Frontier Elementary School
Case Report from the
U.S.A. Exemplary Technology-Supported Schooling Case Studies Project

Frontier Elementary: Technology as an Instructional and Management Tool in an Extended School Year

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The final project report and cases from participating countries can be found at http://www.sitesm2.org/	The final project report and cases from participating countries can be accessed at http://iol3.uibk.ac.at/ICTandSchooling/caseStudies/

Frontier Elementary: Technology as an Instructional and Management Tool in an Extended School Year

Case Overview

Frontier Elementary School is located in an economically diverse section of the fifth most populous county in its state. Frontier provides preK-5 education for 870 students from the immediate neighborhood, over one-third of whom qualify for free/reduced lunch. Faculty has approximately 60 classroom teachers and support staff, two administrators, one Network Manager, one Curriculum Technology Specialist, one media specialist, and one guidance counselor.

The school, built eight years ago, differs from other schools in the district in two ways: First, it has an extended year of 210 instead of 180 school days; second, it serves as the elementary school technology demonstration site for the district.

Technology is used as a tool for managing instruction in the school and enhancing teaching and learning in the classroom. Through the use of the Student Achievement Model (SAM) process and the Integrated Management System (IMS), teachers and administrators make instructional decisions informed by student assessment data.

There is extensive support provided to teachers for technology use and integration into the curriculum. That support includes a district program, the Curriculum Technology Integration Project (CTIP), which trains teachers to use information and communication technologies (ICT) in every classroom and especially in the computer lab. Within the school, support includes the pairing of technical support with instructional support through two faculty, the Network Manager and the Curriculum Technology Specialist, both of whom work in the classrooms with teachers, thereby increasing their confidence in using technology with students.

The school's ICT includes the computer lab, maintained by the school district for district-wide professional development sessions, and a TV studio with daily broadcasts coordinated by 4th and 5th grade students.

Implementation Context

History of the innovation

Frontier Elementary offers a preK-5 education for 870 students (15% of which were non-white minority students) from the immediate neighborhood. The school opened as a technology demonstration site for the district and an extended-year school funded by the state. Although it is a demonstration site, only students from within the neighborhood boundaries are enrolled, just like any other elementary school in the district. When the school opened in 1994, the district provided $9.2 million to build the school, of which $1.2 million was used for technology. The majority of the technology money was spent on hardware and software. The school district paid

for the wiring of the building as well as provided Frontier with a $100,000 training grant to teach ($62,000) and compensate teachers ($38,000) during the extended school year.

The district hired Frontier's principal a year ahead of the school's opening so that she could manage preparations. There were 240 applicants for 40 teaching positions and the principal interviewed all of them. She was looking for good teachers who were flexible and willing to learn rather than experts in technology integration. After hiring and for six months before the school opened, the faculty met Thursday evenings to develop a vision for the school by conceptualizing what they could achieve with technology and the extended school year. The teachers did not receive credit or monetary compensation for their evenings, but they believed that this experience was invaluable for team-building. Indeed, at the time of the school site visit, nearly eight school years later, over half of the teachers originally hired were still at Frontier. The faculty still met regularly on early release Thursdays— 2 hours of time made available by the extended school year and longer hours on the other days. Thursday afternoons were used for curriculum and school management meetings, as well as technology and other training.

During our site visit, staff and teachers described technology as a tool for learning and school management. Technology supported instruction and provided an opportunity to focus on student learning needs. All of the schools resources were devoted to achieving high student performance, usually in the form of high achievement on the state standardized assessments. Technology at Frontier has also been fused with a management philosophy that emphasized continuous improvement for everyone in the school. The school district had adopted a Baldridge-based school management system focusing on continual improvement. The Baldridge philosophy drives Pinellas County's Integrated Management System (IMS), which emphasizes certain core values and guiding principles in the school leadership's definition and implementation of its goals and mission (See also supplemental material in Appendix). These same values and principles also shape the Classroom Learning System (CLS), mirroring the schoolwide IMS management process. The CLS process allows students and teachers to jointly articulate their class mission, develop plans for classroom, come up with individual goal and action plans, and to use data to inform their decision-making about changes in instruction.

At the time of the site visit, Frontier was one of only a few Pinellas County schools using technology to collect and analyze student achievement data through the Student Achievement Model (SAM). Three times a year, teachers submit their student assessment data (from a locally administered assessment called the Pinellas Instructional Assessment Plan or PIAP) via their computers to a central database that generates charts and graphics of student achievement levels for individual students or an entire class. The database also makes comparisons to achievement data from earlier in the school year as well as comparisons to other similar classes in other schools in the county. Once teachers score the data and charts are generated by the school's Curriculum Technology Specialist, teachers engage in grade level discussions about the results. After some consensus is achieved on what the student strengths and weaknesses are, teachers and school leaders devise an action plan to address the weaknesses through changes in instruction. This process of using the SAM model culminates in a schoolwide conversation to decide how to address weaknesses exposed through the analysis of the PIAP scores.

School Culture, Professional Community

The school mission is to provide students with a quality education through an integrated curriculum, extended school year, and a focus on technology. Teachers strive to help students become independent learners who can reach their highest potential; teachers said they believed that technology and the extended year had a beneficial impact on these goals for their students. Teachers have the option of selecting and using ICT in their lessons and have the additional time (because of the extended year) to develop and test specific lessons that use particular software or Internet sites. Most faculty who joined the school at its inception did so because they believed in the extended school year and in the potential for technology to improve student learning. These teachers have also taken a leadership role in orienting new teachers to the school's vision, so the innovation is well integrated into the school.

At the time of the site visit, faculty and students still endorsed the extended-year schedule[1]. A few teachers acknowledged that teaching in the summer was tiring, but they did it because they believed students benefit. Students said that they would rather be in school during the summer seeing their friends and continuing to learn than at home watching television and feeling bored. Teachers generally used the extra teaching days in the summer to emphasize and expand on key concepts from earlier in the year. They also tended to slow down the pace by taking time for extended projects and field trips.

The staff described the school principal as approachable and open in her leadership. The school climate is calm and pleasant, despite being as filled with active students, teachers, and parents as other schools. Teachers said spending additional time together during the extended school year contributed to the sense of collegiality and shared goals. Teachers work collaboratively during faculty meetings, for example, planning math curriculum across same-grade classrooms, and some teachers also develop intensive teaching partnerships. The layout of the school may contribute to this; classrooms are arranged in groups of four with a common room between them for teacher use and storage.

The staff had a weekly scheduled time to learn together about technology, and other topics too. These 2 hour Thursday afternoon professional development experiences tended to usually be at the school because Frontier's Network Manager and Curriculum Technology Specialist could teach nearly all the topics the faculty wanted addressed. As a technology demonstration site, these two staff led many of the technology courses offered in Frontier's computer lab to other teachers in the district. Teachers also rely on informal interaction with each other, learning by word-of-mouth the specific technology or pedagogical skills they need to implement a lesson. The Curriculum Technology Specialist and Network Manager also provided training sessions during a summer training session.

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[1] As of the 2001-2002 school year, Frontier had participated in the extended school year for 8 years, 6 of those as the only school participating. At first, no evaluation systems were tied to it. But now that other Florida schools participate in the extended year, the state has contracted an outside evaluator to conduct a three year evaluation; it will involve interviews with administrators, teachers, parents, students, and classroom observations on the impact of the extended school year. The evaluation will also provide formative evaluation feedback to school leaders. The evaluation began during the 2000-2001 school year.

Technology and Technology Support Structure

At the time of the site visit, the ICT at Frontier included: a computer lab with 30 iMacs with Internet connections; a media center with a closed-circuit television studio; four or more student computers in each classroom with at one or two of them connected to the Internet; and a teacher computer in each classroom. The school has 50 AlphaSmarts, laptop devices used for writing, which constitute two classroom sets. The AlphaSmarts were used mostly in 3-5th grade and could be checked out from the computer lab. The school was also equipped with a full range of productivity software, authoring software, and instructional software and CD-ROMs. For example, in a first grade class, the software used for instruction included: Earobics (to enhance phonetic awareness), Wiggle Works (for creating stories), Math Keys (introducing measurement and probability), and Reader Rabbit. Teachers customized their lessons using software in ways that enhanced instruction.

The school had two full-time technical support staff: a Network Manager, and a Curriculum Technology Specialist. Despite the different backgrounds of these specialists, they worked as a team and filled in for each other as needed, improving teachers' access to on-demand assistance. Teachers were extremely appreciative of the assistance they received from these staff. When there were technical problems the school support staff could not resolve, the support staff called on district technical staff for assistance or called on other specialists or teachers to help them with specific ICT needs.

Sometimes the Curriculum Technology Specialist suggested software packages, or assisted teachers in trying out specific software. The selection of software to infuse into the curriculum was not mandated at the school or district level. Instead, at Frontier teachers were very aware of the technology focus and actively pursued the integration of technology into their curriculum. The Curriculum Technology Specialist described Frontier's teachers and their comfort level using technology:

> Their comfort level is kind of dependent upon how much time they've had to experience the training, and to be involved with it, and it also has to do with just them as a personality, you know, is that something that works for them? And for some people it doesn't, so they tend to use it probably a little less, and that's where Cassie and I try to encourage them to bring their kids into the lab and let us work with them, and let us do projects with them, and look at your curriculum, what you have coming up. How can we help and get the kids involved? And, again, that varies class by class, too, so I wouldn't say "every," but I would say more than not. (Curriculum Technology Specialist)

Students had daily access to ICT in their classrooms. Teachers could also book the school's computer lab for class use. One advantage offered by the lab was that all students could be on the Internet at the same time, whereas only one or two classroom computers are connected. Even though the school is Internet connected, county policy did not allow individual elementary student use of email or chat rooms (teachers may work with students to send email related to their schoolwork). About half of the students had access to ICT at home, as measured by how many parents submitted an email address to their children's teachers.

Although the school started off with adequate resources, according to the principal, over time the need to replace outdated equipment has greatly increased. Computers, servers, software, and hubs have become outdated. Some of the building's wiring has deteriorated, requiring its replacement. The principal and secretary have organized a fundraiser and collected $50,000 to replace some of their aging computers. Additionally, the school district has upgraded the capacity of the school's backbone. However, this funding has not been enough to stem the tide of obsolescence. Without additional funding from the state or the school district, the principal admitted that in the future they would having a hard time keeping up with the latest hardware and software.

Context Beyond the School

As in many other states during the 1990s, Florida established a set of statewide academic standards (Sunshine State Standards) that represent the knowledge and skills Florida students are expected to achieve. Discussion and controversy about the standards has died down in the last few years as the attention of teachers turn toward ways to help student meet the standards. Curriculum goals at Frontier flow from the Florida's Sunshine State Standards and the county school district's Grade Level Expectations. The Florida Comprehensive Assessment Test, or FCAT, measures assessment of how well students meet the standards. Florida State Commissioner of Education described the state standards on the state's Web site:

> The Sunshine State Standards are not minimal skills. On the contrary, they represent rigorous, high stakes academic expectations that will prepare Florida students to compete in one of the toughest marketplaces our nation and world have ever known . . .The Sunshine State Standards are heavy on academic basics, like reading, writing and mathematics. They reflect the need to set high expectations for our students and to challenge them to meet those expectations. And they reflect a commitment to excellence that is at the heart of every teacher and every parent I have met in the state of Florida.
> (Frank Brogan, Florida's Commissioner of Education: http://sunshinestatestandards.net/)

Plenty of opportunities exist to volunteer within county schools. At Frontier, researchers observed at least two parent volunteers in the main office, and as many as four parents volunteering in the television studio during a broadcast (Albeit a couple of those parents had students who were participating in the broadcast.) The school district website maintains a list of volunteer requests from all its schools, along with a volunteer handbook and a schedule for volunteer training to become a mentor or tutor. Parents also have opportunities to familiarize themselves with the technology that their children use in school by attending Technology Night. The final six weeks of the extended school year also provides an opportunity for Frontier to work with previous students, who are no longer in an extended year program, to serve as aides or tutors.

Frontier Elementary School receives support for the use of technology from both the state of Florida and the school district. State Websites provide extensive links to recommended instructional material on the Internet (http://www.firn.edu/instruct/), and the district's IT Website has several webquest instructional sites and is building a database of exemplary lesson plans (http://www.schools.seashore.k12.fl.us/educators/index.asp).

The school district commitment to the Baldrige education program is also highly visible. The Pinellas county school district's Quality Academy spearheads The Quality Management efforts in the school district through training, consultation and materials development. The Academy has received international attention and has become a dynamic force for organizational change within the county, state and the nation. In 1993, the school district was recognized as a benchmark site for its application of quality principles and was awarded the prestigious Governor's Sterling Award, and also participated in the 1995 Malcolm Baldrige National Quality Award (Education Pilot).

Improvement in teaching and learning

Curriculum and Assessment Aspects of the Improvement

As mentioned earlier, the curriculum goals for the district are closely aligned to the Florida Sunshine State Standards. Because of this close alignment, the FCAT scores are seen as significant indicators of progress toward meeting district goals as well. Having curriculum goals, the faculty at Frontier needed to hone in on appropriate and useful software that could integrate well with the goals. The district has assisted schools by providing workshops to teachers to help them assess the usefulness of specific software. Teachers needed to be familiar and comfortable using software in their instruction. The Curriculum Technology Specialist stated that teachers did not usually use the documentation provided by the software manufacturer and that the best way to familiarize teachers was to bring them into the lab and show them. She commented on the specific questions that teachers needed to ask to properly evaluate software.

> What we have found is most productive at our school is to take and bring the teachers in, look at the software with them, walk them through the paces of it, and then spend time talking about how it's actually going to be used. That hands-on time where they're actually looking at it and using it and thinking about, "Well, I could use this with this child for this purpose," or, "This would fit into my curriculum here," or, "This doesn't work with my curriculum; it doesn't work with the county's and the state's expectations; it doesn't meet that need, so we don't want that piece." But having that time set aside for them to be able to look at it, and I don't know that it's the software developer's responsibility to do that, because they don't know the standards and expectations from every state and from every county. They don't know what the needs are within the school, so they're really in a hard position to try and develop something that can be adaptable and made use of in the best way for students.

The responsibility of selecting software was ultimately the teacher's. The school district provided training to assess software and the school's Curriculum Technology Specialist provides hands-on opportunities for teachers to try out software. There is no district-wide or even schoolwide instructional software that teachers are required to use.

Assessment of students is usually incorporated into most lessons. In every class observation, students either assessed their own work or each other's work. Teachers provided ongoing feedback and assessment during each lesson. Teachers in the computer lab quickly reviewed student work (often on a computer screen) and assisted students having difficulty by rephrasing an assignment question or providing clues to identify an answer. Three times a school year, the

Student Achievement Model (SAM), using the locally administered PIAP assessment, provided teachers with additional assessment opportunities to address student weaknesses through instructional change. Assessment and data analysis plays an important role in the context of the school management of instruction through the Integrated Management System (IMS) and the Classroom Learning System (CLS).

Teacher Practices and Outcomes

At Frontier, teachers integrate technology into most of their instruction. It appeared that the more the teachers saw technology as a tool for learning, the more it influenced their pedagogy. Their approaches were chosen based on a number of factors, such as the perceived value of the instructional material, the time available, the needs of the students, and previous experience with different approaches.

Teachers at Frontier acknowledge that computers in the classroom and in the computer lab have changed the way they teach—but that in and of themselves, computers do not make for better teaching. A fifth grade teacher commented on the role of computers in teaching:

> The thing is that we did good teaching ten years ago. You can still do it today. You just use the technology as a tool instead of using paper-pencil. We used to have the kids write a storyboard that was going to be a skit or a play or something they were planning to do, and now we can put the storyboard on the computer. It's a lot easier to manipulate.

Teachers said that they could go back to teaching without technology, but they would not want to do so. Teachers used computers to keep electronic copies of plans and instructional materials and said that revising electronic versions saved them time compared to redoing paper copies. Teachers said that without technology they would have to take a big step backwards, restructure their programs, would not be able to go as in-depth with students, and that students would be less motivated. They also said that with or without technology, good teachers remained good teachers.

Lesson planning itself has changed because of pervasive technology. A first-grade teacher responded to the question of what would change if the technology in the school were to disappear. "It would be detrimental to my program as a whole. I'd have to restructure the way I do things. My lesson plans would be different. My central activities would be different. Even my planning would be different because all my plans are on my computer." The county school district recognized these changes in teacher practices and encouraged teachers to learn and share effective use of technology through its Curriculum Technology Integration Project (CTIP). This project, now in its fifth year, trained cadres of teachers in an intensive program that ran throughout the school year. Forty teachers met two evenings per month. The training sessions were conducted in the computer lab at Frontier Elementary. CTIP requirements for participants were intensive. The principal described these requirements and its impact:

> The project requires teachers in CTIP to teach other teachers, so they go back and share within their own staff, and they keep their hours, and I've gathered quite a bit of data, and it's interesting as the years go by, how much more time these teachers are spending helping others when the word gets out that they have a little training and all of a sudden they are experts. (Principal)

The Curriculum Technology Integration Project developed a curriculum web site where teachers contribute curriculum resources for their peers to use as a resource. The website linked the state standards to the curriculum and provided rubrics and document samples. When a lesson plan called for using specific software such as PowerPoint or HyperStudio, there were samples on the Web site available to use as models. CTIP also reviewed major software applications and their effective uses. The applications—PowerPoint, HyperStudio, DreamWeaver, FileMaker Pro, and Excel—were adequately covered in terms of basic operations, but the emphasis was on, "How are you using it in your classroom? How can you see kids using it?"

CTIP also overlapped well with the school and classroom management systems (i.e. IMS and CLS). These systems were major avenues for implementing the Baldridge objectives. According to a district administrator:

> It's the Baldridge criterion of how we're applying what know about Baldridge at a classroom level. We're giving [teachers] resources at the beginning, instruction in some of that, but they have to go back and teach it to somebody else. There's the power, because we never truly learn something until we have to teach it. The number of hours those teachers have gone back and contributed to their schools has been phenomenal, and I think that's been some of the real success of the program. (District administrator)

Frontier's extended school year has also affected teaching practices. Teachers stated that the lack of a long break is the one potential disadvantage of an extended year. However, the extended year offered teachers the advantage of not having to spend the first few weeks or more of the school year reviewing subject matter and school procedures with students.

Student Practices and Outcomes

Much of the early emphasis of using technology at Frontier was tied to developing skills in writing and in using the Internet as a research tool. The school had a collection of AlphaSmart writing terminals that $3^{rd} – 5^{th}$ grade students used during the writing process. Most of the Internet access occurred when they went to the computer lab. A third grader in the class described how she made use of Internet access:

> I'm working on a project that my class is doing about the tropical rainforest and we are right now going online and trying to find information about different questions that our teacher has given us on a little sheet.

Students at Frontier had learning expectations and practices that have been directly influenced by their use of technology at the school. Their use of the Internet for basic research as opposed to perusing through encyclopedias was unquestioned. They expected to use computers to compose their work and to complete assignments.

In a third grade class we observed, during their science lesson, students reviewed CD ROMs about the rainforest and looked up specific animals. Their assignment was to learn about an animal that they would select for a class project and presentation. As students explored the CD programs, they demonstrated familiarity with the formats of each. Both programs had multimedia introductions and displayed a main content page. One program displayed a list of

nearly a hundred animal names on a left-hand frame. Students easily identified the names as hyperlinks because of the appearance of highlighted text whenever a mouse cursor was placed over it. Once they selected an animal, they were presented with a photo of the animal and several other hyperlinks leading to information about the animal's diet, size, etc.

At another computer station, students discovered that some of the animal screens had multimedia files that showed a brief movie of the animal in motion. Because students were in teams of 3 or 4, sharing access to the computer was important so that all students could have a chance to explore and select rainforest animals. Students quickly learned from each other, and news of the multimedia files reached the first group of students. Again, no direct instruction on how to use these software applications took place. The teacher, who had reviewed these programs beforehand, was confident that each CD ROM was appropriate for this group of third-graders.

By the fifth grade, students had clearly mastered the use of tool applications for use in their projects. Students generally tended to experience software in the classroom that was not available to them through other means. With the proliferation of software available for home use, students and parents were often seeking to purchase software that was used in school instruction. Student practices within Frontier have raised student expectations for using technology in their learning. Parents and teachers voiced concern that the middle school that many of Frontier's students were going to attend did not have the level of technology that student's were used to having. Frontier's principal elaborated on the students' dissatisfaction with less technology access.

> We've got kids that have it available to them every minute of every day, then they get to middle school and they find out you can go to the computer lab for a half hour once every two weeks. Kids are going, "No, this just isn't going to work." They're used to publishing their stories and being able to edit and revise, then they get to middle school and its back to handwriting the stories.

The school principal also pointed out that special education students appeared to have good results using technology. She mentioned the positive reports from special education teachers who used phonics software and the positive claims of improved typing skills. The ability to edit and rearrange written work, in addition to the ease of having to touch keys to write, made composing a story far easier and less frustrating.

Behavior problems may be lessened at Frontier, but whether that was the results of their focus on technology or the extended school year was difficult to ascertain. The Curriculum Technology Specialist believed that the computers could focus a student's attention far more effectively than print materials, but did not solely attribute the lack of behavior problems to either. She added that the comfort level of a teacher could be very important to successfully implementing a lesson, and students were very perceptive about whether a teacher was self-assured about how well a lesson would turn out. Perhaps more attributable to the extensive technology use at Frontier is the self-assurance of the students in learning and using computer software. The Curriculum Technology Specialist plainly stated that students are not afraid to try things and explore a program. The observation of students using CD ROMs in the third grade classroom supports this conclusion.

Given that the curriculum is so closely aligned with the Sunshine State Standards, the FCAT provides a good measure of progress at Frontier. Frontier performed better than average on most FCAT results as compared with the district overall (See Table 1). The table below provides a sample of the data available online to parents, educators, and researchers. Frontier consistently scored higher on the FCAT than the district performed in reading, writing, and mathematics. Although these results could not be attributed to the technology program alone, these data give some indication that student performance has steadily improved by these measures. The principal believed that her teachers' attempt to imbed technology within the state and district standards has helped them to improve a range of student skills that the FCAT addresses, including high-level skills like critical thinking and mathematical problem-solving. Additionally, the process of analyzing the county's PIAP assessment using the SAM model had helped the teaching faculty diagnose problems and make instructional changes that addressed student learning needs. The one exception in Frontier's FCAT performance, however, was a decrease in the reading and math FCAT scores in 2001. Frontier's principal attributed the decrease in the school reading scores to student differences. There had been an increase in the numbers of students who received free and reduced lunch assistance and a large decrease in the numbers of their students who were classified gifted and talented.

Table 1. Percentage of Frontier Elementary and District students over Level 2 on FCAT Performance from 1999-2001.

Year Ending:				
		1999	2000	2001
Grade 4 Reading (% Over Level 2)				
	School	62	77	66
	District	54	62	54
Grade 4 Writing (% Over Level 2)				
	School	96	97	100
	District	85	93	94
Grade 5 Math (% Over Level 2)				
	School	38	59	53
	District	42	44	49

Source: Florida State FCAT data (http://info.doe.state.fl.us)

Lessons for the future

Noteworthy Outcomes

Frontier has been shaped by the extensive integration of technology into the curriculum. However, determining the effectiveness of the technology program at the school as opposed to other factors presented challenges. A number of school variables operating simultaneously and all contribute to the overall achievement of students. The school principal was clearly frustrated by this challenge and pointed out other factors that made the school unique, such as the extended school year and the self-selection of the faculty and staff:

How can you tell what makes a difference? I don't know how you separate the extended year from the technology from the fact that we were able to choose our staff, that we didn't have to take transfers, you know, people who didn't necessarily want to come here, and that we're able to choose from the best of the best to come here. We have an excellent staff for the most part. We never see discipline problems… the kids are excellent. And these are not high socio-economic kids. These are middle and low socio-economics. But we have teachers who have just created this sense of community and a sense of responsibility and ownership, and our kids behave beautifully, and they're nice kids. What I told you before—they'll talk to anybody, they'll share anything, they'll say hello, they're huggers, they're just really nice kids. How you separate all those things to determine what has made the difference, I don't know. Is it the instruction? Is the availability of the technology that they're using? Is it the extended year? I don't know. I want the answer.

In examining data from other schools in the district, or in comparisons with district wide data, Frontier's results need to be considered in light of its use of technology for management and instructional purposes. The regular use of data to inform decisions has enabled the school to make adjustments in their instruction to prepare their students for the FCAT. The use of FCAT software by students and the targeting of specific students for after school tutoring was the result of data-driven decision-making. This use of technology for management and instruction should also seen against the backdrop of a year-around school calendar. Teachers have stated that students appear to retain a previous grade's lessons far better than among students that they have taught in schools with schedules following conventional academic calendars. So the combination of the technology, the management systems, and the extended year appears to count for something.

Although the influence of technology alone is hard to measure, students, teachers, and parents were all able to indicate positive changes because of its presence. Students were motivated and attentive to computer applications, teachers felt comfortable using technology to enhance instruction, and parents believed that it was necessary to expose their children to technology that would dominate the future working world.

Added Value from Technology

The value added by technology at Frontier was that it supported student and teacher practices and was associated with positive student outcomes. In addition to increased academic performance, another outcome stemming from the use of computer was increased student motivation. A second grade teacher elaborated upon how her teaching and students' learning would be different without the technology available at Frontier.

I think it would mean more paper. Even though it can create a lot, it would mean more paperwork without it. I don't think that my students would be as motivated. Technology is an incredible motivator, you know, just having them do some projects on there. They get excited instantly.

Beyond managing paperwork and influencing student motivation, ICT at Frontier has shaped an environment where teachers were comfortable and competent in using the many technology tools

at their disposal. Technology sparked motivation in students who expected to use it as a learning tool. Another outcome from using technology was the creativity that becomes possible by having programs adapted to specific lessons or topics. One third-grade teacher recounted the adaptation of a PowerPoint presentation based upon the television game "Who wants to be a Millionaire." Students created questions about their particular unit, along with other incorrect responses and tailored the "Millionaire" game to their lesson. This was not a completely planned out activity, but the teacher who helped students "retrofit" this PowerPoint presentation claims that students are always excited to be assessed on their learning because it's in the form of a popular game.

Key Implementation Factors

Like many technology intensive environments, upkeep and maintenance of the technology throughout Frontier were paramount to its smooth operation. Learning to how to use the available technology in an instructional context was also important, and the continuous professional development offered by the district and the school has helped to sustain the broad use of technology in most classrooms. Another contributing factor to Frontier's sustaining its innovation was that it opened with the technology and extended school year in place and with the resources to address their implementation. Administrators and teachers knew that Frontier would be a technology-rich, extended-year school. They were in support of this, and also had opportunity to obtain the professional development they needed for the innovation, in the form of technical training, and time together as a staff to articulate their vision for the school. Another key factor in sustaining the innovation was the regular use of data derived from local assessments to diagnose their student weaknesses. This SAM model has given every teacher a stake in the discussion about school improvement and provided an opportunity for teachers to make changes and address students needs. Although the district has been supportive of the innovation at Frontier, they have not able to provide all of the resources the school needs, especially after their initial allocation of funds for ICT. The lack of continued funding from the school district may affect Frontier's ability to replace aging equipment and maintain a state-of-the-art technology infrastructure.

Challenges

The greatest problem faced by Frontier was updating the equipment that was purchased on a one-time budget for the school's opening. Because Frontier is a district technology demonstration site, the administration and faculty at Frontier said the district should provide extra resources to refresh their technology. The extra effort of teachers required by the extended school year contributed to a few teachers leaving the school, but at the time of the site visit, this had been minimal. Staff turnover was not higher at Frontier than elsewhere in the district, and most of the teachers who had left Frontier Elementary School did so for other reasons.

Funding the cost of the extended school year may become a concern for Frontier after the State sees the findings of its external evaluation of extended year schools. In the past, the State considered withdrawing funding for its extended-year schools from Frontier for the 2000-01 school year in order to meet budget shortfalls. The State ultimately provided the funding, but faculty and leaders at Frontier expect that funding could be pulled in the future.

Transferability within the school was not an issue because all of the Frontier staff members were included in the innovation. Transferring Frontier's level of technology to other schools may be difficult, however, due to the cost, not only of the hardware and software, but also of professional development. The school district has been assessing each school and then trying to upgrade those schools farthest behind in technology first. It may be difficult for the district to replenish Frontier's hardware and work on equity across all schools.

Appendix – Supplemental Material

Baldrige Education Criteria for Performance Excellence

The Baldrige Criteria for Performance Excellence provide a systems perspective for understanding performance management. They reflect validated, leading-edge management practices against which an organization can measure itself. With their acceptance nationally and internationally as the model for performance excellence, the Criteria represent a common language for communication among organizations for sharing best practices. The Criteria are also the basis for the Malcolm Baldrige National Quality Award process.

Education Criteria for Performance Excellence Framework

The Core Values and Concepts are embodied in seven categories:

- Leadership
- Strategic Planning
- Student, Stakeholder, and Market Focus
- Information and Analysis
- Faculty and Staff Focus
- Process Management
- Organizational Performance Results

Quest for Excellence Conference

Each year, Quest for Excellence, the official conference of the Malcolm Baldrige National Quality Award, provides a forum for Baldrige Award recipients to share their exceptional performance practices with worldwide leaders in business, education, health care, and not-for profit organizations. For a general overview of the Baldrige National Quality Program, visit its Web site: http://www.quality.nist.gov.