Case Studies of High-Performing, High-Technology Schools:
Final Case Report on School L

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Case Report on School L

Education Trust High-Poverty: Yes
Education Trust High-Minority: Yes
Location: Urban
Grades Served: PK–8

Methods and Data Sources

The North Central Regional Educational Laboratory (NCREL) study of high-performing, high-technology schools was based on a mixed methodology case study research design (Creswell, 2003; Yin, 2003; Greene, Caracelli, & Graham, 1989; Tashakkori & Teddlie, 1998). The research team elected to use quantitative methods to build on findings from previous studies of what educational technology schools use (Anderson & Romnkvist, 1999), how schools use educational technology (Becker, Ravitz, & Wong, 1999), and conditions under which educational technology have helped raise student achievement (Mann, Shakeshaft, Becker, & Kottkamp, 1999; Chang, Henriquez, Honey, Light, Moeller, & Ross, 1998; Wenglinsky, 1998). On the other hand, qualitative methods enabled exploration of characteristic uses of educational technology in high-performing schools that may contribute to the academic achievement of low-income, African-American, and Latino students.

Previous studies in both the qualitative and quantitative literature have generally proceeded from a specific use of educational technology to a consideration of its effects on some measure of student achievement, ranging from instruments designed by teachers or researchers to standardized tests. The NCREL study proceeds from success on state achievement tests at the school level to an exploration of educational technology in successful schools. The initial research questions for the case studies were:

• What effects on student achievement do administrators and teachers in high-performing, high-technology schools attribute to educational technology?
• What types of educational technology do administrators, teachers, and students use in high-performing, high-technology schools?
• What educational technology practices do administrators and teachers in high-performing, high-technology schools employ?
• What educational technology policies do administrators and teachers in high-performing, high-technology schools implement?
• How does the technology capacity of high-performing, high-technology schools affect administrator, teacher, and student use of educational technology?
• What resources, strategies, and structures do schools use to become high-performing and high-technology; to what extent are these integrated with other school improvement efforts?

The NCREL research team defined “high-performing” to mean that students’ reading and mathematics performance on statewide achievement tests was in the top third among all schools.
in the state at the same grade level during the 1999–2000 school year. This definition was chosen to be consistent with No Child Left Behind requirements for adequate yearly progress in both subjects. The NCREL definition represents a subset of schools identified by The Education Trust in which students’ reading or mathematics performance was in the top third among all schools in the state at any grade level in 2000 (Jerald, 2001). The research team used Education Trust definitions of “high-poverty” and “high-minority” without modification to identify high-performing schools with predominantly low-income, African-American, or Latino student populations. The research team identified all schools that met the NCREL criteria for high-performing and The Education Trust criteria for high-poverty or high-minority in 10 states were selected on the basis of geographic distribution and size of low-income, African-American, or Latino student populations.

The research team then surveyed principals of qualifying schools to identify those that used educational technology most intensively, regardless of how they used technology (Sweet, Rasher, Abromitis, & Johnson, 2004). Based on the results of the principal survey, the research team defined “high-technology” to mean schools that reported 50 percent or more of all teachers use technology for professional purposes and assign their students to use technology every school day, and 75 percent or more of all teachers use technology for professional purposes and assign their students to use technology at least once per week. Due to the large number of qualifying schools in one of the 10 states, the criteria was set at 90 percent or more of all teachers using and assigning technology every school day in that state. The research team then conducted telephone interviews with the technology coordinators of all schools that met these criteria and eliminated schools in which the technology coordinator did not corroborate the levels of technology use and assignment reported by the principal.

The research team identified 41 schools that met all criteria for high-performing, high-technology schools with predominantly low-income, African-American, or Latino student populations. In order to encourage administrators and principals to be as forthcoming as possible, the research team pledged that the schools would remain anonymous in all research reports. Twenty of the eligible schools accepted an invitation to participate in case studies. After site visits were conducted, the research team decided to combine one middle school and high school for analysis because they were both located in the same building in a small rural district and respondents in these schools indicated extensive interdependence. In addition, some elementary teachers, also located in the same building, were interviewed and observed during the first site visit because respondents indicated extensive interdependence with the middle school. As a result, the NCREL study included 19 cases of high-performing, high-technology schools with predominantly low-income, African-American, or Latino student populations.

A member of the research team visited each school during the winter of 2002. Open-ended interview protocols provided qualitative data, while classroom observation protocols and survey instruments contained a mix of open- and close-ended items that provided both qualitative and quantitative data. Principals were asked to schedule at least six teachers for 30-minute interviews and 20- to 25-minute classroom observations. Technology plans and school improvement plans were collected during the winter site visit whenever they were available and other documents were collected when offered. Surveys were distributed to all administrators and teachers in each school after site visits were completed. Principals were briefed by telephone on data collection
procedures and asked how many printed administrator and teacher surveys should be mailed to the school. Response rates were calculated based on the number of surveys principals requested, and at least two subsequent telephone calls were made to each teacher to improve response rates.

A case report was drafted based on the triangulation of interview, observation, survey, and documentary (Yin, 2003; Greene et al., 1989). The draft case report addressed each of the original research questions and identified primary and secondary characteristics of each school based on each question. In general, attributes that were reported by a majority (at least one half) of respondents in the school were classified as primary and attributes reported by a substantial minority (at least one fourth) were classified as secondary. Attributes reported in multiple data sources were assumed to be more reliable than those reported in one data source. The draft case report was returned to the principal of each school for review and revised based on comments received from the school.

A member of the research team made a follow-up visit to each school during the spring of 2003. The primary purpose of the second site visit was to observe classroom uses of technology in more depth than was possible during the initial site visit. The research team asked principals to schedule three teachers for a 40- to 45-minute lesson observation, with 30-minute interviews before and after the lesson. The interview before the observation provided a context for the lesson and identified curriculum objectives, instructional and assessment strategies, and planned uses of educational technology. In the interview after the observation, teachers interpreted the lesson and the extent to which curriculum objectives were met, instructional and assessment strategies were effective, and uses of educational technology contributed to lesson outcomes. All lessons that included teacher or student use of educational technology were written up as classroom vignettes and appended to the case report. Finally, the research team prepared a summary for each school based on the revised case report, classroom vignettes, and all data that had been collected from the school.

This report includes the summary, revised case report, and classroom vignettes for one of the 19 high-performing, high-technology schools with predominantly low-income, African-American, or Latino student populations. This school will be designated as School L in this report, which is based on the following data collected from the school:

- Seven teachers and one administrator were interviewed during the first site visit.
- Six classrooms were observed during the first site visit.
- A school improvement plan was collected during the site visits.
- Twenty-one teachers (60 percent) returned a survey.
- One administrator (33 percent) returned a survey.
- The school returned a technology infrastructure inventory.
- Three lessons were observed during the second site visit.

Case Background

School L is located near the downtown area of a large central city and adjacent to a state university campus. The district is the largest in the state and serves a student population that is predominantly African American or Latino. Although the school has been in existence for more
than 100 years, the current building is less than 15 years old. The university negotiated with the school district to acquire the original school property for an expansion of its campus.

At the same time, a group of community leaders went to Washington to protect the Latino residential neighborhood from being completely absorbed by the university. Their successful effort protected a sizable portion of the residential area, which has now become a diverse neighborhood across ethnic and economic lines. However, gentrification has had a negative impact on resources available to the school; close to $100,000 in federal aid was lost in the 2002–03 school year due to fewer students meeting poverty criteria.

School L serves more than 500 students in prekindergarten through eighth grade. A majority of students are African American and most of the remaining students are Latino. The attendance and graduate rates are both greater than 95 percent. About 5 percent of the students are enrolled in the bilingual program, and about 15 percent receive special support services in the form of resource classes or the inclusion program.

Case Summary

Many of the students in School L come from difficult home environments, and the school provides an environment where students are treated with respect and can feel safe. These students have a chance at this school. According to one teacher, “I would say in my classroom alone, at least 96 percent or 97 percent of these kids come from the most tragic stories. You wouldn’t know it looking at them—tragic circumstances and I think because of the principal, because of our mission to treat each child and respect and love and educate them without dumbing down the program, I think they feel safe here. I think they feel like they have a chance. Once they get to know you, they realize they have a real opportunity and I think that’s special. I think that’s very special. I’m really grateful to be teaching in such an atmosphere and environment. There’s nothing like kids knowing they are safe and there’s a chance for them if they just put in the effort.”

School L students are hard working and motivated to learn. Class sizes are large and space is limited, but teachers have created a schedule that allows them to have fewer students in their classes at one time. Teachers maintain an orderly learning environment and reported that technology helps in this respect. Students are excited about technology use and teachers reported that technology eases classroom management, helps create a routine, motivates, and engages students in ways that positively influence their academic performance. School L does not have a computer lab; instead, they have invested in older model computers to create mini-labs in each classroom.

The instructional strength of this school seems to be their focus on reading, which is also a strong focus for the district. School L emphasizes not only reading skills, but also literature. The teachers read books, they talk about their books, and they share books. Students are expected to read as much as possible and are provided a variety of ways to be accountable for their reading, including a reading assessment software program. The use of technology is integrated into the curriculum and instruction.
Student achievement at School L is measured by the state achievement test and the Iowa Test of Basic Skills (ITBS). Teachers employ a variety of other assessments in all curriculum areas. Primary teachers use Miscue Analysis, the Dolch word list, and a variety of local tests and projects. Second-grade students begin taking reading comprehension tests with reading assessment software in the second semester. Although School L is a neighborhood school, its academic achievement levels are competitive with many of the district’s selective magnet schools. In the 2001–02 school year, School L students performed at a higher level than students in the district in all categories of testing performance on the state achievement test. In eighth-grade writing, School L students achieved one of the highest test averages in the state, with more than 95 percent meeting state standards.

School L has a reputation within the district as a desirable place to work, and open positions are highly competitive. The principal seeks good teacher candidates through professional networks and as a result, School L continues to maintain a talented and dedicated teaching staff. Faculty meetings are held regularly and focus on instruction, with teachers sharing successful teaching strategies, and consistent approaches to reward and discipline. School L teachers mentor student teachers and observers from the nearby state university and another private university. Staff members have written and received nine grants from various funding sources, including one to fund eyeglasses for 60–80 students who needed glasses, but had no or inadequate insurance. Other grants have been in the areas of fine arts, reading, writing, science, social science, the environment, and family involvement.

The teachers are also strong advocates of technology use and reported using technology for a number of professional purposes. The majority of teachers reported that using technology to create instructional resources and gather information for lesson plans has contributed to professional practice. The majority of teachers also reported that they most frequently used computers to create lesson plans. When asked what software has had the most significant influence on their practices, most teachers report a Web browser, word processor, and software suite.

The school leadership is also supportive of technology use at the school. Teachers view the principal, who has been at the school for 13 years, as the key element keeping the school functioning at such a high level. The school administrator who returned the survey indicated a number of priorities for student and teacher technology use, including individualizing learning experiences, increasing professional development opportunities, and increasing parental involvement.

Technology is used frequently at the school, most often to improve student achievement because it provides both students and teachers immediate feedback on performance. When teachers were asked about the use of technology that contributes the most to student achievement, some teachers reported its use for mastering and remediating skills, conducting research, writing, analyzing information, and improving computer skills. The majority of teachers reported assigning students to use technology to master or remediate skills and to learn to work independently, and reported assigning students to use mathematics skills, reading skills and reading assessment software.

A number of factors were identified by respondents as contributing to technology use at School L, among these were the acquisition and maintenance of hardware, scheduling, and the
availability of grant funds. Teachers also mentioned that inadequate funding for maintenance and technology support as obstacles. Overall, teachers emphasized the importance of the full-time technology specialist and the significant role this person has played in helping teachers integrate the use of technology in instruction as well as working to maintain current technology resources.

**Academic Achievement**

| Research Question: What effects on academic achievement do administrators and teachers in School L attribute to educational technology? |
|---|---|
| **Primary Characteristics** | **Secondary Characteristics** |
| About two thirds of interview respondents referred to teacher caring about students and teacher competence as characteristics of School L that contribute to student achievement. | More than one third of interview respondents referred to administration leadership, administration supporting teachers, staff teamwork, and content-specific strategies. One fourth mentioned a school improvement plan or unified vision. |
| There was no consensus among teacher survey respondents regarding the specific type of software with the greatest effect on student achievement, but teachers most frequently reported that software uses for purposes related to literacy have the greatest effect. | More than one third of interviewees referred to a content-specific strategy, self-directed learning, and technology motivating students when asked about student uses of technology that contribute to achievement. One fourth mentioned hardware other than computers and communicating with parents or colleagues. |
| About three fifths of teacher survey respondents reported assigning students to use technology daily or weekly to master skills just taught and remediate skills not learned. One half reported weekly assignment for learning to work independently. | One fourth of teacher survey respondents at School L ranked education software for developing mathematics skills among the titles that have the greatest effect on student achievement. Teachers reported that students using software for purposes related to mathematics, writing, and general instruction has the greatest effect on achievement. |
| The curricular focus of School L is a balanced literacy program in which independent reading is heavily emphasized, and technology is used to verify and monitor student reading. | Two fifths of teacher survey respondents reported assigning students to use technology daily or weekly during free time or as a reward for good behavior. One third reported weekly assignment to analyze information or solve problems, improve computer skills, and learn to work collaboratively. One fourth reported assigning technology weekly for students to express themselves in writing. |
| Almost one half of teacher survey respondents ranked mastering skills just taught among the three purposes for student technology use with the greatest effect on achievement. Two fifths ranked remediating skills not learned among the top three purposes. One fourth included conducting research or gathering information in the top three. | One fourth of teacher survey respondents ranked mastering skills just taught among the three purposes for student technology use with the greatest effect on achievement. Two fifths ranked remediating skills not learned among the top three purposes. One fourth included conducting research or gathering information in the top three. |
Educators at School L attributed their success primarily to human factors involving teachers, administrators, and teamwork. When asked about the characteristics of School L as a whole that contribute most to student achievement, five (62.5 percent) of eight administrators and teachers interviewed mentioned teacher caring about students and teacher competence. Administration leadership, administration supporting teachers, staff teamwork, and content-specific strategies were each mentioned by three respondents (37.5 percent). Two respondents (25 percent) mentioned a school improvement plan or unified vision, and no other factor was cited by more than one respondent.

Interviews portray dedicated, talented, hard working, professional teachers who get along and a positive administration that is supportive of the teachers. Teachers have partners with whom they interact about a variety of issues (i.e., students, what they will order, and what they use) so that teachers feel supported by one another. School L has an “open door” policy, meaning that teachers are encouraged to discuss and debate issues, and are allowed to take risks. The leadership is considered to be strong, extending back at least to the previous principal who served at the school for 13 years. Teachers see the current principal as one of them because she was a teacher at School L. As one respondent observed, “We couldn’t do better than having someone who grew up here and is now the principal. Now, if you don’t have a principal who you can honestly say is smarter than I am, works harder than I do, and I don’t know a lot of teachers who say that … I’m saying that’s the primary reason why this school functions at such a high level.” The principal keeps teachers informed and then allows them to make decisions about what they will do based upon that information.

Coupled with the human factors is a learning environment that emphasizes reading and considers “time” as essential. This “time-conscious” metaphor appeared again and again throughout the interviews in various ways. One of the clearest implications of this was “time on task.” One respondent said, “I think the first one would be time on task, that the kids are moving forward with the materials and that they’re keeping with the educational plan of the school.” This environment seems to have been a focus of the previous principal. Another participant recalled that the previous principal “used to say accelerate, don’t remediate.” The School L curriculum is centered on reading, and classrooms are organized to support independent reading accompanied by instruction in phonics and word recognition skills. Each classroom also has a collection of hundreds of books stored in bookcases and plastic crates.

When asked what student uses of educational technology contribute most to academic achievement, three (37.5 percent) of the eight administrators and teachers who were interviewed mentioned a content-specific strategy, self-directed learning, and technology motivating students. Hardware other than computers, and communication with colleagues or parents were each mentioned by two respondents (25 percent). Respondents also mentioned that technology contributes to the ease of classroom management, creating a routine, and a motivational factor that helps engage students in a positive way and ultimately impacts their performance. In particular, the software programs that give students immediate feedback on their work seem to be viewed as very motivating, in part because they are nonthreatening to the students. Technology also provides students with alternatives for showing their competence; using a reading assessment software program is one of a number of ways that students can verify that
they have read a book. Students receive a reading grade that is based solely on the number of verified pages that they read during the term.

The teacher technology inventory survey asked respondents to list up to three software titles that have had the greatest effect on student achievement. Teacher responses to this question were quite diverse at School L; no type of software was listed by one half or more of the 21 teachers who returned a survey. Teachers listed education software for developing mathematics skills six times (n=6). A Web browser, and education software for assessing and developing reading skills were each listed five times (n=5). Most teachers did not list three software titles, presumably indicating they do not believe there are three titles that have had a significant effect on student achievement at School L. The survey also asked teachers to describe what students use each of these software titles to do, and the responses were coded into categories. The most commonly reported purpose for using these software titles was literacy (n=13). Teachers also reported purposes related to mathematics (n=8), writing (n=7), general instruction (n=6), and research (n=5).

The technology inventory survey also asked teachers to indicate how often they assign their students to use educational technology for each of 16 specified purposes. Thirteen respondents (61.9 percent) reported assigning students to use technology daily or weekly to master skills just taught. Twelve respondents (57.1 percent) reported daily or weekly assignment to remediate skills not learned, and 11 respondents (52.4 percent) to learn to work independently. Nine respondents (42.9 percent) reported assigning students to use technology at least weekly during free time, or as a reward for good behavior. Seven respondents (33.3 percent) reported at least weekly assignment for each of the following purposes: analyzing information or solving problems, improving computer skills, and learning to work collaboratively. Six respondents (28.6 percent) reported assigning students to use technology at least weekly to express themselves in writing.

The survey then asked teachers to select the three purposes from the list of 16 that have the most significant effect on student achievement, ranking them in order from one to three. Ten respondents (47.6 percent) ranked master skills just taught among the top three purposes, and eight (38.1 percent) placed it first. Nine respondents (42.9 percent) ranked remediate skills not learned among the top three purposes for student use of technology with the greatest effect on achievement. Six respondents (28.6 percent) included conducting research or gathering information among the top three purposes. Five respondents (23.8 percent) ranked each of the following purposes among the top three: expressing themselves in writing, analyzing information or solving problems, and improving computer skills. No other purpose was ranked in the top three by more than three respondents (14.3 percent).

In addition to reading assessment software, a mathematics skills application has been used at School L for 12 years. Mathematics teachers have become familiar with its structure, which starts with addition and progresses to algebra in 15 modules. By Grades 7 through Grade 8, students know their mathematics facts through drill and practice, and are ready for algebra. Other programs also are used for ratio and proportion, but their use is limited because most of School L’s computers cannot accommodate the more recently available programs on CD-ROM. Writing seems to have a big focus in School L, including the value of using computers for writing (i.e.,
helping with spelling, vocabulary, and grammar). However, one teacher noted, “Technology contributes almost nothing to the high performance of my students on the state writing test. Now the reason why I say that is because they don’t take tests on computers, you know. They have to use pencil and paper. And so, I use a pencil and paper very often.” In the writing laboratory, students use the computer for two weeks of a five-week period.

**Technology Use**

| Research Question: What kinds of educational technology do administrators, teachers, and students in School L use? |
|---|---|
| **Primary Characteristics** | **Secondary Characteristics** |
| Teacher survey respondents most frequently reported using a computer and printer, daily or weekly in the classroom or at home. Teacher survey respondents most frequently reported using a Web browser, word processor, and software suite, daily or weekly in the classroom or at home. Teachers used computers in three fourths of the classroom observations conducted at School L, all with education software. Teacher survey respondents most frequently reported assigning students to use computers. Most hardware was assigned daily or weekly in the classroom. Teacher survey respondents reported assigning students to use software on a daily, weekly, and monthly basis. Students used computers in almost all classroom observations, with a range of education software relating to reading, mathematics, science, and social science. | Teacher survey respondents reported using administration software for grading. Teacher technology use at School L includes a variety of education software, although no one type of education software was reported by more than three teachers. Teacher survey respondents reported assigning students to use a printer. Teacher survey respondents reported assigning students to use a Web browser, software suite, and education software for developing reading and mathematics skills. |

The administrator who returned a technology inventory survey reported using a computer, printer, facsimile, and photocopier when asked to list hardware used for professional purposes. The photocopier was used daily, the computer and printer were used weekly, and the facsimile was used monthly. All hardware except the photocopier was used in both the office and at home. The administrator reported using a software suite and Web browser on a weekly basis in the office and at home.

Teachers who returned a technology inventory survey most frequently reported using a computer (n=22) and printer (n=22). Teachers reported using a scanner (n=5) and digital camera (n=5). Teachers reported using several other types of hardware, including a projector, overhead,
photocopier, audio player, and television, but none of these were reported more than three times.
Respondents reported using most hardware on a daily (n=39) or weekly (n=20) basis in the
classroom (n=50) or a home office (n=27). Teachers reported using 11 different types of
application software, most frequently a Web browser (n=20), word processor (n=14), and
software suite (n=14). Teachers reported using four different types of education software,
although none were reported more than three times. Teachers reported using two different types
of administration software, most frequently for grading (n=7). Most software titles were reported
used on a daily (n=39) or weekly (n=30) in the classroom (n=54) or at home (n=28).

Classroom observation of teacher technology use was consistent with survey data. Teachers used
computers in four (75 percent) of the six classes observed during the winter site visit. One
teacher used an overhead projector and the remaining teacher used no hardware. All observed
teacher use of technology was brief in duration, lasting less than 5 minutes. One teacher used a
word processor during the observations. Teachers used a variety of education software for
science, social science, reading assessment, and mathematics skills in one class each.

Teachers who returned a survey most frequently reported assigning students to use a computer
(n=18) and printer (n=10); no other type of hardware was reported by more than one teacher.
Teachers reported most student use of hardware on a daily (n=18) or weekly (n=10) basis in the
classroom (n=31). Teachers reported assigning students to use seven different types of
application software titles, including a Web browser (n=8), software suite (n=7), or word
processor (n=4). Teachers reported assigning students to use seven different types of education
software titles, most frequently mathematics skills (n=10), reading skills (n=6), and reading
assessment (n=5). Teachers also reported assigning students to use two technology management
titles. The frequency with which teachers reported assigning students to use these software titles
was evenly split between daily (n=14), weekly (n=13), and monthly (n=12) in the classroom
(n=29). Student use of software at home was reported only three times on the survey, although
one teacher who was interviewed mentioned encouraging students to use the Internet at home.

Classroom observation of student technology use was very consistent with survey data. Students
used computers in five (83.3 percent) of the six classes observed during the winter site visit;
students were not observed using any other hardware. Student computer use tended to include a
mix of one and two students per computer; one student per computer was observed in five of the
classes and two students per computer were observed in four of the classes. Student computer
use tended to be sustained between 5 and 15 minutes of the 20-minute observation. Almost every
student used a computer in three of the observations, and about three of four students used a
computer in two observations. Students used a word processor during one observation. Students
used five education software titles for mathematics skills, and one title each for reading
assessment, science, and social science.
## Educational Technology Practices

**Research Question:** What educational technology practices do administrators and teachers in School L employ?

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<th>Primary Characteristics</th>
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<td>Three fourths of interview respondents referred to finding, creating, or updating instructional resources as a professional use of technology with the greatest effect on their practices and student achievement. Technology has had a limited effect on teacher practice at School L. Teacher survey respondents most frequently reported a Web browser among the three software titles with the greatest effect on their practices. Teachers reported that titles used for purposes related to instructional materials, communication, and research had the greatest effect on their practice. Almost all teacher survey respondents reported daily or weekly use of technology to create instructional materials. Two thirds reported at least weekly use to gather information for planning lessons. At least one half reported daily or weekly use to keep administrative records and present information to students. Teachers at School L employ a variety of activity structures in their classrooms, including individual, pair, and small-group work, as well as centers. Four fifths of teacher survey respondents ranked creating instructional materials among the top three purposes of technology use with the greatest effect on their practices, and almost one half placed it first. More than two thirds ranked gathering information for planning lessons among the top three purposes.</td>
<td>One third of interview respondents referred to tracking student data as a professional use of technology with the greatest effect on their practices and student achievement. One fourth mentioned a content-specific strategy, practice for standardized tests, and communication with colleagues or parents. Teacher survey respondents reported a software suite, word processor, and administration software for grading among the three software titles with the greatest effect on their practices. Teachers reported that titles used for administrative purposes had the greatest effect on their practice. Almost one half of teachers at School L cited keeping administrative records among the purposes of technology use with the greatest effect on their practice, and about one fourth cited presenting information to students and communicating with colleagues. Almost one half of teacher survey respondents reported daily or weekly use of technology to communicate with teaching colleagues. More than two thirds reported at least weekly use to access information on best practices. Two fifths of teacher survey respondents ranked keeping administrative records among the top three purposes of technology use with the greatest effect on their practices. One fourth put presenting information to students in the top three.</td>
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When asked what professional uses of technology have the greatest effect on their practice and student achievement, six (75 percent) of the eight administrators and teachers who were interviewed mentioned finding, creating, or updating instructional resources (three mentioned
using the Internet or e-mail specifically). Three respondents (37.5 percent) mentioned tracking student data, and two (25 percent) mentioned a content-specific strategy, practice for standardized tests, and communication with colleagues or parents.

Some teachers mentioned having Web sites available for the students to go to, and one teacher created a Web site for students with a number of links and activities. Another teacher finds quotes on the Internet and places them on top of homework pages; sometimes these quotes are topics of discussion. One teacher prints color overheads at home and uses them in the classroom, particularly maps because existing classroom maps are outdated. This teacher also downloads other writing by students at other schools so her students can compare their writing with them. Teachers use a computerized system for grades and report cards. This system, along with the feedback provided by assessment and skills development programs used by students, enable ongoing assessment.

The administrator technology inventory survey asked respondents to list the three software titles that have had the greatest effect on their practice. The administrator at School L who returned a survey did not list any title, presumably indicating that no title has had a great effect on administrative practice. The administrator technology inventory survey also asked respondents to indicate how frequently they use technology for each of several given administrative purposes. The administrator at School L did not indicate using technology for any of the given purposes on a daily or weekly basis.

The teacher technology inventory survey asked respondents to list the three software titles that have had the greatest effect on their practice. The most frequently listed types of software were Web browser (n=13), software suite (n=10), and word processor (n=7). Other application software listed included database and presentation software (n=2). Administration software for grading was listed five times (n=5). Education software listed included reading assessment (n=3 times) and mathematics skills (n=2). The survey also asked teachers to describe what they use these titles to do and the responses were coded into categories. The most commonly reported uses for these titles were creating instructional materials (n=22), communication (n=12), research (n=12), and administrative purposes (n=10).

The teacher technology inventory survey also asked respondents to indicate how frequently they use technology for each of 10 specified professional purposes. Nineteen respondents (90.5 percent) reported using technology daily or weekly to create instructional materials. Fourteen respondents (66.7 percent) reported at least weekly use to gather information for planning lessons, and 13 (61.9 percent) to keep administrative records. Eleven respondents (52.5 percent) reported daily or weekly use of technology to present information to students. Ten respondents (47.6 percent) reported daily or weekly use to communicate with teacher colleagues, and eight (38.1 percent) to access information and research on best practices. The purposes for which teachers reported using technology least frequently were communicating with parents or guardians, communicating with students outside the classroom, publishing class information, and publishing student work on the Web; more than 85 percent of respondents reported using technology for each of these purposes monthly or less.
The survey then asked teachers to select the three purposes from the list of 10 that have the most significant effect on their practice, ranking them in order from one to three. Seventeen respondents (81 percent) ranked creating instructional materials among the top three professional purposes, and 10 respondents (47.6 percent) placed it first. Fifteen respondents (71.4 percent) ranked gathering information for planning lessons among the top three purposes with the greatest effect on teaching practice. Nine respondents (42.9 percent) placed keeping administrative records in the top three purposes, and six (28.6 percent) placed presenting information to students in the top three. Five respondents (23.8 percent) ranked communicating with colleagues, and four (19 percent) put accessing information on best practices among the top three professional purposes for technology use. No other professional purpose was included in the top three by more than one respondent.

Six classes were observed during the winter site visit to School L; one each in third, fourth, sixth, and eighth grade, and two seventh grade. Four observations were conducted in classrooms, one in a computer laboratory, and one in another setting. Language arts was the dominant subject in three of the observations, and mathematics, science, and social science were each dominant in one observation. Eight different types of activity structures were observed in the six classes: collaborative pairs were observed in five classes; individual work in four classes; an adult-led large group in three classes; an adult-led small group and rotating centers in two classes each; and a collaborative small group, adult tutoring, and open centers in one class each. Individual work was the dominant or codominant activity structure in four classes, while collaborative small groups, collaborative pairs, an adult-led small group, an adult-led large group, and rotating centers were each dominant or codominant in one class.

Educational Technology Policies

| Research Question: What educational technology policies do administrators and teachers in School L implement? |
|-------------------------------------------------|-------------------------------------------------|
| **Primary Characteristics** | **Secondary Characteristics** |
| One half of respondents mentioned insufficient funding at the district level as an obstacle to educational technology use. | One third of interview respondents referred to the administration supporting teachers as a school or district benefit to educational technology use. One fourth mentioned acquiring or maintaining technology. |
| | More than one third of interview respondents referred to inadequate computers as a school or district policy obstacle to educational technology use. One fourth mentioned technology support for staff and that the district hinders the school as obstacles. One fourth also said they were not aware of any school or district policy obstacles. |

The administrator technology inventory survey asked respondents to rate the importance of each of a list of objectives for educational technology use at their school on a scale of one (lowest
priority) to five (highest priority). The administrator at School L who returned a survey indicated the highest priority for individualizing student learning experiences, increasing professional development opportunities for teachers, and increasing parental involvement.

When asked about school or district policies that help School L use technology in ways that contribute to student achievement, three (37.5 percent) of the eight administrators and teachers who were interviewed mentioned that the administration supports teachers, and the same number of respondents said there were none or they were unaware of any school or district policies. Two respondents (25 percent) mentioned acquiring or maintaining technology. When asked about school or district policies that make it more difficult for School L to use technology in ways that contribute to student achievement, four respondents (50 percent) mentioned insufficient funding, and three (37.5 percent) mentioned that computers are inadequate. Teachers seem to think that the district should be providing funding to replace the old computers, although they admit that the district may not have the financial resources to do so. Two respondents (25 percent) mentioned each of the following: technology support for staff, the district hinders the school, other obstacles from the district or school, and they were unaware of any district or school policies that hinder educational technology use.

There appears to be a perception among educators at School L that they have “grown their own” success with little support and some hindrance from the district. Respondents see the district as too disconnected from classrooms; district directives are not seen as being grounded in the reality of classrooms and learning. One respondent said, “As a teacher, I’m so tired of getting something handed down that means nothing to our school. You know what I mean? It doesn’t have a real connection to what we’re trying to do or it comes from left field and we’re already doing reading well. Why are you trying to make us do reading differently? Why break something that’s working? Why not let us continue exploring instruction?” One issue that particularly disturbed educators at School L was being forced to use a new report card in a different format than the locally developed system that is strongly connected to their reading program. One respondent did mention a district Internet filter as a benefit.

The school’s technology plan describes an environment in which technology is used as a tool to improve student learning, with mastery of technological skills, and the implementation of technology across the curriculum fully aligned with state and local standards that emphasize the use of technology to enhance engaged learning. However, respondents noted that use of technology is not mandatory at School L. One teacher observed, “Nothing is forced down anybody’s throat. Almost everything we’ve done in terms of computers transitioned from a number of people wanting to try it out first. For example, I can give you something I’m doing just for the first time this year that I waited to see how it went with my department. I’m using a grading program on the computer. I didn’t want to start it until I saw somebody else work through the box. And it was not mandatory. It’s still not mandatory, but I would say 90 percent of the staff is now using Easy Grade Pro.”

When asked about state and federal policies, the administrator who was interviewed at School L mentioned curriculum support as a state policy benefit, and insufficient federal funding as an obstacle. The administrator singled out state writing standards and performance indicators on which the school’s writing program is based. One teacher spoke out strongly against
standardized testing on the grounds that it does not address the level of knowledge they want students to have. “This idea that we have to jam facts down without a connection… what are the consequences of this having happened?” The teacher implicated No Child Left Behind as part of the reason that the state and district emphasize such tests.

**Technology Capacity**

<table>
<thead>
<tr>
<th>Research Question: How does the technology capacity of School L affect administrator, teacher, and student use of educational technology?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary Characteristics</strong></td>
</tr>
<tr>
<td>School L reported having an average of 7.3 computers per classroom, but almost all have older processors and most are not connected to the Internet. The school has made the unique choice of maintaining older equipment and even purchasing older equipment in order to have a small computer laboratory in every classroom. The school does not have a computer laboratory, a decision that was made as an extension of the decision to have classroom libraries rather than a centralized library. The age of the hardware constrains the software that can be run, and requires extraordinary efforts on the part of the technology specialist to maintain.</td>
</tr>
</tbody>
</table>

Student technology use at School L has long been based on classroom clusters rather than a computer laboratory. This approach is consistent with the use of classroom collections rather than a library in the school’s reading program. There are more than 225 computers in this school, housed in classrooms. Some classrooms have as many as 15 computers. Yet, many of these computers are old and not capable of running current software. One of the strategies implemented by the technology specialist, and apparently supported by the staff, is the decision to purchase larger quantities of older computers rather than a few newer ones. In interviews, teachers commended the technology specialist for hard work, much of it conducted on unpaid time, to make the technology they have as reliable as possible despite its age. There was no talk about access issues, and no mention of a computer laboratory or the desire to have one. However, almost all respondents did mention the age of the computers as a problem. Some respondents also mentioned having a difficult time finding software because of compatibility issues. School L seems committed to its strategy of stretching dollars by purchasing older computers.
On the technology infrastructure inventory survey, School L reported having an average of 1.4 computers per administrative office, 7.3 computers per classroom, and 6 computers in the library. School L does not have a computer laboratory. Only 16 of the computers in School L are relatively new machines capable of running current software; five of these are located in administrative offices, five in the library, and six in classrooms. Seventy-one of the 225 computers in classrooms at School L are connected to a local area network (LAN) and these have Internet access through the school’s T1 line. The remaining 165 computers are not networked. There are two inkjet and two laser printers in administrative offices, two laser printers in the library, and two inkjet and 12 laser printers shared among the 31 classrooms. The school reported having servers for a LAN, e-mail, and a Web site.

When asked what characteristics of School L’s technology environment have the greatest effect on student achievement, several factors were mentioned by three (37.5 percent) of the administrators and teachers who were interviewed. These factors included content-specific strategies, practice for standardized tests, computers in the classroom, the Internet, tracking student data, and technology professional development. Factors mentioned by two respondents (25 percent) included computers in general, a LAN, some type of software, hardware other than computers, technology support for staff, technology used for writing or revising, acquiring or maintaining technology, and other technology work.

Resources, Strategies, and Structures

| Research Question: What resources, strategies, and structures does School L use to become a high-technology school, and to what extent are these integrated with other school improvement efforts? |
|---|---|
| **Primary Characteristics** | **Secondary Characteristics** |
| More than one half of teacher interview respondents referred to general ambience and a content specific strategy as characteristics of their classrooms that contribute to student achievement. | Two fifths of teacher interviewees referred to classroom management, physical space, self-directed learning, and communication with colleagues or parents as classroom characteristics that contribute to student learning. One fourth mentioned each of the following characteristics: staff teamwork, hands-on or project-based learning, a grouping strategy, classroom materials and supplies, printer resources, and technology motivating students. |
| About three fourths of teachers at School L have received professional development through a Rochelle Lee Literacy Grant. | The technology specialist at School L is unusual in two respects; extraordinary efforts are required to maintain the older hardware in the school and the specialist designs technology solutions for administrative problems as well as supports technology integration in the classroom. |
| | School L uses a scheduling technique that reduces class sizes for limited periods during the day. |
Teachers were asked how their classroom learning environment contributes to student achievement and what resources, strategies, and structures they have used to create the classroom learning environment. Four (57.1 percent) of the seven teachers who were interviewed at School L mentioned general ambience, and four mentioned a content-specific strategy. Four factors were mentioned by three respondents (42.9 percent): classroom management, physical space, self-directed learning, and communication with colleagues or parents. Six factors were mentioned by two respondents (28.6 percent): staff teamwork, interactive learning, a grouping strategy, classroom materials and supplies, printer resources, and technology motivating students. The administrator was asked about resources, strategies, and structures used to create the overall school environment and the technology environment specifically. The administrator addressed the school’s reading program at length, mentioning that most of School L’s textbook allocation is used to purchase trade books for the reading program.

Class sizes are not reduced—meaning that having 25–30 students seemed usual. However, the principal (started with the previous principal) has implemented a type of scheduling that allows teachers to have fewer students in their class at one time for certain times of the day. For example, half of a teacher’s students may go to another class for a time period, and then the students swap, so the teacher sees the other half of the students. This scheduling intervention is viewed positively by the teachers. About 75 percent of the teachers have received the Rochelle Lee Literacy Grant. This grant also coincides with a workshop. Some new teachers have been able to take the workshop, but have not received the grant. Two teachers mentioned wanting more space. One interesting resource of this school was a grant for students who need glasses, but did not have adequate insurance to get them.

The administrator and some teachers singled out the importance of a full-time technology specialist who solves technical problems and supports teachers at all levels. The technology specialist regularly performs services such as installing cables and wiring the school, troubleshooting the Internet connections in each classroom, repairing computers with replacement parts, locating new equipment at good prices, and teaching teachers how to use software. The technology specialist also designs programs that support administrative efficiency. The specialist designed a school report card system that automatically computes a reading grade based on data from the reading assessment software application. The specialist also adapted a card scanning system that students use for lunch. The problem was that teachers spent time handing out cards, students needed to carry them to the lunch room, and lunch room staff collected them and returned them to the teachers. The solution was bar codes on lunch cards (made by the technology specialist) that are secured by Velcro to the wall in the lunch room; a student removes his or her card, lunch room staff runs it through a scanner and later puts it back on the wall.

**Classroom Vignettes**

At School L, three classroom observations were made. Two seventh-grade classes were observed; the first was of 25 students in a social studies class, and the second was of a mathematics class of 23 students. A third observation was made of an eighth-grade science class of 14 students. Of the three observations made at School L, only the first two involved the integration of technology into the day’s lesson; these two observations are described below. For both observations, computers and other technologies were used by teachers and students alike in
support of the day’s lesson for each class. In each case, teachers were interviewed before the lesson to establish a context for the lesson observation that follows and an understanding of how instructional strategies and technology will be integrated to facilitate student learning. Teachers also were interviewed following each observation to provide a lesson interpretation and an understanding of the role of technology in achieving specific lesson outcomes.

**Seventh-Grade Mathematics Lesson**

<table>
<thead>
<tr>
<th>Class 1</th>
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</thead>
<tbody>
<tr>
<td>Grade: 7</td>
</tr>
<tr>
<td>Subject: Mathematics</td>
</tr>
<tr>
<td>Setting: Classroom</td>
</tr>
<tr>
<td>Teacher Hardware Used: Overhead projector</td>
</tr>
<tr>
<td>Teacher Software Used: None</td>
</tr>
<tr>
<td>Student Hardware Used: Computers, calculator</td>
</tr>
<tr>
<td>Student Software Used: Mathematics skills</td>
</tr>
</tbody>
</table>

In the preobservation interview, the teacher reported that this mathematics lesson would offer an overview of the introduction to statistics unit of the textbook. The teacher indicated that the lesson would specifically focus on measures of central tendency, including the conceptualization and calculation of the mean, median, and mode. After being introduced to the topic, students would work with a sample set of data to calculate and interpret these statistics. The primary method of delivering this lesson would be direct instruction by the teacher. Students would rely on textbooks, worksheets, and real-life examples as resources supporting this lesson. Students who pick up the lesson concepts quickly would be able to use mathematics skills software for additional practice. The teacher reported integrating computers into the curriculum in ways that demonstrate, reinforce, or remediate the concepts and ideas presented through direct instruction.

During this lesson, desks were organized into three rows of paired desks, and 10 computers were located on tables lining the inner walls of the classroom. Calculators were made available to all students, and the classroom also was equipped with an audio player, overhead projector, video player, and television. The teacher was observed using only an overhead projector for approximately 15 minutes and for the purpose of guiding students through the lesson. The overhead slides functioned as visual representations of some of the more complex ideas addressed in this lesson. At the same time, students also referred to the textbook, notebook, and/or the worksheet the teacher had prepared for them.

Students were observed using computers for approximately 5 to 15 minutes at a time, and at a ratio of two students per computer. Approximately two of every four students were observed using a computer during this lesson. Computer use was determined by students’ mastery of the lesson content; those that demonstrated a solid understanding of the content were directed to a computer software application that would allow additional practice and reinforcement of the day’s lesson. Students were also observed using calculators to assist them in the computation of various measures of central tendency. Many students also used a mathematics skills application at some point during this observation.
The lesson began with the teacher presenting an introduction to statistics using the overhead projector. The teacher interacted with students, posing questions, and asking students to provide answers aloud to the class. The teacher alternated back and forth between the textbook and the overhead slides, which intended to visually represent the more complex concepts and ideas for students. Students were called upon periodically to read aloud from the textbook, and frequently recorded what was on the overhead in their notebooks. During this lesson, words and concepts specific to the study of statistics were defined and explained (such as “data,” “cluster,” and “outlier”). The teacher discussed the concepts of mean, median, and mode and introduced a sample set of data to help students visualize how these statistics can be calculated, and how they are used in real-life applications.

Nearing the end of the lesson, seven students retreated to the computers and used mathematics skills software to practice the concepts addressed by the lesson. The rest of the class worked on problems from their textbook, writing the answers in their mathematics notebooks. The teacher assisted the students at their desks, correcting and explaining their work as needed. Once finished, the teacher asked one student to pass out calculators to the class; students used the calculators to check and verify their work. While the students at the computers continued their practice work unsupervised yet on-task, the teacher continued to assist students in completing the textbook problems, and reviewed their work with the class when finished.

In the interview afterward, the teacher reported great confidence that students got what they needed out of the lesson. The use of mathematics skills software allowed more advanced students to work independently on their own, enabling the teacher to be more available to those students in need of individual help. According to the teacher, the use of technology helped to empower students to perform above and beyond the norm. For example, although one student who was working at the computer was learning-disabled, after completing her lessons at the computer, she assisted several others with the software. The teacher reported that completed worksheets based on the textbook questions, as well as the progress charted by the mathematics skills software, would be used later to assess the effectiveness of the day’s lesson.

### Seventh-Grade Social Studies Lesson

<table>
<thead>
<tr>
<th>Class 2</th>
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</thead>
<tbody>
<tr>
<td>Grade:</td>
<td>7</td>
</tr>
<tr>
<td>Subject:</td>
<td>Social studies</td>
</tr>
<tr>
<td>Setting:</td>
<td>Classroom</td>
</tr>
<tr>
<td>Teacher Hardware Used:</td>
<td>Presentation station, overhead projector, computer</td>
</tr>
<tr>
<td>Teacher Software Used:</td>
<td>Web browser</td>
</tr>
<tr>
<td>Student Hardware Used:</td>
<td>None</td>
</tr>
<tr>
<td>Student Software Used:</td>
<td>None</td>
</tr>
</tbody>
</table>

The social studies lesson observed focused on understanding current events, using *The Onion* newspaper as a point of reference. Specifically, this lesson was focused on teaching students how to read a news story, from deciphering the main points of the story to assessing the validity of the information presented. Ultimately, this lesson was geared toward teaching students how to be more critical thinkers and consumers of information. In the preobservation interview, the teacher
indicated that the lesson would begin with reading a story to the class, and that this story would include a project for students. Students would complete a series of activities relating to this story, and the teacher also would access several related Web sites to help augment students understanding and critical assessment of the details presented therein.

During this lesson, 25 seventh-grade students were observed. This classroom was equipped with 10 desktop computers, two printers, and one of each of the following: audio player, overhead projector, video player, television, and calculator. During the lesson, the teacher was observed using a computer, presentation station, and overhead projector; the presentation station was used to display the newspaper article to the class, and the computer was used to access Web sites on North and South Korea using a Web browser. No student technology use was observed during this lesson.

This lesson began by revisiting the definition of satire, which was the focus of a previous day’s lesson. Students offered definitions, and the teacher recorded their responses on the overhead projector. Students’ note taking was guided by what the teacher included on the overhead. The teacher then read a satire, as depicted by a story in The Onion newspaper. The overhead projector was used to display an excerpt about North Korea. Students orally responded to various questions the teacher asked based on this excerpt. Key words in the story were identified, and students used dictionaries to find the definitions of the words, recording them in their notebooks. The overhead was also used to demonstrate K-W-L—“What do we think we know, what do we want to know, and what have we learned?” The teacher used the excerpt, “Soldiers are buried in camps,” as an example of a metaphor rather than a literal description. Using this model as an example, students made similar distinctions between metaphors and literal expressions in the story. The teacher then accessed the Internet, going to an “International Update” site on North Korea, directing students to listen for facts related to problems between the United States and North Korea as she read the passage.

In the postobservation interview, the teacher reported that the lesson was effective in assisting students with identifying the facts and deciphering what is real from what is not real. She also felt that reinforcing the general concept of satire at the beginning of the lesson was imperative to its success, as this process revealed that many students had forgotten much of the previously taught content upon which this lesson was based. According to the teacher, the lesson provided adequate opportunities for students to listen and focus on the critical elements of the story that facilitate their understanding of the facts and offered opportunities for them to ask questions and engage in a discussion of the lesson as well. The teacher was pleased with the balance of time students spent listening and actively engaged, and viewed this as an indicator of the overall success of the lesson. The teacher reported that she consistently uses the overhead projector in her lessons. However, she uses it as an alternative to the blackboard given that so many students in her class have asthma that is affected by chalk dust.
References


