Case Report on School R

**Education Trust High-Poverty:** Yes  
**Education Trust High-Minority:** No  
**Location:** Rural  
**Grades Served:** K–5

## 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 & Ronnkvist, 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 R in this report, which is based on the following data collected from the school:

- Six teachers and three administrators were interviewed during the first site visit.
- Seven classrooms were observed during the first site visit.
- A technology plan was collected during the site visits.
- Eleven teachers (73 percent) returned a survey.
- One administrator (100 percent) returned a survey.
- The school returned a technology infrastructure inventory.
- Three lessons were observed during the second site visit.

The discrepancy in the number of administrators who were interviewed and the number who returned a survey arose because the school requested one printed administrator survey and response rates were calculated based on the number of surveys requested by the principal.

Case Background
School R is a part of a small, rural district serving less than 1,000 students in two elementary schools and a middle/high school. The community is predominantly white; however, a nearby casino has provided some opportunity for diversity with Asian and African-American families moving into the area. The school district serves a 325-square-mile area, which translates into about three students per square mile. Many students live in wooded areas or in homes scattered along dirt roads. According to educators at School R, most parents have not graduated from high school. The overall economic situation for students in the district is one of poverty, with almost 80 percent eligible for free or reduced-price lunches. The mission of the school district is “Growing Responsible Citizens.”

School R serves approximately 250 students, about 200 of which receive free or reduced-price lunches. An administrator reported that poverty affects instruction. For some families, putting gas in the car is a challenge, which creates other challenges like getting students to school in the morning. The school motto “Education for All” reflects the attitude of teachers, staff, and administrators, that every child can and will learn despite these obstacles. School R students were observed to be polite, engaged in their lessons, and noticeably focused on learning. The school philosophy of the “olders” being role models for the “younger” is reinforced constantly and appears to contribute to the atmosphere of respect.

The town is located in the heart of a national forest preserve. The community is known for its outdoor sports and recreation. The community’s industries are tourism, the casino, and a state prison. Businesses are few: shopping is at K-Mart, the Dollar Store, and small family-owned operations such as tackle shops, cabins, and diners open for the tourist season. The town is small, with no town center, stoplights, or railroad. Houses are along roads or in the woods, and many are mobile homes. Jobs are few and are either associated with the casino, the state prison, or tourism, which is seasonal (fishing in spring and summer; swimming and boating in summer; hunting in fall). While the community is not unique in the region, most similar towns have higher property values and more opportunities for employment.

Case Summary

Small classes of between 15 and 18 students have become the norm at School R in recent years and were made possible by the district administration and school board which determined that investing in grant writing could generate additional resources. Grants have brought significant support for technology, smaller classes, teacher assistants, and release time for teachers to develop expertise in curriculum and instructional strategies, and to coach each other because there is no curriculum coordinator for the school. Administration and staff reported that School R is a place for students to be successful. Teachers work hard, have high expectations for themselves and students, and never use poverty as an excuse for poor achievement. As one teacher put it, “We all say, ‘Every day … your personal best.’” This philosophy has created an atmosphere of respect, which teachers and the principal maintain is the basis for successful student learning.

The school building was recently remodeled and looks new. In 1999, a successful district bond issue passed (the second in 10 years) for school renovation and improved technology. The school
is kept neat, clean, and bright by the custodial staff; teachers display student work outside their rooms and in the classrooms.

The local school district has a 21st Century Technology Plan to guide the integration of technology into the curriculum in a way that meets school and community needs. This approach includes the establishment of a computing center in every classroom where teachers can use multimedia to address different learning styles. Students use technology to produce materials in print and electronic form, and can access a variety of resources through the Internet. At School R, technology is used for many purposes, especially for test preparation by students. Teachers and administrators also use technology to analyze student data to improve instruction and set achievement goals. However, integrating technology into the curriculum is costly, and teachers and administrators actively pursue grant funds to support technology acquisitions and resources.

Students use technology frequently and have positive feelings about their use of technology. Teachers and administrators stated that access to technology helps to diminish feelings of isolation that students may feel as a result of living in their rural community. The school does not have a centralized computer lab; instead, each classroom is equipped with a few computers. According to one teacher, the only drawback to this arrangement is that they are unable to have all the students use computers at once and an administrator stated that the school needs a computer lab. When respondents were asked about the student uses of technology that most contributed to student achievement, many teachers reported mastering and remediating skills. Most teachers reported that they frequently assign students to use technology to remediate skills, master skills, improve computer skills, work independently, and as a free time activity or reward.

Teachers and administrators reported that a number of factors contribute to the use of technology at the school, such as a state program that provides teachers with hardware, district policies, grant funds, and the technology support staff. Few respondents mentioned obstacles to technology use, but frequently changing state standards and failures to communicate changes to schools was mentioned as one source of frustration.

Overall, teachers care about student learning and do the best they can to help their students achieve. Teachers frequently collaborate to determine how to best meet students’ needs and participate in professional development activities regularly. All of the teachers reported using technology to create instructional resources has influenced their professional practices the most. Teachers most frequently reported using a word processor and Web browser. These software applications also are believed to have the most significant effect on teaching practice. While many School R teachers reported that technology has influenced their professional practices, most respondents reported using technology weekly or less.

School R administrators are viewed as supportive, resourceful, and the principal was credited with helping create a positive atmosphere at the school. The administrator who completed the survey reported several priorities for teacher and student technology use at the school, some of the priorities reported included: using more technology in curriculum and instruction; individualizing learning experiences; and increasing professional development opportunities. The administrator also reported that use of technology has significantly affected their professional practices, and noted the use of technology most affected communicating with
colleagues, staff, and parents or guardians, and accessing information on best practices. The administrator also reported using technology daily to create administrative materials, access information and research on best practices, keeping administrative records, and communicating with colleagues and other staff.

School R has developed numerous partnerships with community resources such as mental health services, DARE out of the sheriff’s office, Junior Achievement, and township service projects. On most days, rotating teacher assistants or community volunteers serve as instructional aides, often managing one of the classroom learning centers. The school’s relationship with the community is mutually beneficial, as the wired school serves as a community learning center where adult learners can get technology training.

School R School is a dynamic learning community that has overcome numerous obstacles to student achievement. Though most of the students come from low-income households and the school is in a remote location, teachers and administrators have creatively accessed grant funds and made use of community volunteers to support student learning and to provide students with access to a world of information. Their successes are also due, in large part, to the atmosphere of respect, and the high expectations held by all members of the community: administrators, teachers, students, and parents.
**Academic Achievement**

**Research Question:** What effects on academic achievement do administrators and teachers in School R attribute to educational technology?

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<th>Primary Characteristics</th>
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<td>Two thirds of administrators and teachers who were interviewed referred to a caring environment as a characteristic of School R that contributes to student achievement.</td>
<td>Almost one half of respondents referred to staff teamwork as a characteristic of School R that contributes to student achievement. One third of respondents mentioned small class sizes.</td>
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<td>About two thirds of survey respondents assign students to use technology at least weekly to remediate skills not learned, master skills just taught, improve computer skills, learn to work independently, and free time or a reward for good behavior.</td>
<td>Almost one half of interview respondents referred to the Internet as the educational technology with the greatest effect on student achievement.</td>
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<td>About two thirds of survey respondents ranked remediating skills not learned and mastering skills just taught among the three purposes of student technology use that have the greatest effect on student achievement.</td>
<td>Survey respondents listed Web browsers, and education software for reading assessment and mathematics instruction, among the three software titles with the greatest effect on student achievement.</td>
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When asked what characteristics of School R as a whole contribute most to student achievement, six (66.7 percent) of nine teachers and administrators who were interviewed referred to a caring environment, four (44.4 percent) referred to staff teamwork, and three (33.3 percent) mentioned class size. Administration leaders, a school improvement plan or unified vision, teacher competence, and meeting individual needs were each mentioned by two respondents (22.2 percent). When asked what student uses of technology have the greatest effect on student achievement, four respondents (44.4 percent) referred to the Internet. Two respondents (22.2 percent) mentioned students being familiar with or positive about technology, and two mentioned students using technology frequently.
One respondent described School R as “more of a family atmosphere than a stressful work environment.” Another said, “We don’t—because of our high-risk, at-risk population—we don’t use that as an excuse for our kids not learning. It’s a challenge and that’s the area we’re in, so we have a job to do, and we do it, the best we can, and we really care. The teachers care; the kids are happy to come here.” A third respondent reported, “Many of our students come from homes that aren’t ideal, you know. Sometimes they lose their residence and they’re wondering where I’m going to sleep tonight? The car doesn’t work, how am I going to get there? Some of our students love coming to school because that’s where they get food, through the school. They know it’s a safe place; they know they’re not going to get hit by anyone here, at least not from any adult. If any student tries to hurt them, they know there’s a consequence. I think that they see it as a safe, nurturing place. It’s what’s most important on their mind.”

There was not a strong consensus about the type of software with the most significant impact on student achievement among teachers who returned a technology inventory survey. Respondents most frequently listed a Web browser (n=4) among the three software titles with the greatest impact on student achievement. Respondents listed reading assessment (n=3), mathematics instruction (n=3), word processor (n=2), and student information system (n=2) more than once among these titles. Teachers also were asked to indicate what they assign their students to use this software to do. The reported uses were coded by researchers into categories. Respondents most frequently listed purposes that were coded as literacy (n=6), general instruction (n=6), mathematics (n=5), and writing (n=4). Science and research uses were each listed twice.

The technology inventory survey also asked teachers to indicate how often they assign their students to use educational technology for each of 16 given purposes. Seven respondents (72.7 percent) reported assigning students to use technology daily or weekly to remediate skills not learned. Six respondents (63.6 percent) reported assigning students to use technology at least weekly for each of the following purposes: master skills just taught, improve computer skills, free time or reward for good behavior, and learn to work independently. Three respondents (27.3 percent) reported assigning students to use technology at least weekly to learn to work collaboratively. No more than two respondents (18.2 percent) indicated assigning students to use technology for any of the other 16 purposes at least weekly.

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. Seven respondents (63.6 percent) selected master skills just taught and remediate skills not learned as having the most significant effect on student achievement. All seven teachers ranked these two purposes first or second, but five (45.5 percent) ranked master skills just taught first, while three (27.3 percent) ranked remediate skills not learned first. Four respondents (36.4 percent) ranked express themselves in writing among the top three purposes, and three (27.3 percent) ranked free time or reward for good behavior in the top three. No more than two respondents (18.2 percent) listed any of the other 16 purposes among the top three with the most significant effect on student achievement.

Administrators at School R employ several strategies specifically to ensure student achievement, including: curriculum and instructional strategies linked directly to state standards; disaggregating data in each content area, and grade tested and tracking these data over time;
regular practice of test items from past tests, available electronically; correlation of the state achievement test with other indicators, such as classroom assessments, student portfolios, and scores on standardized tests; and a belief by teachers and administrators that there is always room for improvement. However, administrators expressed some frustration with the frequency in which state standards and tests have changed, and a lack of communication with schools about the changes until after the fact. Respondents also expressed frustration with some rules, for example, if a student leaves the school and can’t be tracked, the student gets a “zero” for the test which is then included in the school’s data. One administrator said that testing as a concept is good, but the testing process can be “dehumanizing.”

One administrator at School R articulated a complete theory of effective schools for low-income students, including: school culture, small class sizes, good use of technology, effective staff development, and adequate facilities.

- According to this administrator, “They have a saying here that’s called ‘Education for All.’ They all believe in that, every child’s going to learn, so they all work together. Actually, the culture of the school fits very well with No Child Left Behind because they’ve held that philosophy here for a long time.”

- The administrator said that small class sizes are needed to meet the individual needs of at-risk students. “If you’re going to teach students who come to your classrooms with a variety of problems for whatever reasons, it’s going to take more on-on-one emphasis or smaller class size to take advantage of what the child needs.”

- The administrator described technology as an equalizer, and said, “If your schools are poverty-level schools and you service at-risk populations, and they do not have the technology, those children will fall behind at a faster rate than they would have during the period of time prior to the advent of technology.”

- The administrator described a number of staff development initiatives funded by grants School R has won. “We have staff development, significant staff development. To be significant, it needs to be sustained over a period of time. Staff development runs three to five years.”

- Finally, the administrator said, “You have to have facilities that allow your staff to do what is needed.” The administrator noted that although School R has a predominantly low-income student population, the school itself does not convey a feeling of poverty. “We have strong emphasis not only on having enough space, but we have a strong emphasis on taking care of it and I would tell you that all of our facilities … look like brand-new facilities where only wealthy kids go.”

The administrator emphasized that this approach costs money. “I will not tell you that we educate kids with few dollars. We are a well-funded school, but we had to make it that way.” The administrator added, “I’ve often told people that education for poor students or at-risk students is not rocket science. It’s something that you can put into a very simple format. I’m also going to tell you that it’s a formula that our politicians don’t want to listen to. It’s very simple, the reason for that is it costs more money to educate poor students.”
**Research Question:** What *kinds of educational technology* do administrators, teachers, and students in School R use?

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<td>Survey respondents most frequently reported using computers, printers, digital cameras, word processors, and Web browsers.</td>
<td>Survey respondents reported using scanners, projectors, presentation software, print creativity software, and e-mail.</td>
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<td>Survey respondents most frequently reported using hardware and software daily or weekly in the classroom or home office.</td>
<td>An administrator survey respondent reported using spreadsheets and technology management software, in addition to software reported by teacher survey respondents.</td>
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<tr>
<td>Survey respondents most frequently reported assigning students to use computers, printers, Web browsers, and education software for assessing and developing reading skills.</td>
<td>Survey respondents reported using 13 software titles monthly.</td>
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<td>Survey respondents most frequently reported assigning students to use hardware and software on a weekly basis in the classroom.</td>
<td>Survey respondents reported assigning students to use digital cameras and software for assessing and developing mathematics skills.</td>
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<td>Classroom observations of teacher and student technology use were generally consistent with data reported by survey respondents.</td>
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The administrator who returned a technology inventory survey reported daily use of a computer and printer, weekly use of a digital camera, and monthly use of a scanner and projector. The administrator reported using a computer and printer in the school office, library, computer laboratory, and home office while most of the other hardware was used in the library and the computer laboratory. The administrator reported daily use of a word processor, Web browser, and e-mail in the school office, library, computer laboratory, and home office. The administrator also reported weekly use of a spreadsheet and technology management software, and monthly use of presentation software.

Teachers who returned a technology inventory survey most frequently reported using a printer (n=12), digital camera (n=11), and computer (n=10). Other hardware reported included a scanner (n=5), projector (n=3), and laptop (n=2). Most hardware was reported used daily (n=22) or weekly (n=10) in the classroom (n=41) or home office (n=24). Among software titles, teachers most frequently reported using a word processor (n=11) and Web browser (n=11). Other software reported included presentation (n=5), print creativity (n=4), e-mail (n=3), digital imaging (n=3), and Web publishing (n=2). Frequency of software use among all titles was split about evenly between daily (n=16), weekly (n=17), and monthly (n=13). Teachers reported using most titles in the classroom (n=41) or home office (n=31), with only one title reported used in the computer laboratory and none in the library.
Classroom observations of teacher technology use were generally consistent with data reported by survey respondents. Teachers used computers in three of the seven observations during the winter site visit. A presentation station (a television monitor or projector) and a television or video player were each used by teachers in two observations. One teacher used an overhead projector and one used a digital camera. A Web browser, presentation software, and reading skills software were observed in use by one teacher each. Survey and observation data suggest routine, moderate teacher use of common educational technology at School R, primarily word processors and Web browsers, with supplemental use of digital cameras, and presentation hardware and software.

Teachers who returned a technology inventory survey most frequently reported assigning students to use a computer (n=10) and printer (n=11); the only other hardware reported was a digital camera (n=4). Teachers reported assigning most hardware on a weekly basis (n=12), with some assigned daily (n=5), monthly (n=3), or less (n=4). Almost all hardware was assigned for student use in the classroom (n=22). Teachers most frequently reported assigning students to use a Web browser (n=8) and reading skills software (n=8), following by reading assessment (n=6), mathematics instruction (n=5), and mathematics skills (n=4) software. A student information system and multicurricular skills software were each reported twice, and no other type of software was reported more than once. Most titles were assigned weekly (n=22) or monthly (n=10). Almost all were assigned for use in the classroom (n=42), with none assigned for use in a computer laboratory or library, and only two assigned for use at home.

Classroom observations of student technology use were generally consistent with data reported by survey respondents. Students used computers in three of the seven observations during the winter site visit. Students in one class were observed using a digital camera. Student use of computers consisted mostly of one student per computer for between 5–15 minutes during the 20–25 minute observation. Students were observed using a Web browser, and educational software for reading skills, mathematics instruction, and multicurricular instruction in one class each. One teacher commented, “We find some good Web sites for them to go to, make sure that they are supervised.” Survey and observation data suggest routine, moderate student use of common educational technology at School R, primarily Web browsers and educational software for assessing and developing reading and mathematics skills, with supplemental use of digital cameras.
## Educational Technology Practices

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

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<td>Survey respondents most frequently reported a word processor and Web browser among the three software titles with the greatest effect on their practice. The most frequently reported purposes for using these titles were creating instructional materials, communication, and research.</td>
<td>One third of interview respondents cited finding, creating, or updating instructional resources among professional uses of technology with the greatest effect on their practice and student achievement.</td>
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<td>A majority of survey respondents reported using technology less than weekly for each of 10 specified professional purposes.</td>
<td>An administrator survey respondent reported that e-mail for communication, a word processor, and Web browser for research and grant writing have had the greatest effect on administrative practice.</td>
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<td>All survey respondents ranked creating instructional materials among the three given professional purposes of technology use with the greatest effect on their practice, and almost one half ranked it first.</td>
<td>Survey respondents reported presentation software among the three titles with the greatest effect on their practice.</td>
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<td>An adult-led large group was observed in all classrooms, and was the dominant activity structure in five of the seven classrooms observed.</td>
<td>Almost one half of survey respondents reported using technology at least weekly to communicate with other educators. At least one fourth reported daily or weekly use to present information to students, communicate with parents, gather information for lessons, and research best practices.</td>
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<td>Although there appears to be a consensus among educators that use of a word processor and Web browser for researching and creating instructional materials have the greatest effect on their practice, most teachers use these tools on a less-than-weekly basis.</td>
<td>Almost one half of survey respondents ranked gathering information for lessons and communicating with parents among the three professional uses of technology with the greatest effect on their practice. At least one fourth ranked presenting information to students and communicating with other educators among the top three professional uses.</td>
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When asked about the professional uses of technology that have the greatest effect on their practice and student achievement, no response was coded for more than one third of the nine teachers and administrators who were interviewed. Three respondents (33.3 percent) referred to finding, creating, or updating instructional resources. Meeting individual needs, money or grants, the Internet, and communication with staff or parents were each mentioned by two respondents (22.2 percent).
The administrator who returned a technology inventory survey reported that using e-mail for communicating with educators or parents, and keeping administrative records, and using a Web browser and word processor for grant writing have had the greatest effect on administrative practice. The administrator reported using technology on a daily basis to create administrative materials, access information and research on best practices, keep administrative records, communicate with colleagues not at school, and communicate with other staff at school. The administrator reported using technology weekly to present information to teachers or students, analyze student data for school improvement, communicate with parents or guardians, publicize school information, and publish school information on the Web. When asked to rank the three purposes that have had the greatest effect on administrative practice, the respondent placed communicating with colleagues not at school first, communicating with staff at school second, and accessing information and research on best practices third.

Teachers who returned a technology inventory survey most frequently listed a word processor (n=11) and Web browser (n=7) among the three software titles that have had the greatest effect on their teaching practice. Other software reported included presentation (n=3), print creativity (n=2), and digital imaging (n=2); no other type of software was listed more than once. Teachers also were asked to report what they use this software to do, and the reported uses were coded into categories. Multiple uses for a given software title were each coded into the appropriate category. The most commonly reported purposes of use were creating instructional materials (n=11), communication (n=9), and research (n=6).

The technology inventory survey also asked teachers to indicate how often they use technology for each of 10 specified purposes. A majority of respondents reported using technology less than weekly for all of the given purposes. Five respondents (45.5 percent) reported using technology daily or weekly to communicate with other educators. Four respondents (36.4 percent) reported using technology at least weekly to present information to students and to communicate with parents or guardians. Three respondents (27.3 percent) reported using technology at least weekly to gather information for lessons and access information and research on best practices. However, the most commonly reported frequency of technology use across all of the given purposes was less than monthly.

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. All respondents (100 percent) ranked creating instructional materials in the top three purposes, and five respondents (45.5 percent) ranked it first. Five respondents (45.5 percent) ranked gathering information for planning lessons and communicating with parents or guardians among the top three purposes. Three respondents (27.3 percent) ranked gathering information for planning lessons first, compared to only one respondent (9.1 percent) who ranked communicating with parents or guardians first. Four respondents (36.4 percent) ranked presenting information to students in the top three purposes, and three respondents (27.3 percent) ranked communicating with other educators among the three purposes with the most significant effect on their practice. None of the other 10 purposes was selected in the top three by more than two respondents.

Seven classes were observed at School R during the winter site visit: one kindergarten, first grade, third grade, fourth grade, and multiage class and two fifth-grade classes. All observations
were conducted in classrooms. Mathematics and language arts were each dominant or codominant subjects in three of the observations, while science was dominant or codominant in two of the classes. Eight different activity structures were observed in these classes. An adult-led large group was observed in all seven classes. Adult tutoring was observed in three classes. An adult-led small group, collaborative pairs, collaborative small groups, individual work, and rotating centers were each observed in two classrooms. A student-led large group was observed in one classroom. An adult-led large group was the dominant activity structure in five of the classrooms, while rotating centers and adult-led small groups were each dominant in one class.

Educational Technology Policies

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<th>Research Question: What educational technology policies do administrators and teachers in School R implement?</th>
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<tr>
<td><strong>Primary Characteristics</strong></td>
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<td>Two thirds of administrator interview respondents cited money or grants at both state and federal levels as a benefiting educational technology, as well as plans or standards at the state level.</td>
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The administrator technology inventory survey asked respondents to indicate the priority of 20 given objectives for educational technology for their school on a scale of one to five, with one being the lowest priority and five being the highest priority. The administrator at School R who returned a survey indicated the highest priority for five of the objectives: use more technology in curriculum and instruction, individualize student learning experiences, increase professional development opportunities for teachers, improve students’ 21st century learning skills, and support school reform efforts. The administrator indicated the second highest priority for seven of the given objectives: improve teachers’ strategies for integrating technology, improve student achievement on state assessments, improve student achievement on standardized tests, better prepare students for careers, improve students’ basic skills, improve administrative efficiency, and make school improvement decisions more data driven.

Most respondents at School R have a generally favorable view of school and district policies. Four (44.4 percent) of the nine administrators and teachers who were interviewed referred to money or grants as a benefit of school and district policies. Professional development and computers in the classroom were each mentioned by three respondents (33.3 percent), and technology support for staff was mentioned by two (22.2 percent). Two respondents (22.2 percent) said they were not aware of any beneficial school or district policies. Four respondents (44.4 percent) said they were unaware of any school or district policy obstacles, and no obstacle was mentioned by more than one respondent. Two (66.7 percent) of the three administrators who were interview referred to plans or standards and money or grants as state policy benefits, and to money or grants as a federal policy benefit. No state or federal policy obstacles were identified by more than one administrator.
The district has developed a 21st Century Technology Plan to serve as a guide for decisions and policies that will drive the technology curriculum. The district plans to integrate technology into the curriculum in a multifaceted way, incorporating not only the school’s needs, but the community’s as well. The integration includes having a computer center approach in each classroom, using multimedia to address all learning styles, teachers and students using technology to produce materials in electronic and print formats, having access to a variety of information sources via the Internet and other electronic sources, using technology to provide opportunities to learn through simulation and modeling, developing a local Intranet to contain a growing information base, providing a distance learning system for professional development, college level coursework, dual enrollment, integrated enhancement and adult education, and providing regular, open access to technology and training in the use of technology to learners within the community.

**Technology Capacity**

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<th>Research Question: How does the technology capacity of School R affect administrator, teacher, and student use of educational technology?</th>
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<tr>
<td><strong>Primary Characteristics</strong></td>
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<td>Technology is accessible to both teachers and students, with an average of nearly five computers and a laser printer in each classroom. Combined with small class sizes provided through a grant, the resulting student to computer ratio is about 3:1 or 4:1 in most classrooms.</td>
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<td>All computers are newer models capable of running current software and are connected to the Internet.</td>
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<td>The school has invested most heavily in education software for assessing and developing reading and mathematics skills.</td>
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<td>Three fourths of interview respondents referred to some type of software as a characteristic of the school’s technology environment that contributes to student achievement.</td>
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<tr>
<td>The school does not have a computer laboratory so that all computers can be located in classrooms, and teachers generally agree with this decision.</td>
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On the technology infrastructure inventory survey, School R reported having an average of one computer per administrative or staff office, one computer in the library, no computer laboratory,
and 4.9 computers per classroom. All computers are new models capable of running current software. School R reported that 62 of the classroom computers are connected to a local area network (LAN), and all 78 have Internet access through a Digital Subscriber Line (DSL). The school reported that each administrator or staff office, the library, and each classroom have a laser printer. The school did not report having any projectors or monitors in any location, but monitors were reported in interviews and observed in classrooms. School R reported having servers for an integrated learning system, LAN, e-mail, printers, and the Web. All teachers at School R are provided with a laptop or desktop computer for home. An administrator mentioned that the school is considering “getting the students hand-held devices, Palms, laptops, something like that.”

On the software inventory section of the survey, School R reported owning a total of 21 different software titles. The application software titles included a software suite, Web browser, print creativity, and two reference titles. The education software titles included four reading skills, two mathematics skills, two mathematics instruction, two science, one reading assessment, one mathematics assessment, and one keyboarding title. The school reported using one student information system, and two titles that were not coded. School R has a LAN messaging system that allows students to send e-mail within the school. The school has purchased two reading assessment software applications as well as mathematics instruction software and mathematics assessment applications. The school also has a variety of skills development software; some software is purchased by individual teachers, especially in the lower grades. Students are able to use a state achievement test preparation program using bubble sheets that are scanned in and the results are reported.

When asked what characteristics of School R’s technology environment facilitate use of technology in ways that contribute to student achievement, seven (77.8 percent) of the nine administrators and teachers who were interviewed referred to a software title, although two of these mentioned that software at School R was inadequate in some respect. Centers or workshops, computers in the classroom, and communication with staff or parents were each mentioned by three respondents (33.3 percent). Two respondents (22.2 percent) referred to professional development. The combination of computers in classrooms, and the use of centers as an activity structure is a recurrent theme at School R. The school made a decision to place technology in the classrooms, rather than in a computer laboratory. Each classroom is equipped with at least four computers, a printer, Internet connectivity, a television monitor, VCR, and audio player. Each classroom also has access to reading, mathematics, and test preparation software.

Because of small class sizes of 14 to 15 students made possible by a grant, there is student to computer ratio of 3:1 or 4:1. As a result, students can use a computer every day. Referring to the decision to establish a computer laboratory, one administrator said, “We years ago took that issue on in depth with our teaching staff. Thank goodness, our choice was not to do that. Our choice was to establish computer labs in every classroom. Now there’s a big difference between taking your class once or twice a week down to the computer lab and doing whatever you might have the students do. There’s a big difference between that and having computers in the classroom all day long that students can use.” Another administrator remarked, “When computers are used in the classroom, they tend to become much more transparent as opposed to a computer lab where
you go to do computer work. If the computer’s in the classroom, the kids tend to think of it as just the computer that they use to do school stuff, as opposed to being at school and going to do computer stuff.” The teachers generally agree with the policy of having the computers in the classroom. The drawback, as one mentioned, is that you cannot do something in which all of the students would need to be on the computer. A third administrator agreed that placing computers in classrooms was a good decision. “But, now we need a lab, too.”

**Resources, Strategies, and Structures**

**Research Question:** What *resources, strategies, and structures* does School R use to become a high-technology school, and to what extent are these integrated with other school improvement efforts?

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<th>Primary Characteristics</th>
<th>Secondary Characteristics</th>
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<td>There is a strong consensus among teachers who were interviewed regarding the resources, strategies, and structures that contribute to student achievement in their classrooms. All interview respondents referred to a student grouping strategy. Two thirds mentioned meeting individual needs and one half mentioned interactive learning. All administrators who were interviewed mentioned money or grants as a resource that supports both the school learning environment in general and the technology environment in particular. Grant writing is a major focus of the district. Two thirds of administrator interview respondents mentioned professional development, hardware other than computers, and technology support staff as resources that contribute to student achievement through the school’s technology environment.</td>
<td>One third of teacher interview respondents referred to class size, centers, or stations, and technology aiding classroom management as resources, strategies, and structures that contribute to student achievement in their classrooms. The administration seems to be visionary in its goals, and effective in following through on them. It was not unusual for teacher interview respondents to praise individual administrators.</td>
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When asked about their classroom learning environment and the resources, strategies, and structures they have used to create that environment, all teachers (100 percent) who were interviewed at School R referred to a student grouping strategy. Four (66.7 percent) of the six teachers referred to meeting individual needs, and three (50 percent) mentioned interactive learning. Class size, centers, or stations and technology aiding classroom management were each mentioned by two respondents (33.3 percent). Most classrooms at School R are large, with ample room for students to move freely. Student furniture is age-appropriate, usually tables and chairs grouped to accommodate four to six students, and which at some part of the day become centers where students rotate for lessons. Student work and visual organizers are on the walls. Rooms
have grade-level and subject-area instructional materials along the walls in bookcases, manipulatives organized for easy student access, a classroom library, a sink, and storage.

Rotating centers are a common instructional approach at School R, with four computers comprising one of the centers, especially in the lower grades. Three teachers and one administrator talked about the centers. It seems that the administrator has actively encouraged the use of the centers. One teacher commented, “I always have five centers, and we do them over two days so we’ll do three centers on one day and two on the next, we rotate through.” Another teacher commented, “I really like the children being able to get to the computers, especially during center time that’s when they’re mainly used in my classroom. They love it, they enjoy it, and it’s fun.” In one class, students who had finished their work at the Read Alone Center moved to the Computer Center to use the reading assessment software, responding to comprehension questions and recording their work in their student folder. While the teacher worked on phonics with other students, she rotated to the adjacent computer center to review student work.

When administrators were asked about resources, strategies, and structures at the school level, money or grants was mentioned by all administrators (100 percent) who were interviewed as a resource used to develop both the school learning environment generally, and the technology environment specifically. Professional development, hardware other than computers, and technology support for staff were each mentioned by two (66.7 percent) of the three administrators who were interviewed as resources contributing to the school technology environment. Some teachers described the principal as being wonderful, giving the person credit for the development of the atmosphere in the building. Teachers also give credit to the Title 1 director for supporting them and their students, particularly in supporting some of the work done in centers. The superintendent seems very progressive and purposeful in keeping plans in place that lead to revenue sources that can improve learning.

Technology support is provided through the Technology Committee and the district technology coordinator. The technology committee is comprised of members of the administration, teachers, other staff, students, and community members. Its role is to provide general guidance and make recommendations to the district technology coordinator, superintendent, and board of education. The district technology coordinator oversees operations and manages support of all technology issues in the district. The district also has developed a “Student Technology Corps,” which is a secondary-level curriculum track for students interested in technology-based careers. Students in this track follow a small group, independent study, student mentor-based track that moves from basic troubleshooting to repair, and teacher training to network systems administration. All work done by this group supports the district and community network and systems. Students emerging from this course of study leave high school as experts trained and experienced in the use and management of current technology. The technology coordinator was hired as a less-expensive alternative to outsourcing technology support, and also provides staff development and is a good grant writer.

School R has been very active and successful in grant writing. The school qualifies for a number of grants because of at-risk population, and they basically have two full-time grant writers who work for the school district. They have brought in millions of dollars over the past years. Grants have been used for professional development, smaller class sizes, and technology. Reduced class
sizes were made possible through a grant that is worth about a half million dollars a year. One teacher described some of the benefits of the smaller class sizes: “Although our [state achievement test] scores were increasing before we had the smaller class size, I can see what a difference it has made for me as a teacher reaching these children; how much further along they are. I’ll do activities with kids now that four or five years ago were difficult for them and now early in first grade, coming from a smaller kindergarten class, they’re simple for them to do. I’m able to take them further than I was before.” Title 1 funds provide support for a variety of things, including the use of teacher aides and placing computers into classrooms.

The local community is supportive, which one administrator believed to be unusual for a low-income population. Two bond proposals have been passed in the last 10 years that have allowed them to improve their facilities. There are also a variety of parent and grandparent volunteers.

Classroom Vignettes

Three lessons were observed during the site visit. The first observation was a mixed second- and third-grade social studies and language arts class of 30 students. The second observation was a second-grade social language arts class of 15 students. The third observation was a third-grade mathematics class of 17 students. In two of the three observations, teachers and students were observed using computers or other technologies; these two observations are described below.

Teachers used technology to reinforce and evaluate student learning or for research. In one case, students were assigned to use technology for the expressed purpose of assessment, and in the other case, students used technology for research that would reinforce the day’s lesson. Teachers began lessons by orienting students to the lesson topic and then allowing them to engage in these activities by themselves or in collaborative groups.

In each case, teachers were interviewed before the lesson to establish a context for the lesson observation and an understanding of how instructional strategies and technology would 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.

Second Graders in an English Class

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<th>Class 2</th>
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<tbody>
<tr>
<td>Grade: 2</td>
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<tr>
<td>Subject: English</td>
</tr>
<tr>
<td>Setting: Classroom</td>
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<tr>
<td>Teacher Hardware Used: Computer</td>
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<tr>
<td>Teacher Software Used: Reading assessment</td>
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<tr>
<td>Student Hardware Used: Computer</td>
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<tr>
<td>Student Software Used: Reading assessment</td>
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Before the lesson, the teacher indicated that students would be working in cooperative groups in centers on four different activities: expressing themselves artistically, reading alone, library, and
phonics. The teacher planned to assess student learning based on performance on a reading assessment software application and the final products of the other activities.

This lesson took place in a classroom which was equipped with four desktop computers, one printer, audio player, overhead projector, video player, television, and microphone. Fifteen second-grade students sat at five tables. The classroom was rich with visual prompts and student work displayed on the walls. The classroom was organized into centers that could accommodate from one to six students. The teacher used a lavaliere microphone so that students could better hear the teacher in the large room (all teachers received this technology from a grant a few years ago for the purpose of being heard without being loud).

The teacher divided the class into four groups: library, poster, read-alone, and phonics. Students were directed to rotate groups. The library group read books aloud to the teacher aide while the other students read silently waiting their turn. When they are ready, students took assessment tests on the reading assessment software application. Students taking the reading assessment test used the application for less than five minutes or for between 5–15 minutes. The poster group worked on a baseball poster project, which included brainstorming and sketching. The read-alone students were directed to read silently at a table. The teacher worked with the phonics group on workbook pages on consonants. During the lesson, the teacher kept students on task and directed rotations by saying “switch.” Students were engaged in their tasks and self-directed with occasional checks from the teacher.

After the lesson, the teacher reported that most students accomplished what was planned and remained on task during the lesson. The teacher noted that the phonics activity was adjusted based on student feedback after the student groups rotated once. Student learning also was assessed by performance on the reading assessment software application and a phonics test. The teacher added that School R is fortunate to receive Title I funding which keeps class sizes small, enhancing the learning environment.

**Third Graders in a Mathematics Class**

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<th>Class 3</th>
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<tr>
<td>Grade:</td>
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<tr>
<td>Subject:</td>
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<td>Setting:</td>
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<td>Teacher Hardware Used:</td>
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<td>Teacher Software Used:</td>
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<td>Student Hardware Used:</td>
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<td>Student Software Used:</td>
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Before the lesson, the teacher indicated that students would be learning to collect data and display the data in a graph, which is included in district and state standards. The teacher planned to have students access a Web site where they could collect data which they would then process and display in a graph. To accomplish this, the teacher planned to introduce the activity and then have students work in collaborative groups on the assignment. Students would be assessed by the graphs that they would print out and hand into the teacher at the end of the lesson.
The observed lesson took place in a classroom, which was equipped with five desktop computers, two printers, one audio player, overhead projector, video player, television, and calculator. During the lesson, 17 third graders sat at six tables. The teacher begins the lesson on graphing by listing the Web sites that students may access on the blackboard. Four students attempted to connect to one of the Web sites on the four classroom computers, but only two were able to connect to the Web site. Once connected to the site, the teacher showed students the different kinds of information that were available, but told them they would only be looking for “local snowfall.” Students used computers for 5–15 minutes.

Each table of four to six students then used the printouts of the snowfall data in the immediate geographic area of School R. The teacher shows students how to label the graph, and how a “line graph” is used to show “how something changes over time.” The teacher then instructed each group to transfer the weather data from the Internet onto the graph that they were making by hand. Each of the group members had a role, such as to find the data, record the data by plotting the graph, check the graph after each data entry, and make sure the graph was properly labeled. The students appeared to be engaged in this project and enjoyed it. In addition to the teacher, a teacher’s aide also was available to assist students if necessary.

After the lesson, the teacher reported that other key concepts of graphing will be discussed in future lessons; however, students displayed great interest in the topic during the lesson. The teacher noted that having students conduct preliminary research for data on the Internet was an effective way to introduce the lesson, adding that computers capture and engage interest in addition to being useful for the lesson. The teacher also reported that students will be able to interpret and draw conclusions from graphs and data, which are skills assessed by the state achievement test, as a result of the lesson.
References


