process, guided by strong principals and administrators working closely with their teachers who, together, carefully move these new tools into their practice. The principal is able to set a vibrant and coherent school culture that welcomes innovation, while the teachers figure out how the devices compliment their goals and lessons.

Second, the laptop by itself would not be as effective a tool if it were not paired with the interactive whiteboards and the virtual learning environments. The core of both laptop programs is classroom sets of Intel Classmate PCs, interactive whiteboards or projectors, wireless Internet access, and a virtual learning environment. The success of each ICT tool is tightly linked to the others. This ecosystem of tools, coupled with specific teaching strategies, mediate the students' engagement with the content: use of the virtual learning environment for collaboration, organizing, sharing and assessing, and monitoring progress. The interactive whiteboard supports whole-class instructional approaches and student presentations, and the e-record book connects schools and parents.

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INTRODUCTION

One-to-one computing programs and laptop programs have been a popular approach to education reform over the last decade around the globe. Different countries have different reasons and motivations behind the introduction of one-to-one learning environments. In the Russian Federation and other Commonwealth of Independent States (CIS) countries, one focus of national education policy is to modernize the education system by integrating new technologies that have emerged within education in Western Europe and North America (Pogosian, 2012). A frequent problem identified in the research is that the laptops, once distributed to the children, may seldom be used in the classrooms. Research on laptop programs easily identifies 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 (Akbaba-Altun, 2006; Comenius, 2008; Kraemer, Dedrick, & Sharma, 2009; Light & Rockman, 2008; Vyasulu Reddi & Sinha, 2003; Winthrop & Smith, 2012). Understanding how technology was actually used by teachers in their classrooms was a critical factor for developing effective interventions in Western nations, yet little is known about how laptop computers are currently being used in the classrooms in Russia or other CIS societies. Our study sought to shed more light on the issue of integrating information and communication technologies (ICT) by taking a close look at how laptops were used in the classrooms of Russian schools that were using laptops on a daily basis.

In April of 2012 the Education Development Center's Center for Children and Technology traveled to Moscow and Nizhny Novgorod to conduct research on two schools that have one-to-one laptop initiatives. Although both schools have developed their own laptop programs, the core of their programs are classroom sets of Intel® Classmate PCs*, interactive whiteboards or projectors, wireless Internet access, and virtual learning environment.

SOCIO-CULTURAL THEORY OF LEARNING AND THE ROLE OF EDUCATIONAL TOOLS

Our exploration of the use of these ICT tools in Russian classrooms is grounded in a socio-cultural theory of learning (Vygotsky, 1978). A socio-cultural perspective envisions learning as a social process, wherein individuals develop and grow intellectually in interaction with other people and *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 utilize a wide range of artifacts (i.e., pens, books, copybooks), semiotic systems (i.e., language, images, diagrams), social interactions (i.e., group work, teacher-student questioning), and institutional structures (i.e., education policies, laptop programs). Furthermore, these tools and teaching strategies that 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,

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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.

RUSSIAN EDUCATION CONTEXT

After the end of the Soviet Union, the Russian education system entered a long process of reform and transformation. In the Russian case, reform means something slightly different than how that term is often interpreted in the West or in developing countries. In the West and in the developing countries, reform is typically understood to be about improving educational standards and outcomes and, in the case of developing countries, providing more and better resources to the system. In Russia, except for a period of extreme economic crisis in the 1990s, the education system has been generally high-performing (Gonzales et al., 2008; U.S. National Center for Educational Statistics, 1999) and sufficiently resourced (Alexander, 2001; Johnson, 1996). The central challenge was to meet the emerging needs of society as Russia experienced profound changes in its political and economic structures (Kuzmenko, Lunin, & Ryzhova, 2006; Russia. Ministry of Education and Science of the Russian Federation, 2001a).

The reforms undertaken by the new Russian Federation focus on transforming a rigidly centralized Soviet education system concentrated on meeting the needs of the Communist state into a system that is decentralized, more responsive to local and regional concerns, and built around the needs of learners and a market economy (Pogosian, 2012). Additionally, the reforms sought to “develop students’ capacity for independent decision making, critical thinking and democratic citizenship” (Johnson, 1996, p. 122).

The current framework of reforms was launched in 2010 under the name “Our New School”(Nikolaev & Chugunov, 2012). The initiative is built around six principal approaches to creating a more comprehensive education system, including adopting new educational standards, developing a comprehensive student support system, improving school infrastructure, maintaining school children’s health, expanding individual school’s independence, and cultivating talented teachers who are qualified to teach in these 21st-century schools. The Moscow municipal Department of Education website outlines the role of schools in the new Initiative.

School functions as a crucially vital element in [enabling Russia to become a competitive society in the world of the 21st century]. The major tasks of the modern school are to reveal every pupil’s abilities, to breed a respectable and patriotic person, a personality ready to live in a highly technological, competitive world. School education must be organized so that school leavers could independently set and obtain ambitious goals and efficiently adapt themselves to different life experiences.

Structure and control

The structure of the school system in Russia is unique. The most common form of schools are large all-age schools that go from 1st to 11th grade (Alexander, 2001), meaning that most students are at the same school their entire schooling. Elementary education in Russia goes from 1st to 4th grades, and students stay with the same teacher for all four grades. The classes in middle school (5th to 9th grade) and secondary school (10th and 11th grades) are departmentalized and students move between classrooms. Teachers in most content areas have specialized classrooms where they have access to the tools and resources needed to teach their content areas. Students attend school six days a week. Typically, the school day goes from 8:00 a.m. to 12:00 or 1:00 p.m., and students will attend anywhere from six to eight classes a day with a maximum of 36 lessons a week. Elementary students will study from five to seven subjects per semester, while middle and secondary students study up to 14 unique subjects. Many students return to school in the afternoon for sports, clubs, and additional academic support.

After the reforms, the federal government retained a central role in establishing the curricula and ensuring quality, but a number of key decisions have been moved to the school level. The federal level sets curricular standards and requirements for educational materials, financial planning, teacher training, and quality assurances and monitoring. The regional governments and municipal governments set regional or local policies and programs, manage in-service and some teacher training, and oversee the production of educational materials (Alexander, 1999).

The schools assign students to classes, select the educational materials (from within the approved resources), and make decisions about the teaching methods, assessment, and how the curriculum will be implemented (Alexander, 1999). With the support of vice-principals, a single principal oversees the entire school and, therefore, plays a key role in creating the actual learning environment of each school.

There are only two moments in a student's schooling when all Russian students take a standardized exam. At the end of 9th grade, all students take an exam developed by each region—the State Final Assessment. And Russia has implemented a nation-wide test at the end of 11th grade that serves as a unified university entrance exam—Unified State Examination (USE). However, some regions administer additional examinations. For example, the school in Moscow reported that the region assesses 2nd and 4th grades in math, Russian language, and environmental studies.

Curricula and instruction

A general understanding of the common Russian pedagogical model may be helpful. First, Russia has taken a different approach to overseeing the system's quality than that of most Western countries. Russian tradition is to attempt to guarantee the quality and consistency of the inputs—such as curricula and teacher training—rather than placing the emphasis on outputs, as in yearly standardized tests at all grades (Alexander, 2001). Therefore, the Russian Federation has only one standardized exam, which comes at the end of high school,

but the curriculum standards are very demanding (Elliott, Hufton, Illushin, & Wayne, 2001).

Research on Russian education and classrooms shows there are a few common aspects to many, if not most, Russian classrooms. In comparative studies with the West, Russian teachers tend to use more whole-class approaches, and learning activities tend to be very tightly designed and structured by the teacher to be interconnected. The learning activities are tightly focused on the standards and content coverage (Alexander, 1999, 2001; Elliott & Tudge, 2007; Hufton & Elliott, 2000; Hufton, Elliott, & Illushin, 2002). Lessons tend to move through a cycle of steps from introducing the lesson, recalling or consolidating prior knowledge, presentation of new material, hands-on practice, reinforcement, and assessment.

The principals at both schools we visited reported working with their teachers to support lesson planning as a way to transform learning in their schools. The director of the school in Moscow shared her thoughts on lesson planning to create more authentic learning for students: “We see the importance of the lesson as a form of teaching—in Russia, a ‘lesson’ builds confidence and skills but doesn’t help kids learn to apply it in the real world. The subjects are seen as too academic. We want teaching to push collaboration, interdisciplinary understanding. In the real world, knowledge is not compartmentalized.” The school administration approves all lessons before the school year starts. This is one of the central ways a principal can drive change in the teaching process and in the learning environment.

In addition to the ICT resources and skills courses, nearly all teachers at the schools we visited have access to their own, well-resourced classrooms with books, posters, art supplies, and other educational manipulatives. This sustained access to high-quality educational resources, coupled with the increased access to technology, has changed what teachers are able to do in their classrooms.

Given the careful attention to lesson flow, we were attentive to how teachers would integrate a new set of tools (the laptops) into this lesson flow.

Student behavior and engagement in school

Research on Russian schools generally finds that Russian classrooms are typically orderly and disciplined (Alexander, 2001; Elliott et al., 2001). Russian students report lower levels of disruptions than do students in other countries (J. Elliott, Hufton, Hildreth, & Illushin, 1999). These researchers noted almost no disciplinary issues among the children, even during long teacher-driven lectures. Students remained in their seats, faced forward, and participated eagerly when called upon. Russian students maintained a sense of self-control and discipline rarely observed in US schools. For example, when asked about the school policy at the Nizhny school that allowed students to *have* but *not use* cell phones in class, one student explained that it was not necessary to ban cell phones because, as 10th graders, she and her friends would not even think of texting during class.

Along with positive behavior in school, the research also finds that Russian students tend to be motivated to work hard in school, to be focused on improving their performance (Elliott et al., 1999), and to enjoy being at school. The comments of the students and parents at both of the schools we visited reflect the research. One of the mothers interviewed in Nizhny, for example, said, “My daughter says she loves school and with a great interest attends school. Even when she is really tired, she wants to go to school.” A 3rd grader at the Moscow school said, “I love the school. I feel very free in the school. I love the teachers. The whole environment is very nice. I communicate with everyone. I like school, I prefer being here than at home when I am sick.”

School and community connections

Historically, Russian schools have been closely connected to the families and community of their students (Alexander, 1999; Bronfenbrenner, 1972). Other research suggests that Russian parents work to support the teachers’ authority and guidance, and typically support their children’s education by reinforcing the schools’ demands on the students to study and do homework (Alexander, 2001; Elliott et al., 2001). It was clear from the school visits and interviews that these teachers and parents are working together to help students reach their maximum success. A parent in Moscow expressed how she felt the teachers there were her “allies in preparing my child.” But the parents at both these schools commented that the teachers are not only interested in the students’ academic progress, but want to know what and how they are doing in life. One parent pointed out:

There is a lot of attention to children and special activities of music, art, and the Intel Teach course. The school helps them to be new and better people. The parents can see how interested the teachers are in improving the lives of their children.

The teachers also value the parents’ support. An elementary teacher said, “Parents are very involved. They know we have the same goals. They help us with events like the theater outings, forest walks, and making educational movies.”

Technology in education

Technology is given two roles in the Russian reform efforts. First, during the Soviet Union, Russia had a long history as an engineering and technological superpower (Semenov, 2003), and the government seeks to maintain that. A clear goal is “affirming Russia’s status in the world community as a great power in [...] high technology” (Russia. Ministry of Education and Science of the Russian Federation, 2001b, p. 11). But the federal government also understands that technology is a vital new tool to support learning across the curricula (Russia Ministry of Education and Science, 2001b, p. 13) as well as an important domain for the economy. Developing technology skills and competencies is critical for a successful life (Nikolaev & Chugunov, 2012; Pogolian, 2012).

The National Education Doctrine of 2000 lays out the goal of ensuring students’ and teachers’ access to ICT (Russia Min. of Ed. and Sci., 2001b, p. 15). A recent World Bank study (Nikolaev & Chugunov, 2012; World Bank, 2008) found that Russian schools have had reasonable success building the school-level infrastructure, but research finds that

technology use is frequently limited to computer class and underutilized (Nikolaev & Chugunov, 2012).

Federal guidelines are an important factor in influencing the way teachers use computers. Health Regulations and Standards 2.2.2/2.4.1340-03 from the Russian Ministry of Health (Russia. Ministry of Health, 2003) recommends that schools limit the amount of time children are on computers as follows: students use computers for 15 minutes per day for students in grades 1–4; 20–25 minutes for grades 5–9; and 30 minutes for grades 10–11. Both the schools we visited adhered to these recommendations and, therefore, the teachers were very deliberate and careful about how they brought technology into their classrooms.

METHODOLOGY

This study used an instrumental case study approach (Stake, 1995) 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 country was identified, EDC then coordinated with the Intel leadership to select two exemplary schools where they knew the laptops were being used daily.

The case studies were developed over two days of visits at each of the two schools. At each school we interviewed school leaders, classroom teachers, parents, and students. We observed classes both in person as well as over Skype. Intel program leaders also were interviewed in order to gain a deeper understanding of the overall context of the laptop programs.

Table 1: School Visits

School	Subjects Interviewed				Classes Observed
	School leaders	Teachers	Students	Parents	
Moscow	3	8	6	6	8
Nizhny Novgorod	7	8	13	5	9
Total	10	16	19	11	17

Of the 16 teachers we interviewed, 15 were women. The teachers were mostly experienced educators: They had been teaching 15 years on average in the Moscow school; at the Nizhny Novgorod school, they had been teaching for an average of 19.2 years and, on average, had spent 16.4 of those years at that specific school. Most of the observations were done in elementary and middle school classrooms; only two were done in high school classrooms.

In addition to talking with school-based educators, we also interviewed individuals involved in the various affiliated educational programs that support or coordinate with Intel’s laptop program.

Table 2: Interviews with affiliated program staff

Location	Program Staff	Subjects Interviewed
Moscow	Director of Open Education Program in Moscow	1
	Director of Project Harmony in Russia	1
Nizhny Novgorod	Director of Education Galaxy	1
	Intel Teach Regional Coordinator	1
	Intel Steps to Success Regional Program Coordinator	1
	Director of Institute of Education Development in Nizhny Novgorod	1
Total		6

The Schools

The two schools we visited were selected because they represented different contexts. One school is in a densely urban neighborhood in central Moscow, and the other school is in an industrial town of 50,000 people in the Nizhny Novgorod region. Russian schools all follow federal curriculum standards and thus teach the same content, but the school sets the teaching processes. At both schools, we observed teachers deliver complex and rigorous lessons and have ongoing administrative support; computers were integrated seamlessly into the curriculum, and students were disciplined and engaged. The case studies below outline in more detail the technology infrastructure and support, the classroom practices, and the impact on students and parents observed at each school.

Case One: The Moscow School: A big-city school.

The school we visited in Moscow is ranked as one to the best public schools in Moscow. The school's director said they are known for their innovative learning environment and programs—one of which is the one-to-one laptop program for the elementary and middle school students. Like most schools in Russia, the Moscow school spans from 1st to 11th grade. The school, located in a neighborhood near Moscow University, has one building for the elementary and middle grades and another building for the high school grades. Classes start at 8:30 a.m. and go until 12:00 or 1:00 p.m., depending on the grade level. The school remains open in the afternoon and evening for after-school activities and clubs. The school offers many extracurricular activities, from music and art to robotics.

There are 800 students attending classes at the Moscow school, with another 400 students who take courses online. The distance students are either Russian students living overseas who want to get a Russian high school diploma, or high school students who have decided to stop attending daily classes while preparing for specialized college entrance exams. The Moscow school has 100 teachers in addition to the director and her staff of vice-directors and administrators.

The Moscow school has two large buildings that serve the bulk of their students. Although old, both of the buildings are well-maintained, bright, and airy, with ample space for classes, clubs, athletics, and cultural activities. And, like many Russian schools, the Moscow school also has a small museum on-site; theirs is a museum about a famous World War II army regiment from the neighborhood that had fought at the Battle of Stalingrad.

The halls and classrooms were spacious. The school buildings also had other physical spaces available to support the children's learning, such as two libraries, two auditoriums, cafeterias, and gymnasiums, as well as open spaces in the hallways where the children could play during their breaks between classes. The school does have a computer lab, but it also has one-to-one environments in the classrooms.

Technology infrastructure

Every elementary (1st to 4th grade) and every middle school (5th to 9th grade) classroom at the Moscow school had a set of netbooks for every student, if needed. The school reported having 925 computers, of which 825 were laptops (Classmate PCs). Every teacher also had a laptop computer and either an interactive whiteboard or a projector. Some classrooms had both. The school has wireless Internet throughout the building, and was using a virtual learning environment where teachers and students could store and share their work.

The school has built up its technology resources over time. They won an initial grant of Classmate PCs for the elementary grades from Intel in 2007. Later, the school wrote a proposal to the Freewill Foundation to get the student laptops for the middle school. Early on in the process of building the ICT infrastructure, the school used its own funds to purchase the teacher laptops, but now the Moscow Department of Education provides teacher laptops (or whatever device they need).

But the school's important technology resources were not just the hardware available in the classrooms. There was a virtual ecosystem of Web-based environments that were essential to the daily life of the school as we observed it. There were two online tools or platforms that were very important to the school.

First, the Moscow school has had an e-learning platform since 1997. For the last few years they have been using an e-learning environment created by the RUSAL, a Russian aluminum company. RUSAL used the software, Prometheus, as a project management system, but the company has a program to give schools the software and the Moscow school used that platform to create an e-learning environment. Their e-learning platform has four components for the students, which the school described as:

- *I Read*—students can find multimedia materials to support their lessons. There is an online version of most of the textbooks, but teachers also could upload other material.
- *I Do*—has interactive activities for students to practice skills. Teachers also used this capacity to elicit students' prior knowledge on a topic by asking them to do questions or solve a problem as a warm-up exercise.

- *I Test*—has teacher-made tests connected to the daily lessons for students to self-test on the skills learned and monitor their own progress. The director described the goal of these activities as mostly for the students' own information, although the teacher also gets the data.
- *I Respond*—are summative examinations done for a grade. The school does this level of assessments three times a year.

Teachers build a folder for each of their courses and design materials for each of the four components above. Except for the summative tests, all the online activities give immediate feedback to students as well as to teachers. The vice-principal, who is responsible for supporting the one-to-one learning environment, gave an example of how the platform functioned: "At the beginning of a lesson, the teacher is supposed to elicit students' prior knowledge. With the electronic textbook, students can click through to an assessment page that will test their prior knowledge;" the system gives students immediate feedback explaining why the answer is correct or incorrect and gives the student the correct answer. The results also go to the teacher. So, if these pre-lesson assessments are done as homework, the teacher can modify her lesson plans to focus on actual weaknesses and challenges of her students.

Teachers can provide support and guidance to students with internal messaging systems, but the Moscow school's use of the platform is more as a database giving students data and reports rather than a networked or social environment.

A second virtual platform, which plays a visibly important role among the parents, educators, and students at the Moscow school, is the electronic record book system created by the federal government. The school had been using its own electronic grade book system since 2005, but recently moved to the new system provided by the Ministry of Education. The Russian government launched an All-Russian school e-record book (<http://dnevnik.ru/>) in 2010. The e-record book platform is intended to enable parents to review their children's grades and homework daily, to stay in contact with teachers, and to receive teachers' messages whether via email or cell phone (Yeltsin Presidential Library News, 2011). Parents at the Moscow school also spoke about using the e-record book to communicate with other parents to coordinate school activities. Teachers and parents can access and interact with the e-record book from multiple devices. One teacher commented that she frequently uploads her daily grades from her tablet, and she can also use her smartphone.

The director reported that the e-record book served as a vital link between parents and teachers. In her view, the e-record book served to reinforce the use of the Prometheus system and the laptops in class. Since teachers are expected to post daily grades for their students to the e-record book, the use of the laptops in the classroom for presentations or the assessments on Prometheus give teachers activities that can be used to track students' progress.

Access at home. Since the laptops are the property of the school, the students cannot take the laptops home. We asked students, teachers, and parents about the lack of home access

and whether this might be a problem. All of the parents and students we interviewed reported having numerous devices of their own, such as computers, laptops, tablets, mp3 players, smartphones, etc. Nor did the teachers feel access was a problem for students; they felt that most had access, and the few who might not have a computer could access computers at the after-school program. The Moscow school is in an affluent neighborhood, but this observation mirrors research on the digital divide in Russia, which suggests that access is no longer a problem even for poorer students (Lebedeva, 2011).

Technology and classroom practice

The school has developed an interconnected pedagogical model and ICT infrastructure, where the technology is an important part of almost every class and where technology can be used anywhere it's needed. The director commented that one of her challenges in meeting her goal of having the laptops be a meaningful part of every class was helping the teachers understand when and how to use the laptops. Almost every class we observed used the laptops to perform key tasks that would be impossible without the technology, and most of these key tasks fell into clear categories when used in the classroom.

Focused use of the student laptop in classroom. Because of the 20-minute rule, teachers planned carefully when and how they used the laptops. All of the uses of laptops that we saw in the classroom could be divided into three categories: Internet research, student presentations (either creating one or giving one), and assessment. All of the observed activities occupied, at most, 20 minutes within the 45-minute classes. However, from interviews with parents, teachers, and students, it was clear that students were spending substantial amounts of time on a computer for their homework. One parent happily mentioned checking the e-record book for her son's grade on a presentation he had made the previous day that took him three hours to make on his computer.

Internet Research. The teachers at the school were excited by the potential of Internet research as a pedagogical tool. In interviews, the teachers spoke of how this gave students a voice and allowed them to bring information of their own into the class. Previously, the teachers and the textbooks were the only sources of information. One elementary teacher reflected: "Before, I was the only source of information; children knew what I wanted them to know. Now the children have many opportunities to find their own information; it makes them more active, provokes more thinking."

In the observations we saw ample evidence, through presentations and student work, that students were doing research but that most of that work took place after school. Because of the limits on the amount of time students may spend on the computer, teachers did not dedicate much class time to students doing Internet research. When teachers at the school did have students research in class, they appeared to have other reasons than just giving students time to work. In one 6th-grade science class, the teacher was starting a unit on the evolution of plants and had divided students into research groups on different topics. The groups had 15 minutes to organize themselves and do preliminary Internet research on the laptops to develop a work plan. After the 15 minutes, the groups gave oral updates to the

class about what their next steps would be. Without the technology, the teacher would have done this first step as a homework assignment and checked in with students the next day.

Student presentations. A second use of the laptops at the Moscow school that teachers spoke about and that we saw in the classrooms was student presentations. Through the virtual environment, students can easily move their presentations to the teacher's computer to project on the screen or interactive whiteboard. The student presentations we saw used images and text, but some students also had manipulatives or physical examples to pass around. In a 3rd-grade science class, a group presenting on geology passed around a piece of coal while they explained how it is formed over time.

The teachers feel that doing presentations provides a number of benefits. First, they provide an opportunity for teamwork and for children to learn how to work with others. A veteran teacher who has been at this school for only three years remarked that one thing that she found impressive about this school was how well the children work together. And a 5th grader who has just transferred to this school said one of the things she likes about this Moscow school is the teams at this school, because her old school did not do teamwork. Second, presentations allow the students to be creative, both in generating their own synthesis of information and in designing the presentations and adding images and sound.

Finally, presenting to their peers and being able to assess peers' presentations creates a sense of competition that motivates students. Teachers observed how the competition pushes their students, as presenters, to create better presentations, provide more or novel information, and improve their public-speaking skills. As audience members, students tried to push their peers by asking tough questions.

Ongoing (formative) assessment. Perhaps the most consistent classroom use of the laptops was to access the school's online assessment system. It is a school policy that there should be a student assessment built into every lesson, all of which are automated through the Prometheus platform. The director explained that the objective was to give students more control over their learning. Teachers and students described two types of daily assessments. Content-based assessments use multiple-choice items or short, open-ended answers, with immediate feedback so the student can assess their own progress. The other type of daily assessments were open-ended questions asking, "What have I learned today?", "What could I do to improve?" and so on, asking the students to self-reflect. The self-reflections also might include a few survey questions to generate graphs so the whole class could reflect on the group's progress.

In the classes we observed, the online assessments were embedded within a larger pedagogical practice of a class-wide conversation about the students' progress. For example, in one class, after the assessment was completed, the teachers asked students to indicate whether they had had a good day (thumbs up) or a bad day (thumbs down), to share their reasons, and a few students were asked to explain what they could do to improve.

Learning beyond the classroom. The Moscow school uses various strategies to extend learning beyond the classroom, ranging from after-school programs to special school-wide, interdisciplinary projects. The school director believed that children should be engaged in learning anywhere, and maintained that, “We teach anywhere—parks, museums, anywhere. Teachers should be able to teach anywhere.” The students talked about many after-school clubs they enjoyed, such as music, art, dance, and sports. And one club was built around technology—a robotics club that used Lego kits and participated in regional competitions. The club had a number of girls on the team as well as boys, and the club president was a girl.

The school also organized school-wide, extra-curricular projects which they called Quests. The director described the Quests as school-wide thematic activities that would engage students in multiple classes or subjects, would connect to the real world, and could create opportunities for parent involvement. During our visit, the school was engaged in a Quest about Leonardo da Vinci to coincide with a traveling exhibit that was in Moscow (<http://davinci-genius.ru/main/>). Students explored da Vinci’s work as an engineer and artist in class and through extracurricular activities, and parents were encouraged to take their children to the exhibit. A vice-director oversees the Quests, and the activities are planned by teachers and students using Google Docs* and Google Calendar.*

Use of interactive whiteboard and projectors. Most of the classrooms at the Moscow school have interactive whiteboards or projectors that teachers used to present information or to show videos, or students used to present their work. In most of the lessons we observed, teachers used the whiteboards to create a common reference point for the students by putting up instructions, notes, or math problems, or by displaying images or short video clips related to a topic. In one classroom, the teacher used a five-minute video showing the evolution of animal life from dinosaurs to today’s animal kingdom to remind students of their prior study of animal evolution and to start the conversation about the evolution of plants. The whiteboards and projectors are also used for student presentations.

Professional support and growth

The teachers and administrators at the school view themselves as a professional learning community that is always exploring and experimenting with new approaches and strategies. One teacher we interviewed started bringing her own laptop to school and exploring the uses of ICT in the classroom back in 1995. Back then there were few programs about ICT and education in Russia, and a group of educators at the school were mostly working on their own.

The director considers the “life-long learning of the teachers” to be central to the school’s quality. “My mission is continuous improvement and innovative teaching,” which she accomplishes by combining plenty of professional development opportunities with a culture of teacher peer-to-peer mentoring. She spoke of augmenting opportunities of the national PD system with opportunities she funds with her own resources. The school has participated in all of the Intel PD programs—*Teach, Getting Started*, and *Skills for Success*—

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as well as bringing in consultants to do specialized trainings. For example, they had a training focused on using Google Apps*.

When teachers return from trainings, the director asks them to teach their peers afterwards and to work with each other to implement new approaches in the classrooms. In a couple of our observations, there were younger teachers observing the lessons as well.

Students and the technology

The introduction of new ICT tools into the classrooms and of new learning activities at the school is having an impact on what students do in the classroom and on their experiences at schools in a number of interesting ways.

New sources for information. Parents, teachers, and students all spoke about independent research and accessing information on the Internet. As mentioned above, the teachers explained that one goal of Internet research was for students to “be more active” and to “provoke more thinking” by having students find information and decide what to include on their own. These sentiments were echoed by the students we spoke to at the Moscow school. One 3rd-grade student explained that the computer helps her get more information. At school she searches the Internet and then creates a presentation with the results. For another boy, the Internet helps him clarify any confusion or uncertainty he might have about a topic. If he doesn’t understand something, he uses the Internet to get more information.

Parents also commented on Internet research and the change in children’s access to information. One father connected this change to broader social changes, reflecting on his youth in the Soviet era where “media was controlled and provided no real information,” but today students can easily find information over the Internet, TV, and other media. He felt the school was both encouraging students to find their own information and giving them the skills to do it well.

New roles for students. Integrating presentations into the classroom has enabled students to become more active in the classroom and take on new roles. Through the presentations, students can be sources of information and expertise for their peers; they have a responsibility to find good information and present it in a way that is clear and understandable for others. The students at the Moscow school generally appeared comfortable and confident while presenting, using appropriate gestures and verbal cues (e.g., “as you will see next ...”) to orient the audience. In one observation, the audience used a rubric to assess the presentation skills of their peers.

A student who had just transferred to the school said teamwork was one of the exciting ways of learning at this school that was not at her old school. The students typically worked in teams to create presentations, and the students we interviewed enjoyed working in teams; one student thought that teams were good because there are other people to help out. A 5th grader explained how the different strengths and interests of team members

* Other names and brands may be claimed as the property of others.

would compliment each other to strengthen the team. He also felt that teamwork was building an important skill for the future, because “when you group up, you will work in teams.” Although the presentations promote student collaboration, we observed group work in almost every class when students would quickly divide into small groups to solve a problem set out by the teacher, or start to plan a project. In one 3rd-grade class, the students worked in specialized teams (as geologists, ecologists, and environmentalists) to answer the question “What resources do we need to live?” Each group had a laptop where they took notes, collected information, and built their presentation.

Formative assessment and self-reflection. One of the most interesting uses of the laptops in the Moscow school was to support students’ assessment and self-reflection at the end of almost every class. The leadership of the Moscow school consciously designed the assessment capacity (*I Test*) into their RUSAL learning environment, and teachers reported it was required in each lesson. In the interviews, the students spoke favorably about the assessments because they were able to know how they were doing. One 5th-grade student explained that he also did extra tests on his own to check his knowledge. And one of the high-school students explained another important difference of the assessments at this Moscow school: Unlike the rest of Russia, where there are just five letter grades (A, B, C, D, and E), their tests were in percentages and identified which items were wrong. He felt this was a much better way to know where his strengths and weaknesses lay in each subject.

This formative self-assessment is potentially a very powerful practice, since the research on formative assessment shows a strong relationship to student learning (Black & Wiliam, 1998a; Hattie, 2008); even student self-assessment can improve learning outcomes (McMillan & Hearn, 2008). Not only does it enable teachers to know where students are in their learning, it encourages the development of students’ meta-cognition as they assess where they are, realize what learning challenges they experience, and develop ways to improve.

Parents and technology

Like many Russian schools, this Moscow school has a very involved parent community (Alexander, 2001; Elliott et al., 2001), and the technology played a role in supporting parent-teacher communication. Many of the teachers spoke of using email and text messaging to communicate with parents, but the e-record book was becoming the central link. Teachers post daily grades to the e-record book, but they also can post messages to parents—either individually or to all the parents at once. The parents we interviewed checked the e-record book every few days, and especially if they wanted to see how a child had done on a big assignment or presentation. But the parents also can communicate with the teacher or with each other through the e-record book. One father who was very involved in the school, helping out on building projects like repairing the playground or painting, found the parent community feature of the e-record book to be a great advance in that he could easily coordinate with other parents to schedule activities. Instead of trying to track people down over the phone, he could coordinate simultaneously with a group of parents to assign tasks and pick dates.

Case Two: The Nizhny Novgorod School: An industrial-town school.

The school is located in a small industrial town about an hour outside of Nizhny Novgorod, Russia's third-largest city. There are 52 teachers for 900 children in grades 1–11. The school is known as a "School with Advanced Areas of Study," meaning that, in addition to being a regular school, they also offer more in-depth teaching in certain areas: math, Russian language and literature, biology, physics and informatics. The intensive courses start after middle school, and students select to pursue one specific area; students can change tracks if they want. The school day runs in two shifts, from 8:00 a.m. to 12:00 p.m. and then 1:00 p.m. to 4:00 p.m. The children are served breakfast in the morning, but return home to eat lunch with their families.

The school is located in one four-story building that has a large front yard with trees and grass for playing, as well as an ice rink and a soccer field in the back. The school also has a library, a gym, a computer lab, a large cafeteria that also serves as an auditorium, and a number of science labs. The school is clean, and the classrooms and hallways had many plants that added to the pleasant environment. One student described the school as being "constructed in a thoughtful way" and "easy to get around" compared to her previous school where she would get lost. The walls also are painted with bright colors. Many of the murals at the school were painted by graduates who had been trained in traditional Russian painting and who had then returned to beautify their school. In fact, many of the teachers and parents are alumni of the school and told us that they returned to the area because they wanted to continue to be a part of the strong school community.

The students at the school were all from the neighboring middle-class community. A teacher described the student body as "a mix of students from wealthy, poor, well-educated, not as well-educated, married and not-married families." Teachers and parents alike noted that most of the parents whose children attended this Nizhny school have university degrees. Local industry includes paper, radio, car, and glass factories, as well as a number of other small businesses. During the Soviet era, the area also was well known for its military research and production facilities. There are 19 schools in the area, and families have a choice of where they can send their children. This school is considered an exemplary school among community members and teachers alike. While the other schools in town have computer labs, this school is the only one with a one-to-one laptop program. At other schools, teachers use ICT in teaching and planning but they don't have the same access at home and neither do the students they are teaching.

The City Education Manager agreed that this school is one of the best schools in the district. One reason, she indicated, is that parents are more motivated and interested in school because they are more highly educated themselves and they want the same quality education for their children. To really get the level of change that is happening in this school, she asserted that students need ICT at home so that all the spheres are linked—regional policy, school practice, and home access. When asked why they chose the school, parents talked about it being the best school in the region. They believe the school offers a diverse array of activities and rigorous academic preparation. Parents also pointed out that the students at the school compete in and win academic contests (one student even won a

national environmental award), and that the graduation rate is high. Finally, parents said they chose the school because the graduates from this Nizhny school go on to the best universities in Russia.

Technology Infrastructure

The first computers appeared at the Nizhny school in 1986, when computer-study classes first began. The regular use of ICT at the school started in the late 1990s. According to the school administrators, when the technology was first introduced, the students were more motivated and they enjoyed studying more. It allowed teachers to connect more easily with students because they were operating with a shared language. As a result, students and teachers became closer. Now there is even more communication because of the Internet and email. Teachers now work with children not only in the classroom, but any time—outdoors, on weekends, after school hours. Anytime they want or need to connect, they can.

Currently, the school has 160 computers. There are three computer labs with about 15 desktop computers in each room. There are three laptop carts with 24 computers in each set. The school uses both Assus* and Classmate PCs. The laptop carts do not provide charging station for the laptops; they are charged in various classrooms around the school. There is also a teacher room with computers. In Russia, the schools build their own technology infrastructure; the government provides very little of the equipment. The school acquired at least some of their laptops through a grant from the regional government, and they bought the desktops and conventional laptops through school funds. The laptops are used in the primary grades, but they are move around among the classes. All primary school teachers have teacher laptops. The primary students use these computers while they are at school, but they are not allowed to take them home. There is wireless Internet provided throughout the school building.

Many of the classrooms at the school also had interactive whiteboards (IWBs). There are six classrooms in elementary school that have IWBs and projectors, and eight classrooms with additional ICT support in middle and secondary school. In fact, five of the eight classrooms we visited had IWBs (one class we observed was held outside so by default did not have IWB access). All of the teachers who had interactive whiteboards also had either chalkboards, bulletin boards, or dry-erase boards; it was clear that the IWB was just one tool in their larger set of resources.

In addition to the computer-related technologies, teachers have access to CD and cassette players. During three of the observed lessons, teachers used these machines to play music for the students. The music played in the background and served as a calming presence to focus students while they worked in class; it was not addressed directly in the lesson.

Teachers also use the government-provided electronic record book that allows the teacher to post assignments and grades online for parents to monitor. There is a message board function where students can talk about school projects and assignments. The school maintains the site itself. In order to use the e-record book, one must have email. The school

* Other names and brands may be claimed as the property of others.

also uses free online sites and services for email and document sharing. The Computer Teacher and Technology director is in charge of all the passwords, and can look up a student password if someone forgets.

Teachers also have access to an e-learning platform that is built into the Classmate PC laptops and helps them monitor what the students are doing in real time. Teachers can share one child's screen, or the screens of everyone in the group, to help attract the attention of the children or show them an exemplary project. This interactive tool allows teachers to control the learning process while increasing their own creativity. Teachers also can share their own screens with the kids.

After-school access. The focus on the use of technology at school has had a positive impact on students' access to technology at home. Because the laptops belong to the school, children are not allowed to take them home. According to one parent, this has prompted at least some families to purchase computers for their children to use after school hours. Students reported that if their home Internet was not working or their home computer was broken, they could always come to the school to use those resources either after school or on weekends. Older students who don't have access to the Classmate PCs say that they can use the computers in the lab or at their homes to create presentations and do research. According to data reported by the school, 93% of students have access to computers and 83% have access to the Internet in their homes, an increase from 87% and 60% in 2010. All students and parents interviewed reported having access to computers (laptops or desktops, though often times more than one), TVs, and cell phones at home. A smaller subset of students also said they have access to e-readers, video-game consoles, and MP3 music players.

Technology and classroom practice

As the quantity and quality of ICT access has increased over time, administrators, teachers, and parents all note a change in educational practices, both in school and at home. And as more teachers have become comfortable using the technology, they have become more adept at integrating it into their daily lessons. Teachers now use interactive whiteboards to demonstrate challenging theories and to visualize difficult concepts, while students use them to showcase presentations to peers and parents. Laptops are used for in-depth research, to create projects, and to access assessment software. Flash drives are used to carry information back and forth between school and the home.

With the one-to-one access to the laptops and desktop computers, students also are able to take technology-specific courses, in particular a computer-skills course called informatics. Students at all grade levels take this required course that plays a large role in exposing students to new software, current online applications, and other Web 2.0 learning tools. They also study computer languages and how to create code. One parent who was particularly excited about this course said: "New subjects have appeared—English from first grade, and the informatics class is new. New technology. Now the children are studying more subjects in first grade. There are a lot of skills that students get in first grade—Excel, PowerPoint, Word."

The principal summarized the change in classroom practices when she said, “ICT has changed the way we teach—we know what each child knows and can do. Now teachers can see the results of the success of each student and find the ways to try to help everyone in the school. ICT has helped shape the curriculum and helped each kid grow.” The ICT helps students do research, create presentations, generate charts, and design projects. As teachers integrate more technology into their teaching, students also are learning technical skills, creativity, collaboration, and independent thinking. The principal concluded that, “We have been able to maintain the same demanding system, we have just changed the tools so that has not been lost.” The section below outlines the ways in which the teachers at the Nizhny school use the various available technologies.

Laptops and computer labs. Teachers in the primary and middle school grades have access to three carts of Classmate PCs that rotate among grade levels and subject areas. The federally mandated 20-minute rule that prohibits students from using computers more than twenty minutes per class period has driven teachers to be creative and purposeful in the ways in which they incorporate technology into their lessons. In eight of the nine lessons the research team observed, students used the laptops. The uses varied by grade level and subject area, but generally fell into three main categories: creating products, research, and presentations. These are all described in more detail below.

Creating products. Students most often used the laptops to engage in the design and creation of age-appropriate but real-world products. Students used productivity software such as word processing software and spreadsheets, along with other Web 2.0 tools such as Advance Graph, Sticky Notes, and Wikis, to draw pictures, to design clothing, and to create surveys. Through these applications, students not only learned vital technical skills but also practiced more complex thinking skills such as designing, analyzing, collaborating, and presenting. In one after-school informatics class, the teacher used Intel’s *Skills for Success* program to have 1st graders design a survey about travel. The students had the freedom to design their own survey question and to decide how they would graph the results using Excel.*

Fourth-grade students in a technical trades class (this included sewing and woodworking) used Microsoft Paint* to design their own garment for a doll they had previously created. The teacher explained that she had the children use the graphic software to draw rather than a pen and piece of paper because she wanted to keep the drawings simple; if they had used their own hand instead of a mouse to draw, they would have created designs too complex to actually sew. She also chose the computer over paper to improve computer skills and creativity and to show they could do something like this on the computer. Using the technology limited what the children could do in a way that was useful for her goals for the lesson. Since students used a computer, they could also print the images and then cut them out. In this example, students were able to apply their knowledge of traditional clothing design and their technical computer drawing skills in an authentic context with a real application.

* Other names and brands may be claimed as the property of others.

Though this particular project was not observed, one of the informatics teachers described a project of which she was particularly proud. She described how a group of 5th graders used a Wiki to showcase their ideas about what their ideal keyboard would look like. Students came up with many creative ideas, including keyboards with sensors, new buttons for social networking, and also a keyboard that could be locked. The teacher described this as an ideal keyboard for a teenager. It was a practical example relevant to the life of young people that allowed them to be innovative and independent in designing a potentially useful product.

Finally, at the end of a geometry lesson about area, a 2nd-grade teacher had her students create pictures using only rectangles. This was done using the “drawing” function in Microsoft Word*. The students used many colors to make their images more interesting and lifelike. One student made a computer with a mouse, another made a house, and another drew a truck. The students saved their work on a folder on the desktop. While the real-world application was less apparent in this example, students were allowed the freedom to dream up and then draw their own image, using their creativity and improving upon their technical skills.

Research. Access to laptops and computers at school has allowed students quicker and deeper access to information. One student talked about the Internet as a library that gives them access to many more books than they have access to in their physical school library. A 10th- grader pointed out, “Internet research has helped us find more information than they could find in a conventional textbook.” Because students have the ability to get information themselves, the teacher is no longer the sole source of information. Now she helps the children to find information for themselves and then guides conversations in the class. One 4th-grade teacher talked about the changes in the student/teacher dynamic: “Because students have the ability to get information themselves, the teacher is no longer the sole source of information. Now I help the children to find information for themselves, to guide conversations in the class, because there is so much information.”

But because of the 20-minute rule, research is mostly done after school or at home. Often children will start the research at school and then continue at home. In one 4th-grade classroom, the teacher led a whole-class discussion about research the students had done the night before on the various meanings of the Russian word for the month of March. A parent said that she was impressed that her daughter was already doing Internet research in 1st grade. This is a skill that students continue to hone throughout their schooling. Teachers encourage the development of research skills and, because of the ubiquitous Internet access on the school grounds, students can look up information whenever they need to, either during class or after school.

Presentations. Gathering information, creating presentations, and facilitating presentations are common instructional practices and play an important role in the education of the students at the Nizhny school. Access to the Internet and to the Classmate PCs at school allows them to quickly find information to build a presentation during class or after school.

* Other names and brands may be claimed as the property of others.

Through the creation of presentations, students are learning multi-media communication skills, creativity, and collaboration skills. Children as young as 9 years old are gathering information from the Internet and creating presentations to share with their peers. A group of 10th-grade students talked about using computers to create presentations that help tell stories and visualize text. Through presentations, students use text, image, and sound to make artistic choices and build an effective and compelling product while improving their research analysis and oratory skills.

The research team observed a number of student presentations over the course of the two-day school visit. Students in a 7th-grade Russian literature class shared complex PowerPoints with sound and multiple moving images that they had created about various aspects of Russian culture. One group presented on the word “motherland,” another group discussed the impacts of industrialization on the Russian wilderness. The class also was punctuated by poetic interludes where students would recite a poem or play a clip of an actor reading a famous Russian poem. Students did not appear to be taking notes during this exercise, and it was not clear if this was an evaluative or merely informative assignment.

In one 5th-grade informatics class, the period started out with one girl giving a presentation to the rest of the class on how to use Photo Story software. She also had put together a bound paper booklet with screen shots and text, and walked students through how to use it. After explaining to her peers how she learned how to use Photo Story, she showed them a presentation, complete with piano music, that she had put together using the software. In this example, the student was not only honing her technical skills, but also fine-tuning her explanatory skills and using logic to help provide step-by-step instructions to help guide her peers.

Interactive whiteboards. In four of the nine observed lessons, teachers used the interactive whiteboards as part of a whole-class lesson. The boards were used to guide teacher lectures as well as to project students’ presentations. We did not observe students physically interacting with the touch screen aspect of the board; it was used exclusively for teacher-directed, whole-class instruction.

In a 4th-grade home economics class, a teacher created a PowerPoint presentation about the history of Russian clothing. She used the interactive whiteboard to project the slideshow that included dynamic images and sound. Even though it was a teacher-made presentation, pairs of students at various times stepped up front to read what was written on the board. The teacher asked various questions about the history of clothing, about what humans used to wear. She also explained different fabrics and materials and their purposes. Throughout the presentation, students were engaged and looking forward at the board. Two dolls repeatedly appeared in the PowerPoint and gave interesting facts about Russian garments. Many different children participated in the conversation and, as a whole, the group was engaged.

Russian educators pay particular attention to the health and safety of their students. In addition to the 20-minute restriction on computer use, teachers incorporate various

kinesthetic activities into their lessons to keep their students' minds and bodies engaged. In one 2nd-grade geometry class, the teacher used the IWB to do a short visual activity to exercise the children's eyes and to help them regain their focus. (The translator described it as a "gymnasium for the eyes.") Students watched a video and, while music played in the background, they moved their eyes following the objects on the screen. This exercise was inserted to give their eyes a rest because they had been staring at the computer for the 20-minute allotment. In both of these examples, the board functioned as a tool that aided in sharing teacher-developed content and teacher-designed activities. Though students do often have the opportunity to present their own research (as described in the previous section), the device remains under the teacher's purview.

Assessment software. Formative and self-assessment is a common instructional practice in Russian schools. As we observed, teachers often will use verbal assessments, asking children how they feel or what they learned today. Teachers also ask students to assess themselves and each other. Written assessments help student evaluate personal progress or group work. Sometimes the students will assess the work of their teacher and offer advice on how to improve the lesson. Teachers also use visual assessments, like thumbs up, high-fives, or using different colored hats to indicate a certain mark or grade.

The laptops have contributed to this deep-seated cultural practice by enhancing teachers' ability to monitor their classrooms. The Classmate Classroom Management System has allowed teachers to incorporate a different kind of monitoring and assessment into their regular practices. Through this management system, teachers can broadcast quizzes and observe students' screens. Teachers can use the software to check student progress on a particular task, or to showcase an exemplary assignment. This allows for more personalization of learning. According to one 4th-grade teacher, "The ICT helps and the formative assessments help pay more attention to each child. I now have different tasks for each child's ability."

Because students can see what their peers are doing, the management system encourages self-monitoring among students. Students can discuss the work immediately and can comment through the group chat function. They can compare their own progress on a task to that of their peers. They can learn from each other, share ideas and build off each other's work.

Some of the challenges around using this tool include that the data is not stored or saved anywhere. Also, one teacher commented that she is hesitant to use the tool because the network tends to be unstable.

Technical and pedagogical support

The main source of technical support for teachers at the school is an Intel-trained Master Teacher (MT). ICT policy is created at the regional level and there is a pedagogical person there who provides support and textbooks to get started with ICT integration. But the MT at the Nizhny school is the only Intel-trained teacher in the district. She works with teachers all around the district on ICT integration. There is a teacher club and they work together across subject areas on projects to find new solutions for challenges they have;

they also share information about the health and safety of children. They gather every couple of months to exchange plans and ideas, and also use email and an electronic journal to communicate with each other. One teacher said she and her colleagues were creating a lesson bank of activities that they all could access. But because of the lack of state programs supporting ICT, at least in this domain, most teachers have to make up things on their own.

The MT at the school is a computer teacher as well as the director of technology at the school. In order to remain informed of the newest technologies, she communicates with colleagues both in school and through educational networks. She also uses online resources for distance training and self-education. The technology director helps teachers learn how to use ICT using Intel's *Teach to the Future* course. For those who are struggling, she uses Intel's introductory course, *Getting Started*. She uses various practical seminars that are more broad and smaller workshop groups, according to teachers' needs. She also goes directly into classrooms to help teachers with specific issues. Especially when they started using the one-to-one program, she worked one-on-one with the teachers. At this point, 90% of teachers have had training and are able to use ICT in their classrooms. Nearly all 90% use computers in their lesson and extracurricular activities, but this wasn't always the case.

The administration also accommodates teachers' requests to buy technology and to participate in regional projects. According to the principal, there has been a shift of teachers' mindset and the way they see the world. The school has older teachers who are used to working without ICT (their main tools were chalk and chalkboard), and it was difficult for them to see the ICT advantages. "But eventually," the principal said, "we found that the teachers who adopted the ICT eventually did not want to go back to the old ways. It is now easier for them to teach with ICTs. It is easier than teaching with the blackboard. Now teachers ask for ICT. Now teachers without ICT are asking to have access."

Students and technology

Across grade levels, students said they enjoy coming to school. They praised the school for the high-quality teachers, the interesting and challenging course work, and the access to various technologies. Students commented that they use technology in almost all subject areas, including art. It is also one of very few schools in the district that offers any computer programming courses. In addition to all the ways that students interact with the technology (described in the *Technology and classroom practice* section, above), the technology also has impacted students' engagement, classroom behavior, and social interactions.

Motivation. Even though students were already quite engaged in school, they noted a number of benefits from having access to the technology. A 7th-grade student said, "I like studying with the ICT. We know we can use the knowledge we receive here in our future lives." The computers and Internet can help them do things like tell stories, visualize texts, conduct deeper analysis, and find more information than they could find in a conventional textbook. Students also can create software programs in their informatics class.

Many of the parents interviewed talked about their children having an increased interest and engagement in school since the introduction of the laptops. One grandmother said that she believes her 1st-grade grandson is now more motivated to go to school because he gets to use the computers. One parent lauded the teachers for trying to do things that are useful and interesting to the students. A 4th-grade teacher remarked that she tries to make her classrooms more open by encouraging students to ask questions of the teacher. She went on to say, "Now, using the technology, kids start to help. In previous times teachers told students to be quiet, but now we ask kids to debate and discuss." Other teachers agreed, saying that, because students have more autonomy and input into their learning, they are more motivated.

The principal echoed the sentiments of the students, parents, and teachers who felt that school had become more interesting since the laptops arrived. She described how technology was being used in her school: "[Technology is used] to help learning be visual, to make it interesting and engaging. We use laptops to teach science and do virtual experiments, to do Olympiads in science. Yes, they have science labs, they have modern equipment that is constantly updated. Yes, there is a library. The computer does not replace labs or libraries, it just adds to those spaces."

Student/teacher relations. Teachers and administrators note the change in the dynamic between students and teachers since the introduction of the technology. The informatics teacher agreed: "It was more rigid when I was a student. The environment of the classroom is more free, students are more free to ask questions to the teacher." The computers and the Internet increase student access to information, so the teacher is no longer the sole provider of answers. The principal is also monitoring that change: "The role of the teacher changes, the student is now at the center of the learning process, not the teacher."

Not only do students have more freedom in the classroom, the increased access to information has empowered them to take more control of their own learning. Students' investment in their own education drives how they use the technology and facilitates their ability to know when they need to work harder and get extra help. Students in Russia will often return to school after lunch for another two to three hours of elective classes, sports clubs, and extra help from their teachers. Through the e-record book, students can find their grades and other records. With this tool they can immediately see where they are excelling and where they are struggling. Students who are not satisfied with their grades will seek out their teacher to get additional instruction to improve their grade. It is common for students to come back to school, and therefore children are not stigmatized or ostracized for spending additional hours there; it is seen as a necessity and is a common practice.

This increased access to achievement data allows students and teachers alike to create more personalized lesson plans and activities. One of the informatics teachers summarized the changes: "The education process has changed. We are paying more attention to the individual children, and we do more projects. We try to find new activities and new ways of teaching." A middle-grades language arts teacher who also works as a subject area coordinator commented: "Today you saw in the lesson—some children were weaker in ICT

skills, so they got written tasks; stronger students work in teams. Students can choose the task, but I have to give chances for all student to be successful.”

Collaboration. In all of the classes the research team observed, students were collaborating in some capacity—to deliver a presentation, conduct research, or complete in-class assignments. Parents and teachers agreed that, since the introduction of the laptops into their classrooms, there is more group work between students. A group of 4th- grade students noted that: “It is more interesting and fun to work as a team. If I don’t know something my teammates can help me.”

One 4th-grade teacher explained the changes in the levels of collaborations since the introduction of the computers. “The computer has helped very much to promote collaborative work. Now the students make the small projects and lessons, as well as long-term projects. Children frequently use computers in their group work. They can share information, communicate with each other. Using computers brings the collaborative work into the classroom. In the past students sat in rows listening to the teacher, before they worked in pairs, but now they can work together anytime and anywhere.”

Another teacher gave an example of a collaborative project that used a Wiki to help create a whole-class biographical portrait. Students worked in teams and out of class to create a community hub and information portal about their 4th-grade class. The class was broken into teams of journalists, researchers, and writers. The journalist group traced current events happening in the class. The research team surveyed the class about things like pets, birthdays, and clubs. The writers made a class journal where they wrote about the history of the class. Students also engaged in self- and peer-assessment, and even created the rubrics for class presentations.

This increase in collaboration is facilitated and supported by students’ school and home access to technology, where they can use chat and email to set up meetings and communicate about an ongoing project. The group of 4th-grade students said, “It is easier to work together online to set up meetings.” Though responses varied among students, many noted that they prefer computer-based teamwork to face-to-face collaboration.

In addition, students are learning collaboration skills that are relevant to life beyond the classroom. Students and teachers alike recognize the challenge of working in a group with individuals you don’t like. But both groups noted the importance of learning how to work with others and of figuring out how to produce a high-quality product or project despite the differences.

Parents and technology

Parents at this school in Nizhny are very involved in their children’s education. There is a school-wide organization of parents and there is a committee of parents at each grade as well. There are about 30–40 parents in the school-level group, one from each class, with approximately 3–4 classes at each grade level. One parent noted, “In the 1st grade, parents are very worried about student marks, so they are communicating very often with teachers and the school.” Another parent shared that she goes to the school about every two weeks,

sometimes for individual consultations with teachers and other times to listen to student presentations. According to this mother, “The life of my children is everything.”

All parents interviewed talked about the value and importance of the e-record book as an important tool for engaging with teachers and with their children. Parents check the online portal on a weekly, and sometimes daily, basis to stay informed and involved in the life of their child’s school. Parents use it to look over grades, review behavior notes, check homework, set up meetings with teachers, and to chat with other parents to plan events. In addition to the time spent interacting through the e-record book, parents at the school also engage in the more typical modes of communication like phone calls and face-to-face meetings.

Russian parents have always been involved in their children’s schooling, but the technology has helped to enhance and improve the old practice. There is a seamless link between school and home, and communication is now quicker and more efficient. Because of the high level of technology access in homes, parents are able to stay abreast of their children’s progress and can asynchronously communicate with teachers, rather than waiting for the monthly or yearly face-to-face meeting.

Intel Education Resources in Russia and CIS States

Over the years, Intel has sought to be a trusted partner in the development of modern, high-quality education systems worldwide by offering a portfolio of educational programs to help teachers and students use ICT as a critical tool to support education (Light, Menon, & Shulman, 2007). The schools we observed were involved with a number of these Intel® programs that provide their teachers with professional development in using technology and innovative pedagogical strategies, and help students to explore ICT by doing community research projects.

A core component of Intel's efforts is the development, dissemination, and support of the Intel® Teach Essentials Course, a professional development program that offers teachers the knowledge and skills to integrate information and communication technologies as critical tools to encourage active student learning through inquiry-driven, project-based learning activities. The curriculum also discusses crucial factors for creating high-quality student-centered learning environments, including the classroom management issues associated with using technology with students, conducting research on the Internet, assessing work products, and managing intellectual property issues. Intel worked with Project Harmony to adapt the Essentials materials for the Russian context. Project Harmony aligned the project ideas and resources to the Russian Federal curriculum standards and topics.

The schools also used the Intel® Teach Getting Started course to help prepare their teachers. Envisioned as a precursor to the Essentials course, Getting Started provides an

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introduction to software productivity tools and student-centered approaches to learning. The course guides teachers in creating products that support their teaching work. The course also models a learner-centered learning environment, and allows teachers to directly experience, as learners, learner-centered instruction, inquiry learning, activities that support critical thinking, and project-based collaboration with peers.

Intel Education Galaxy is an online professional community and set of virtual resources that Intel has specifically created for Russia and the CIS countries. Education Galaxy sponsors contests, offers online training courses, and supports an active community of Russian-speaking teachers sharing resources and strategies on how to use ICT to support their students' learning.

In addition to a variety of teacher professional development programs, Intel also created a curriculum for students. Teachers can use the Intel® Learn Skills for Success curriculum to give the opportunity to design, create, and solve problems in collaboration with their peers. Skills for Success also provides students with a structure, tools, and adult guidance to gain new knowledge and to become proficient in basic skills. In the Moscow school, a group of elementary teachers were using the resources as part of their class to introduce the technology to their students by having them create projects. In the Nizhny school, Skills for Success is used as an after-school program with 1st-grade students to introduce them to technology; all students are encouraged to take the program.

Additionally, Intel® also licenses a low-cost netbook, the Intel Classmate PC, that is produced locally and that many countries have adopted for their school systems. Both schools in Russia utilized the Intel Classmate PC with their elementary, middle-, and high-school students.

DISCUSSION

The research on large-scale laptop programs around the world has frequently found that the laptops were not used in many classrooms (Kraemer et al., 2009; Winthrop & Smith, 2012) and the Russian experience has been similar (Nikolaev & Chugunov, 2012). This study seeks to inform this broader discussion around the challenges of helping teachers use the laptops with their students by exploring the daily use of laptops in the classrooms of two Russian schools, in the belief that understanding how schools were integrating laptops would help explain why the laptops are being used. In both schools we saw how the laptops and the ICT resources had become a daily part of learning in the classroom.

In our observations in the classrooms of the Moscow school and the Nizhny school, we saw a number of teaching strategies that used the laptops, supported by other technologies, to engage students and support their learning in innovative and potentially powerful ways. In these classrooms, the use of the laptops was intertwined with an ecosystem of interactive whiteboards, the e-record book, online assessment, and wireless connectivity.

Ubiquitous computer use and access to key Web-based educational tools facilitated changes in three important educational practices that in turn supported changes in the overall learning environment.

1. Increased independent student research. The teachers at both schools spoke about the importance of asking students to do their own research on the Internet. Teachers felt this was important for two reasons. First, because it gives students a new active role, making them responsible for their own learning. Second, teachers felt it was important for students to understand that there are many sources of information and many perspectives. The Internet allows students to find information and select the best on their own. Independent research encourages students to pursue their own interests and interpretations of topics, which they can then share with their teachers and peers. The presentations that we saw, which were based on student research and perspective, allowed students to share and debate issues.

2. Increased formative assessment and self-reflection. Traditionally, Russian teachers frequently assess students' understanding with quizzes and tests, but the laptops, combined with virtual learning environments (Prometheus or the built-in LMS), allowed both schools to integrate easy, computer-supported assessment and self-reflection into any lesson where the laptops are available. These online assessments provide students and teachers immediate feedback about strengths and weaknesses. The way teachers wove assessment and self-reflection into lessons reinforces the traditional Russian goals of student self-regulation and management of their own learning (Alexander, 2001; Hufton & Elliott, 2000). After the assessments, teachers asked students to reflect on the results and discuss what they could do to improve their scores the next time. Research has found that both on-going assessments (Black & Wiliam, 1998a, 1998b) and student self-reflection (Andrade & Valtcheva, 2009; Hattie, 2008) can improve student learning.

3. Increased student collaboration. The introduction of laptops and access to wireless Internet allows students to work together at school or from home. The technology facilitates group research projects and presentations, and allows students to communicate freely. Students enjoyed the increased peer interaction even when they recognized the challenge of working with individuals with varying skill levels. One 4th-grade teacher described the changes she has seen: "Using computers brings the collaborative work into the classroom. In the past, students sat in rows listening to the teacher, before they worked in pairs, but now they can work together anytime and anywhere." The Intel Learn Skills for Success curriculum has also provided students with more opportunities to work together to solve problems and design projects.

The above three elements support transformations in three important aspects of the learning environment.

1. Creating a more personalized learning environment. The research literature identifies an important variable for fostering children's engagement in learning — creating an environment in which they feel personally known (McLaughlin, Talbert, & Kahne, 1990; Sebring et al., 1996; Wehlage, 1989). The roles of the students as researchers, as another source of knowledge, and as active participants presenting and debating information with peers, helps students know that they are seen by their teachers and fellow students as individual learners with unique perspectives. The ongoing assessment also supports personalization, because the teacher can monitor students' individual progress. Teachers at both schools spoke about the ways in which the immediate feedback provided by the electronic formative assessments helped them adjust their lessons and vary their assignments to meet the needs of individual students. In Moscow, a teacher talked about the value of the formative assessments: “[The e-learning platform] helps get education results and I am able to monitor the progress of each student. Teachers can help figure out the most appropriate intervention for each student. During teacher planning, I can adjust my lessons to help those students.” In school in Nizhny, teachers used the Classroom Management Software built into the laptops to monitor student focus and progress. They encouraged students whom they saw falling behind, and gave more challenging work to students who were speeding ahead.

2. Changing the relationship between students and teachers. The new learning strategies enabled by the technology were giving students new roles in bringing in information and sharing knowledge. Access to the laptops and technology tools are being used for more student-directed research, more individualization of the design and presentation of projects, and more interaction and collaboration among peers. Students are more empowered to make choices about their own learning. The changing classroom practices are, ultimately, shifting the relationship between teachers and students. Though teachers continue to design and set the parameters for most of the learning activities, they no longer control every step. One 4th-grade teacher described the change in this way: “In the past, students did not have computers, their only source of information was the teacher. Now, the teacher is like a facilitator, a tutor that helps children to get information. Now students can search for information themselves.”

Teachers also perceive that student relationships have changed as well. Now that the students are asked to work in teams and to collaborate in projects, students are more apt to support each other around academic, social, and technical problems.

3. Facilitating school-community connections. The e-record book, in particular, plays a key role helping parents stay informed of their children's progress and enabling communication with teachers and among parents. In accordance with Russian ideas of education, community is very important and both schools were using technology to support that dimension. In particular, in Moscow (where the complications of traffic and urban sprawl make it harder for parents to visit the school as frequently as in the past) the e-record book, email, and texting helped parents stay connected. Through the e-record book, parents in Moscow have more access to student

progress and can be more involved in helping students reach maximum achievement level.

These two Russian schools boasted an environment where students are cared for, education is valued, teachers are respected, and students are empowered. In the current reform initiative, “Our New School,” the teacher is seen as a key component and lever of change in the schools of the future. As described in the reform, “the teacher’s task is to help children find their bearings in the future, become self-sufficient, creative and self-assured people” (Moscow. Department of Education, 2012). Taken as a whole, both of these schools are using technology to support broader changes in the learning environment that accord with the principles of the reform.

CONCLUSION

The initial impetus of this research was to approach only one question about one-to-one programs—Why do many teachers *not* utilize the laptop resources?—by looking closely at schools and classrooms where the tools are being used in context. Our exploration focuses on the experience of two Russian schools that are using the laptops daily. The impacts of these tools can be seen in classroom practice, student engagement, peer collaboration, assessment, and communication with parents. This, in turn, has shifted the dynamic between teachers and students and has also helped foster a more personalized and humanistic learning environment.

Although both schools developed their own approaches to how to use the laptops, there are common elements supporting their success. First, the emerging ICT-rich practices are the result of careful instructional decisions being made at the school level. Both schools are taking advantage of external resources and training, but the actual classroom practices are supported by principals and are carefully tailored and embedded into the classroom by the teachers. Successful integration is a deliberate process, guided by strong principals and administrators working closely with their teachers, who together carefully move these new tools into their practice. The principal is able to set a vibrant and coherent school culture that welcomes innovation, while the teachers figure out how the device compliments their goals and lessons.

Second, the laptop by itself would not be an effective tool if it were not paired with the interactive whiteboards and the virtual learning environments. The core of both laptop programs is classroom sets of Intel Classmate PCs, interactive whiteboards or projectors, wireless Internet access, and a virtual learning environment. The success of each ICT tool is tightly linked to the others. This ecosystem of tools, coupled with specific teaching strategies, mediate the students’ engagement with the content: (1) use of the virtual learning environment for collaboration, organizing, sharing and assessing, and monitoring progress ; (2) use of the interactive whiteboard to support whole-class instructional approaches and student presentations; and (3) use of the e-record book to connect schools and parents.

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