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

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Case Report on School E

Education Trust High-Poverty: Yes
Education Trust High-Minority: No
Location: Rural
Grades Served: K–6

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 E in this report, which is based on the following data collected from the school:

- Eight teachers and two administrators were interviewed during the first site visit.
- Seven classrooms were observed during the first site visit.
- A district technology plan was collected during the site visits.
- Ten teachers (59 percent) returned a survey.
- One administrator (100 percent) returned a survey.
- Three lessons were observed during the second site visit.
Case Background

School E is located in a coastal community. The economy of the county has historically been dominated by commercial fishing. The fishing industry has declined due to regulations and other environmental and economic factors. Recent real estate development and associated tourism in the area have begun to change the tax base somewhat. Respondents noted that until the fishing industry began to decline, a good education was not critical to economic success and, as a result, many students’ parents did not graduate from high school. As a result, individuals from traditional fishing families have increasingly come to value education. Respondents also noted that although real estate development and tourism have brought some households with high levels of education into the community, those families either do not have children or do not send their children to School E. There is the sense that a charter school in the district may have been created primarily for these families.

In 2001–02, approximately 1,500 students attended schools in this district. The district operates two elementary schools, one PK–12 school, one high school, one adult school, and one alternative education school. Approximately 80 percent of the student population within this district is white, with some African-American, and Latino representation as well. More than 50 percent of students in this district are eligible for free or reduced-price lunches and less than 1 percent are limited English proficient (LEP).

School E serves approximately 300 students in Grades K–6. The student population is overwhelmingly white, with only a few African-American and multiracial students. In School E, almost three fourths of the students are eligible for free or reduced-price lunches, and none are LEP. Most minority families are concentrated within a certain area of this district, and the local elementary school serving this area is approximately 40 percent black students. One respondent noted that some families in the region bring their children “across the bridge” to attend School E, although a large majority of students reside in the neighborhood in which the school is situated. The school system has school choice at all grade levels, so any student in the district can attend any elementary school.

Case Summary

Respondents describe School E as a small, rural school that is like a family; a place where teachers work together to provide a quality education and try to be as innovative as possible. One respondent observed, “We try to look at the whole child, and try to understand where they’re coming from. A lot of our kids have problems at home and we’re so small we know about them.” The effects of poverty are plainly visible in the immediate neighborhood surrounding School E. One respondent noted, “Some children don’t have running water or windows in their homes.” The spirit of the administrators and teachers was perhaps best summed up by the respondent who said, “I love this little school; it breaks its back to help these babies.” Respondents also described both the previous and current principals as being very supportive of group decision making in their management styles.

Student learning is supported through several supplemental programs, including after-school tutoring, peer tutoring, after-school, and reading programs. Students are recognized for their
achievements in academics and citizenship, and they participate in academic challenges such as a geography bee, spelling bee, the school’s speech contest, and the Presidential Academic Award. Students may also be involved in extracurricular activities, such as student government, career exploration, band, newspaper club, and Roots & Shoots Club.

Teachers rely on a variety of strategies and resources in the core areas to instruct their students, including team teaching, use of parent volunteers, interdisciplinary writing, and the use of content-related software such as reading assessment and multicurricular instruction applications. The curriculum at School E is guided by the state assessments and is aligned to state standards with an emphasis on basic skills and reading. Teachers use two phonics-based reading series, and use technology to analyze student data and determine achievement gaps. All students in Grades 1–6 receive at least two 30-minute blocks of computer time a week for skills practice using multicurricular instruction software. Students who are in need of remediation spend an extra 30 minutes a day on the multi-curricular instruction application and their progress is assessed quarterly. The teachers are very enthusiastic about this software, noting perceived similarities between it and the state achievement tests.

Teachers at School E consider themselves caring and competent professionals dedicated to helping students achieve. Teachers engage in professional development opportunities to stay current on instructional practices and technology. There is a great degree of collaboration among the teachers. For example, during summer workshops, the second-grade teachers meet with the first-grade teachers to share what materials the students will need to know in order to be prepared to enter second grade by the end of the year.

Teachers also are enthusiastic users of technology, which they reported they use most frequently to create instructional materials, present information to students, and communicate with parents/guardians and staff. Teachers also most frequently reported using word processor and Web browser software on a daily basis. Teacher reported that they most frequently assign students to use technology to master and remediate skills, improve computer skills, and work independently. Teachers also noted that student use of technology to master and remediate skills, work independently, and improving computer skills have had the most significant effect on student achievement.

The administrators are viewed as being supportive of teachers and their use of technology. Among the administrators’ highest priorities for school improvement and technology are increasing professional development opportunities; improving student achievement on state assessments; and improving student achievement on standardized assessments. This school’s administrators most frequently use technology to create administrative materials, and analyze student data for school improvement; these uses also have reportedly had the most significant impact on administrative practices.

The teachers and administrators reported generally positive views toward the district technology plan and the adequacy and maintenance of technology at the school. The administration is supportive of technology and grant funding and professional development, which have contributed greatly to technology use at School E.
School E’s state achievement test results for the most recent three years show high percentages of students exceeding standards for language arts, math, and writing. School E has enjoyed extremely high writing scores, which respondents attribute to an excellent fourth-grade teacher. It should be noted, however, that mathematics performance in Grades 3–6 also declined from more than 75 percent of students meeting high standards in 2001 to just more than one half meeting high standards in 2002.

**Academic Achievement**

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<th>Research Question: What effects on academic achievement do administrators and teachers in School E attribute to educational technology?</th>
<th>Primary Characteristics</th>
<th>Secondary Characteristics</th>
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| All teacher survey respondents reported that software for multicurricular instruction has the most significant impact on student achievement. Purposes related to literacy skills development, math skills development, and instruction/practice were most commonly reported student uses of software with the greatest effect on student achievement. All teacher survey respondents reported assigning students to use technology at least weekly for mastering skills just taught, remediating skills not learned, improving computer skills, and learning to work independently. One half or more respondents reported assigning technology use at least weekly for the following purposes: a reward for good behavior; learning to work collaboratively; exploring concepts, models or simulations; analyzing information or solving problems; express themselves in writing; and conduct research or gather information. More than four fifths of teacher survey respondents ranked remediating skills not learned among the top three purposes of student technology use with the greatest effect on student achievement, and almost as many reported mastering skills just taught in the top three. | Two fifths of teachers and administrators interviewed at School E indicated staff teamwork and teachers’ concern for students as the key defining characteristics of this school as a whole, with the greatest impact on student achievement. At least one quarter of teachers and administrators also listed teacher competence, high academic expectations, primary preparation, and individuation of instruction as characteristics of School E as a whole that contribute to student achievement. With regard to the specific uses of student technology that have the greatest impact on student achievement, slightly less than one half of respondents indicated meeting individual needs and software applications as the most frequently mentioned factors. Teacher survey respondents reported reading assessment and multicurricular skills applications among the software titles with the greatest effect on student achievement. Two fifths of teacher survey respondents ranked learning to work independently as one of the top three purposes of student technology use with the greatest effect on student achievement. One third of survey respondents ranked improving computer skills among the top three purposes.
When asked what characteristics of School E as a whole contribute most to student achievement, four (40 percent) of the 10 teachers and administrators who were interviewed reported both staff teamwork and teacher care for students. Three (30 percent) respondents cited teacher competence, while two (20 percent) reported high academic expectations, primary preparation, and meeting the individual needs of students. Although teachers in School E possess the usual characteristics of being caring and supportive, there is a striking level of collaboration that is very much focused on ensuring consistency and preparation from grade to grade which emerged in the analysis of the interview transcripts. School E teachers appear to work together, and are willing to communicate and share information with one another. They collaborate to determine the best methods of helping students succeed. During summer workshops, for example, second-grade teachers meet with first-grade teachers to articulate what prerequisites need to be covered in the lower grades to ensure that students, upon completion of the first grade, will be prepared for their next year of instruction.

Student achievement at School E is measured by the state level achievement test. School E’s test results for the most recent three years show 60 percent to 70 percent of students meeting high standards for reading, 40 percent to 55 percent for math, and more than 90 percent for writing (no writing scores are available for 2002 because of the low numbers of test takers). The state gives schools a grade based on their students’ test performance. Respondents cited the substitution of the writing score with the reading score in 2002 as the reason for this drop-off. In their state, the writing test is only administered to fourth-grade students. If fewer than 30 students take the writing test, the reading test scores are substituted in the formula used to determine grades. School E has enjoyed extremely high writing scores, which respondents attributed to an excellent fourth grade teacher. It should be noted, however, that mathematics performance in Grades 3–6 also declined from more than 75 percent meeting high standards in 2001 to just more than 50 percent meeting high standards in 2002.

Administrators and teachers at School E take student achievement very seriously, and credit strong teaching, high expectations, and remediation for their success. The school’s high expectations are clearly communicated to students, and incentives such as “food bribery” and awards are frequently offered. Students in need of remediation spend an extra 30 minutes each day in the computer laboratory using multicurricular instruction software. For the first nine weeks, these students are determined by state test scores from the previous year. The list is redrawn at the end of each quarter based on reports generated by multicurricular instruction software. At the end of the school year, several students receive $10 awards in recognition of having the highest or most improved state test scores, the highest grade point average, the most Accelerated Reader points, the greatest gains on multicurricular instruction software, and perfect attendance.

When asked about the specific uses of student technology that has the greatest impact on student achievement, four (40 percent) of the 10 respondents indicated through interviews meeting individual needs, and software applications as the most frequently mentioned factors. Additionally, two (20 percent) respondents indicated self-directed learning and practicing standardized tests as methods of technology use that facilitate student achievement at School E. School E has used a reading and mathematics series that emphasizes basic skills in recent years, and currently uses one phonics-based reading series for Grades K–1 and another phonics-based
series for Grades 2–6. All teachers at School E participated in choosing and integrating these applications into the school’s curriculum. Respondents credited the phonics-based series that is currently used in Grades K–1 with having the strongest effect on student achievement at the school. Technology, especially the multi-curricular instruction software application, was credited with a support role.

All ten (100 percent) of the teachers who returned a technology inventory survey reported multicurricular instruction software among the titles with the greatest impact on student achievement. Respondents listed reading assessment software (n=4) and multicurricular skills (n=2) applications also among the top three 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=14), math (n=11), instruction (n=8), assessment (n=2), writing (n=2), and research (n=2).

The technology inventory survey also asked teachers to indicate how often they assign their students to use educational technology for each of 16 prespecified purposes. All 10 of the teacher survey respondents (100 percent) reported assigning their students to use technology at least weekly to master skills just taught, remediate skills not learned, improve their computer skills, and to learn to work independently. Eight (80 percent) have their students use computers at least weekly as a reward for good behavior, and seven (70 percent) assign students to use computers to learn to work collaboratively at least weekly. Six teachers (60 percent) assign their student to use computers to explore concepts, models or simulations, analyze information or solve problems at least weekly, and five (50 percent) reported assigning computer use at least weekly so students could express themselves in writing, and conduct research or gather information. Teachers reported assigning computer use least frequently for the following purposes: nine teachers (90 percent) reported assigning technology use for communication with people outside of the classroom, and eight (80 percent) reported assigning the creation of multimedia presentations, publications, publishing work on the Web, and presenting information to an audience monthly or less. Seven teachers (70 percent) reported that they assigned technology to graphically organize information and ideas monthly or less.

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. Nine (90 percent) respondents included remediating skills not learned within the top three purposes for student technology use; seven (70 percent) ranked this purpose as number one. Seven (70 percent) teachers included mastering skills just taught among the top three purposes, with all seven ranking this item as number one. Four (40 percent) teachers indicated learning to work independently among the top three purposes, with all four ranking this item as number three. Three respondents (30 percent) included improving computer skills among the top three purposes of technology use.
Technology Use

**Research Question:** What *kinds of educational technology* do administrators, teachers, and students in School E use?

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<th>Primary Characteristics</th>
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<td>Teacher survey respondents most frequently reported using computers and printers. Hardware use is reported used on a daily basis in the classroom or computer laboratory. Teacher survey respondents most frequently reported using word processors and Web browsers. Respondents reported using software daily in the classroom. Teacher survey respondents most frequently reported assigning students to use computers and a printer. Respondents reported assigning hardware use on a daily basis in the classroom and computer laboratory. Teacher survey respondents most frequently reported assigning students to use multcurricular skills, and instruction and assessment software. Respondents reported software use occurs on a daily basis in the classroom, with some use in the computer laboratory. Students used computers in about three fourths of the classroom observations. All of these observations were of students using computers individually. Students were observed using reading and other educational software.</td>
<td>Teacher survey respondents reported using digital cameras and projectors. Teacher survey respondents reported assigning students to use educational software applications for reading, a Web browser, and software suite. Teachers were observed using technology in one third of the classroom observations. The only software that was observed used by teachers was a Web browser.</td>
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Although the computer laboratory and multcurricular instruction software were initiated by district administrators, School E administrators and teachers have embraced the concept enthusiastically. Multcurricular instruction software has clearly become the centerpiece of School E’s technology integration efforts. Respondents attributed their enthusiasm to a comparison of reports provided by this software and state test results that the technology specialist prepared at the end of last year. Teachers perceived similarities between the software reports and the state test that significantly increased their confidence in the program. Every student in Grades 1–6 spends at least two 30-minute periods per week in the computer laboratory, and the classroom teacher accompanies students in the laboratory on for at least one of those periods. All computer laboratory time is dedicated to the multcurricular instruction
application, except in those rare instances when teachers are doing projects in their classrooms and need to use the computer laboratory for Internet research or other purposes.

Several respondents emphasized the value of the reports that the multicurricular instruction software generates as being the most valuable aspect of the program. A first-grade student, for example, is enrolled in level 1.0 at the beginning of the year, and the software advances the student automatically when certain skills have been mastered. When a student needs remediation of a particular skill, the technology specialist enrolls the student under a different identification number and sets that account to a lower level. Respondents believe that the multicurricular instruction application is a valuable tutor that provides individual attention that would not be possible without this technology. Respondents tend to believe that the reports generated by the software are even more valuable, however, because they enable the teacher to individualize face-to-face instruction for each student.

Technology use at School E appears to have been initiated by the district and embraced by administrators and teachers at the school. Two district administrators were cited by one respondent as having been particularly responsible for major improvements in the technology infrastructure, hardware, and software at the school. The district purchased reading assessment and multicurricular instruction software, which are clearly the two most used software applications at the school, as well as mathematics instruction software. The district also has purchased another multicurricular instruction application for use during the 2003–04 school year.

The administrator who completed a technology inventory reported daily use of both a computer and printer, with predominant use of this hardware at the office. Additionally, the administrator reported using a scanner in the school’s computer laboratory on less than a monthly basis. Software utilized by this school’s administrator includes word processing and Web browser applications, both of which are used on a daily basis at the office.

Teachers used computers and printers in two of the seven classroom observations during the winter site visit, and were observed using this hardware for a duration of 5 minutes to 15 minutes. In five of the seven classroom observations, teachers were not observed using any hardware at all. The only software teachers were observed using was a Web browser application; this was observed in two different classrooms.

Teachers who returned a technology inventory survey most frequently reported using a computer (n=10) and a printer (n=10). Other hardware use includes a digital camera (n=4), and projector—type not specified (n=2). Most hardware was reportedly used daily (n=18) in the classroom (n=20), or the school’s computer laboratory (n=10). Among software titles, teachers most frequently reported using a word processor (n=10) and a Web browser (n=10). Other software reported includes applications for multicurricular instruction (n=5), reading assessment (n=3), and grading (n=2). Most software was used daily (n=23) in the classroom (n=32).

Students used computers in five of the seven observations conducted during the winter site visit. All five observations were of student computer use on a one-to-one ratio for more than 15 minutes at a time. Students were not observed using any other technology during these on-site observations. Three students were observed using reading instruction software, while an
additional two students were observed using multicurricular assessment software during on-site observations. No other observation of software use was coded for more than one classroom.

Teachers who returned a technology inventory survey most frequently reported assigning students to use a computer (n=9) and a printer (n=6). No other student hardware was coded more than once. Teachers reported assigning most hardware on a daily (n=12) basis, and is typically used in the classroom (n=14) or computer laboratory (n=13). In terms of software, teachers most frequently reported assigning students to use multicurricular skills, instruction, and assessment software (n=12), as well as reading skills and assessment software (n=5). Other software assigned includes a Web browser (n=3) and software suite (n=2). Most software use by students occurs on a daily (n=26) basis in the classroom (n=31) or computer laboratory (n=20).

Educational Technology Practices

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<th>Research Question: What educational technology practices do administrators and teachers in School E employ?</th>
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<td><strong>Primary Characteristics</strong></td>
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<td>Two thirds of interview respondents reported that use of technology to meet individual needs of students, and communication with staff and parents has significantly affected professional practice.</td>
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<td>Survey respondents most frequently reported word processor, Web browser, and a software suite as the software titles that have had the greatest effect on teaching practice. Respondents commonly reported using software for communication, creating documents, and general instruction.</td>
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<td>All teacher survey respondents reported using technology to create instructional materials on a daily or weekly basis. Four fifths of respondents reported using technology at least weekly to gather information for planning lessons or accessing model lesson plans, and more than one half use technology at least weekly for the following purposes: present information to students, communicate with students’ parents, keep records, and communicate with colleagues.</td>
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<td>Four fifths of survey respondents ranked creating instructional materials as one of the top three purposes of technology use with the greatest effect on practice.</td>
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When asked about the professional uses of technology that have the greatest effect on their practice and student achievement, six (75 percent) of the eight teachers and administrators who were interviewed mentioned meeting the individual needs of students and communication (with staff, parents, or others). Three (37.5 percent) respondents each reported tracking student data and finding, creating, or updating instructional resources. Two (25 percent) respondents each indicated standardized tests, local area networks, software, management/organization, and finding professional development resources.

The administrator who completed a technology inventory survey reported that software for word processing, used specifically for creating administrative materials, has had the greatest impact on administrative practices. When asked to rank the top three technology uses from a specified list of administrative purposes, the administrator for School E ranked creating administrative materials, maintaining administrative records, and analyzing student data for school improvement as first, second, and third respectively. This administrator generally uses technology on a daily basis to accomplish these objectives. Teachers at School E tended to view the administration at School E—principals and superintendents included—as supportive of technology use and integration on campus, as evidenced by the active roles the administration has assumed in applying for grant dollars to support this school’s technology initiatives.

Teachers who returned a technology inventory survey most frequently listed a word processor (n=6), Web browser (n=6), and software suite (n=5) among the top three titles that have had the greatest effect on their teaching practices. Other software reported included multcurricular instruction applications (n=4). 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 given software titles were each coded into the appropriate category. The most commonly reported purposes were communication (n=8), document creation (n=6), instruction (n=6), administration (n=4), research (n=3), and instructional materials (n=2).

The technology inventory survey also asked teachers to indicate how often they use technology for each of several specified purposes. All of the respondents (100 percent) reported use of technology on a daily or weekly basis to create instructional materials. Eight (80 percent) reported using technology at least weekly to gather information for planning lessons or accessing model lesson plans, and presenting information to students. Seven (70 percent) use technology at least weekly to communicate with students’ parents or guardians, and six (60 percent) reported that they use technology to keep administrative records and communicate with teaching colleagues on a daily or weekly basis. Four respondents (40 percent) reported accessing information and research on best practices for teaching at least weekly. All 10 teachers (100 percent) reported using technology monthly or less to communicate with students outside the classroom. Teachers also reported using technology least frequently to publish student work on the Web and publish class information on the Web; at least seven (70 percent) respondents reported using technology for either purpose monthly or less.

The survey then asked teachers to select the three purposes from the list of 10 that have had the most significant effect on their practice, ranking them in order from one to three. Eight (80 percent) of the 10 respondents ranked creating instructional materials in the top three purposes,
and seven (70 percent) of those eight ranked this purpose first. Four (40 percent) respondents ranked gathering information for lesson planning within the top three, and three (30 percent) of those four ranked this purpose as second. Four (40 percent) also included keeping administrative records within the top three, with two (20 percent) of the four ranking this item as second, and two others ranking it as third.

A total of seven classes were observed at School E; one observation each was made in first, second, fourth, and fifth grades, two were made in the sixth grade, and one additional observation was made in a mixed elementary classroom. Five of the seven observations were made in a classroom setting, with two observations being made in the school’s computer laboratory. Language arts was the dominant subject in five of the observations and mathematics was the dominant subject in two. Six different activity structures were observed; individual work was observed in every class, an adult-led large group structure was observed in five classes, and collaborative pairs, collaborative small-group, adult tutoring, and peer tutoring structures were each observed in one class. Individual and adult-led large group structures were each recorded as the dominant activity in five classes, while the collaborative small group structure was recorded as dominant in the remaining class.

Very clearly, the curriculum at School E is guided by state assessments. Accordingly, teachers and administrators both structure their practices in ways that maximize student preparation through developing and reinforcing content knowledge and test-taking skills. Throughout this process, the administration is able to determine the degree to which the appropriate materials are available to accomplish this goal, while teachers are charged with making sure the technology resources that are available to students for this purpose are utilized. One School E teacher observed, “The money they [administrators] spend on our classroom computers and our computer laboratory, our instructional booklets for all students are very freely handed and given out and encouraged. And they encourage us greatly to use them.”

Interviews demonstrated the importance of preparation to School E, as evidenced by the role of multicurricular instruction and assessment as requirements in the curriculum. Classes spend a number of sessions each week in the computer laboratory using these applications to work on building both content knowledge and test-taking skills. Students generally work independently during this time. A significant benefit of these software applications is that they allow for individualization to meet particular student needs. Educators and administrators at School E focus their practices toward employing educational technology in ways that are thought to directly impact student achievement.
Educational Technology Policies

Research Question: What educational technology policies do administrators and teachers in School E implement?

<table>
<thead>
<tr>
<th>Primary Characteristics</th>
<th>Secondary Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Both administrator interview respondents referred to grants and money allocated for technology as benefits of state and federal policies. However, one administrator stated that these funds are insufficient.</td>
<td>Two fifths of interview respondents cited policies, plans, and standards, as well as grant dollars as important factors that support the use of technology in ways that contribute directly to student achievement.</td>
</tr>
<tr>
<td></td>
<td>One third of interview respondents stated that administration leadership and technology support for staff are key benefits offered to School E through school and district policies.</td>
</tr>
<tr>
<td></td>
<td>Slightly less than one fourth also cited professional development initiatives as benefits of school and district policies.</td>
</tr>
</tbody>
</table>

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 E who completed a survey indicated the highest priority for three of the 20 objectives: increasing professional development opportunities for teachers, improving student achievement on state assessments, and improving student achievement on standardized tests. Those objectives listed by this administrator as among the lowest priorities for School E include: supporting school-reform efforts, and publicizing student and school accomplishments.

Most respondents appear to have a generally favorable view of school and district policies, based on the knowledge they have of such policies. Respondents reported that the administration is supportive of technology integration at School E, and encourages teachers to use technology, especially through the dedicated laboratory times for student use of multcurricular instruction software. When asked specifically about school or district policies that help School E use technology in ways that contribute to student achievement, four (40 percent) of the 10 respondents interviewed cited both plans, policies, and standards, namely those that relate to technology use, and money or grants for computer and technology use. Three (30 percent) respondents indicated administration leadership and technology support for staff, while two (20 percent) respondents cited professional development initiatives. No other response was coded for more than one respondent. In terms of obstacles brought about by school and district policies, seven (70 percent) of the eight respondents reported that there are none, at least that they are aware of.

In terms of federal policies that promote the use of technology in School E, both of the administrators interviewed from School E (100 percent) indicated money or grants. No benefits due to state policies were coded for more than one administrator. One administrator (50 percent) reported that insufficient funding are state and federal policy obstacles.
Technology Capacity

**Research Question:** How does the *technology capacity* of School E affect administrator, teacher, and student use of educational technology?

<table>
<thead>
<tr>
<th>Primary Characteristics</th>
<th>Secondary Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Networked computers with Internet access are available in all classrooms.</td>
<td>Two fifths of interview respondents cited the computer laboratory and the provision of technology support for staff as the characteristics of the school’s technology environment that have the greatest impact on student achievement. Other characteristics of the school’s technology environment identified by at least one fourth of respondents include meeting individual needs, computers in the classroom, practicing standardized tests, assessing or documenting learning, local area networks, Internet, software, and general technology resources.</td>
</tr>
</tbody>
</table>

School E did not return a technology infrastructure survey.

The original emphasis on technology among administrators and teachers at School E was to put computers in classrooms. In Grades K–2 each classroom has four networked computers with Internet access. In Grades 3–6, each classroom has five networked computers with Internet access. The district wanted each school to have a computer laboratory, and won a grant that resulted in the purchase of 20 computers for a laboratory and multcurricular instruction software for the school three years ago. The computer laboratory currently has 31 networked computers with Internet access. Earlier software purchases of educational CD-ROMs reflected the emphasis on computers in the classroom as well as the strong orientation toward skills development. The district also purchased reading assessment software a few years ago.

When asked about the characteristics of School E’s technology environment that facilitate the use of technology in ways that contribute to student achievement, four (40 percent) of the 10 teachers and administrators who were interviewed mentioned the computer laboratory and technology support for staff. Three (30 percent) respondents mentioned computers in the classroom, and two (20 percent) respondents cited practicing standardized tests, assessing or documenting learning, local area networks, Internet, software, and general technology resources. No other responses were coded for more than one respondent.
Resources, Strategies, and Structures

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

<table>
<thead>
<tr>
<th>Primary Characteristics</th>
<th>Secondary Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>One half of interview respondents stated that the overall ambience of the classroom is the primary characteristic of the learning environment at School E contributing to student achievement.</td>
<td>About two fifths of interview respondents referred to classroom management, practice of standardized tests, print resources, and other instructional practices as primary characteristics of the learning environment.</td>
</tr>
<tr>
<td>Both administrator survey respondents cited professional development as an invaluable resource to School E that has contributed substantially to the development of its technology environment.</td>
<td>Secondarily, one fourth of teacher interview respondents mentioned content-specific strategies; classroom materials and supplies; teacher-created materials; computers in the classroom; finding, creating, or updating instructional resources; frequent use of technology; and planning instruction as important factors contributing to the overall learning environment.</td>
</tr>
</tbody>
</table>

The district employs a full-time technology person who addresses technology maintenance issues and is viewed as being helpful, and is well-respected. At the building level, a key technology person is a teacher. This teacher has developed the role of being the technology specialist in the school and helps to maintain computers and has an important role in assisting teachers in identifying useful software. This teacher also helps teachers and students alike in learning how to use such software.

When asked about their classroom learning environment and the resources, strategies, and structures they have used to create that environment, four (50 percent) of the eight teachers interviewed indicated the overall ambience of the classroom. Three (37.5 percent) teachers stated classroom management, practice standardized tests, other instructional practices, print resources, and other instructional materials. Two (25 percent) teachers commented content-specific strategies; classroom materials and supplies; teacher-created materials; computers in the classroom; finding, creating, or updating instructional resources; frequent use of technology; and planning instruction.

When administrators were asked about resources, strategies, and structures at the school level, no response was coded for more than one administrator. When administrators were asked about the specific factors that contributed to the development of the technology environment in the school, both (100 percent) cited professional development.
Classroom Vignettes

Three classroom lessons were observed at School E. The first was of an English class of 16 first graders. The second was of an English class of 19 second graders. The third was of a social studies class of 16 sixth graders. Teachers or students were observed using computers and other technologies in each of the lessons. In each case, teachers were interviewed before the lesson to establish a context for the lesson and an understanding of how instructional strategies and technology would be integrated to facilitate student learning. Teachers also were interviewed following each observation to interpret the lesson interpretation and the role of technology in achieving specific lesson outcomes.

Students and teachers used technology in all three observations. Teacher use of technology was limited to assisting students during the lessons. In the first- and second-grade classrooms, the school’s emphasis on skills development in the primary grades and the close integration of technology with this objective are evident. In these observations, students were assigned to use technology for skills development and assessment. Internet research observed in the third lesson was not as closely integrated, but it was evident that most of these students had developed a significant amount of proficiency with the Internet. In all observations, students and teachers shared a comfortable rapport and students were predominantly self-directed and on task.

First Graders in an English Class

<table>
<thead>
<tr>
<th>Class 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade: 1</td>
</tr>
<tr>
<td>Subject: English</td>
</tr>
<tr>
<td>Setting: Classroom</td>
</tr>
<tr>
<td>Teacher Hardware Used: Computer</td>
</tr>
<tr>
<td>Teacher Software Used: Multicurricular skills</td>
</tr>
<tr>
<td>Student Hardware Used: Computer</td>
</tr>
<tr>
<td>Student Software Used: Reading assessment, multicurricular instruction, multicurricular skills, math skills</td>
</tr>
</tbody>
</table>

Before the observation, the teacher explained that the observation would not be of a formed lesson, instead students would be having “enrichment time” and working at six centers: multicurricular instruction and reading assessment software, reading center, writing center, puzzle center, and math center (manipulatives). The teacher planned to assess students through observation during the lesson and review student performance on reports generated by the computer programs used.

This observation took place in the first-grade classroom, which was equipped with six desktop computers, two audio players, two video players, a printer, and a television. During the observation, 16 students were seated in three clusters of desks pulled together in one group of four and two groups of seven. The teacher gave students a seatwork assignment to complete before going to centers, except that four students were allowed to go to computers and three students were called into a reading group with the teacher. Three of these students used multicurricular instruction software and one used reading assessment software; the former...
students wore earphones. All students were able to quickly launch their programs and settled into work immediately. The student using reading assessment software completed the test in just a couple of minutes. During, the observation, some other students went to this computer to take a reading assessment when they had finished reading a book. The students using multicurricular instruction software stayed in that program for approximately 25 minutes. As they finished each exercise, they announced their scores to the room. When they were completely finished, they went to their desks to complete the seatwork assignment before returning to the computers to play educational games on CD-ROM. In general, duration of student use of software was less than five minutes in some cases and more than 15 minutes in others. In addition to multicurricular instruction and reading assessment software, students also used a variety of educational software CD-ROMs.

The teacher called three students into a reading group with her at a semicircular table in one corner of the room. The materials used in this group are part of the K–1 phonics program, and the school’s strong focus on phonics is evident as students applied the phonics rules they have learned to decode words. The teacher showed students sight words on flash cards and gave the card to the student if he/she correctly pronounced it. There was a great deal of competition among the students to see who could collect the most cards. When the students finished the sight words, the teacher gave them permission to get a strawberry candy from her desk. The teacher then told the students that they need to read aloud from a “fluency book,” a leveled booklet. The teacher asked students to reread several passages until they were fluent. At one point, she referred to a character in the book and asked students, “Is that how she would have said it?” The students reread the passage with much more expression than before. The teacher then dismissed the group to complete the seatwork assignment.

As students completed the seatwork assignment, the teacher gave them permission to go to their centers. The teacher occasionally gave directions to students at their seats or in centers, asking them to help each other or reminding them of behavioral norms. In one case, the teacher asked a student if she had taken her reading assessment, and told her to read a book because she needed to take a test that day. At another point, the teacher logged a student into a computer so the student could use multicurricular instruction software. One student worked at a publishing center writing a story. Four students played a game on the floor, and four other students worked on a puzzle on the floor.

After the lesson, the teacher stated that based on observations, students appeared to learn what they were supposed to learn at each of the centers. The teacher stated that students’ questions were not answered right away in an effort to help them become independent learners, noting that once students complete their work at an assigned center, they are free to move onto another center, but they must stay on task during enrichment time. The teacher expressed confidence in the computer programs that students are assigned to use, especially multicurricular instruction software, and linked student use of software to high performance on achievement tests.
Second-Grade English Class

<table>
<thead>
<tr>
<th>Class 2</th>
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</thead>
<tbody>
<tr>
<td>Grade:</td>
<td>2</td>
</tr>
<tr>
<td>Subject:</td>
<td>English</td>
</tr>
<tr>
<td>Setting:</td>
<td>Classroom</td>
</tr>
<tr>
<td>Teacher Hardware Used:</td>
<td>None</td>
</tr>
<tr>
<td>Teacher Software Used:</td>
<td>None</td>
</tr>
<tr>
<td>Student Hardware Used:</td>
<td>Computer</td>
</tr>
<tr>
<td>Student Software Used:</td>
<td>Reading assessment, multicurricular instruction</td>
</tr>
</tbody>
</table>

Before the observation, the teacher stated that students would learn various phonics skills and ways of spelling the long “o” sound as well as comprehension skills. The teacher planned to present the material before engaging students in a discussion of the material. The teacher also planned to use the 2–6 phonics series during the lesson. The teacher planned to assess students by spot-checking their work.

This observation took place in the second-grade classroom, which was equipped with five desktop computers, a printer, audio player, overhead projector, video player, and television. During the observation, 19 students were working independently and in pairs. Four students were reading to each other in two pairs. Three students were using computers along the wall by the teacher’s desk; two of the students were using multicurricular instruction software and wearing headphones and the third student was taking a test on reading assessment software. Seven students were reading silently at their desks, four were selecting books from the classroom library, and one was completing a worksheet. Other students came to the reading assessment computer to take a test as they finished reading their books. The teacher observed the students at work, occasionally redirecting students and checking on progress.

About 20 minutes into the observation, the teacher announced that no more students should take a reading assessment because the class would be moving on in a moment. A couple of minutes later, she asked students to put their books back in the classroom library and clear their desks. Student desks were pulled together into five groups of four or five desks each. The teacher had written several words on the blackboard that were part of a phonics lesson. The teacher called on students to read each line of words aloud, and asked the class several questions about the words. The students were engaged in this lesson and raised their hands eagerly. The teacher then called on a few students to come to the board and underline the “o” sounds.

The teacher then read a story, which repeated the “oo, oo, oo” sound, aloud to the class with great expression. Students recited “oo, oo, oo” in unison with her as she read the story. The teacher then directed students to open their reading books to a certain page. The teacher asked who remembered their theme, and called on a student who said that the theme was courage. The teacher then asked students to think of something that takes courage, and several students gave answers. At the end of the observation, the teacher was asking students to look through their book quickly, look at the pictures, and get an idea of what the book was going to be about.
After the lesson, the teacher stated that most of the phonics discussed during the lesson were a review. The teacher felt that students were able to identify the various phonics rules and hoped that students would become more comfortable using the comprehension strategies discussed during class. The teacher also commented that software use (e.g., multcurricular instruction and reading assessment software) enriched the learning process, noting that students were generally familiar with the format and knew what was expected of them. The teacher was satisfied with student performance during the lesson, citing that students correctly answered the teacher’s questions during the lesson. The teacher planned to have a formal assessment of learning at the end of the week.

Sixth-Grade Social Studies Class

<table>
<thead>
<tr>
<th>Class 3</th>
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</thead>
<tbody>
<tr>
<td>Grade:</td>
<td>6</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>Computer</td>
</tr>
<tr>
<td>Teacher Software Used:</td>
<td>Web browser</td>
</tr>
<tr>
<td>Student Hardware Used:</td>
<td>Computer</td>
</tr>
<tr>
<td>Student Software Used:</td>
<td>Web browser, search engine, productivity tool</td>
</tr>
</tbody>
</table>

Before the observation, the teacher stated that students would be studying periods in history, specifically civilizations. Students would be assigned to work in groups of two to research a civilization. The teacher planned to assign students some guiding questions and directing students to some Web sites with information on civilizations in additional to traditional reference materials. The teacher planned to assess students by the reports and oral presentations they would submit at the end of the unit.

The observed lesson took place in a sixth-grade classroom. The classroom was equipped with seven desktop computers; one was located on the teacher’s desk, one on a table by the teacher’s desk, one on a bookshelf in another corner, and four together on a table in an adjacent corner of the room. A printer, audio player, video player, and television also were available in the classroom. During the lesson, 16 students sat at individual desks that were arranged in two rows facing each other with a few desks in a row at one end.

The teacher began the social studies lesson by questioning the students about what they had been learning about different civilizations. The teacher had written the names of several different civilizations on the whiteboard, and called on students one at a time asking them which civilization they wanted to research and then asked them to find a partner. The teacher also wrote eight questions on the board for students to answer about the civilization they selected. The teacher then directed four pairs of students to the cluster of computers on a table, and told them they would each have 20 minutes to find answers on two Web sites preselected by the teacher. After 20 minutes, they were to switch places with the other four teams. When not on computers, students were instructed to use their textbooks to find answers. The students on the computers quickly found the two bookmarked Web sites. The teacher guided students in finding information on these two Web sites, and then worked with one group to help them interpret some of the information. At this point, a student spontaneously used a search engine to find several “cheat sheets” on ancient Rome. Two other pairs noticed this development and also went to the
same search engine. There was a lot of discussion within and among pairs at the computers, and some sharing of the mouse and keyboard. One of the pairs opened a text editor to type their answers, while the other groups took notes by hand.

The teacher checked on the eight students working at their desks, who had been reading their textbooks silently with very little interaction within the pairs. Two of the pairs went to the two remaining student computers in the classroom, and the teacher then helped another pair use the computer at the teacher’s desk. The remaining pair did not get to a computer until near the end of the observation, when one of the original groups finished.

After the lesson, the teacher reported being pleased with the research students conducted during the lesson. The teacher stated that one of the purposes of the assignment was to encourage students to become more self-directed, which they appeared to be during the lesson. The teacher gave students some general guidelines and then students were self-directed for most of the lesson. The teacher also was pleased with student use of the Internet noting that students who accessed the recommended Web sites navigated the sites with no problems and even found some information that was not in their textbooks. The teacher commented that computers with access to the Internet are a valuable resource for students citing the speed at which students were able to locate pertinent information on the Internet. However, the teacher also reported feeling constrained by not having enough computers for each pair to use them simultaneously during class.
References


