
**CASE STUDIES OF
HIGH-PERFORMING,
HIGH-TECHNOLOGY
SCHOOLS:**

*Final Research Report
on Schools with
Predominantly Low-Income,
African-American, or
Latino Student Populations*

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CONTENTS

Introduction	1
Methods	2
<i>Selection of Schools</i>	2
<i>Data Sources</i>	4
<i>Cross-Case Analysis</i>	5
Findings	8
<i>Challenging and Cohesive Learning Environment</i>	8
<i>Coherent Instructional Program</i>	12
<i>Professional Community of Teachers</i>	18
<i>Effective School Leadership</i>	21
<i>Emphasis on Improvement</i>	26
<i>Parent and Community Involvement</i>	30
Discussion	32
References	36
Appendix A: Descriptors	38
<i>Challenging and Cohesive Learning Environment</i>	38
<i>Coherent Instructional Program</i>	39
<i>Professional Community of Teachers</i>	40
<i>Effective School Leadership</i>	41
<i>Emphasis on Improvement</i>	42
<i>Parent and Community Involvement</i>	43

INTRODUCTION

The Education Trust has ... identified 4,577 high-flying schools nationwide that are in the top third of poverty in their state and also in the top third of academic performance. Whatever these schools are doing to perform so well, and we need to understand that better than we do now, it is very unlikely that they have teachers who are dramatically different from teachers in less effective schools. ... Again, there is a main effect, something goings on in the school as a whole that affects the practice of all teachers in the school, and raises student achievement accordingly (Whitehurst, 2002).

To what extent can educational technology help schools close achievement gaps? What types of educational technology can administrators, teachers, and students use to help close achievement gaps? What kinds of educational technology practices and policies can help schools close achievement gaps? In order to address these questions, the North Central Regional Educational Laboratory (NCREL) conducted case studies of 19 high-performing, high-technology schools that have predominantly low-income, African-American, or Latino student populations. NCREL's case studies were designed to discover characteristics of high-performing, high-technology schools that may contribute to the academic achievement of low-income, African-American, and Latino students.

METHODS

Previous studies in both the qualitative and quantitative literature have typically proceeded from a specific technology or use of technology to a consideration of its effects on some measure of student achievement, ranging from instruments designed by teachers or researchers to standardized tests. In contrast, this study proceeds from success on state achievement tests at the school level to a consideration of what technologies successful schools use and how and why they use them. The initial research questions for NCREL's case studies of high-performing, high-technology schools were as follows:

- 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?

Selection of Schools

For the NCREL study, "high-performing" means 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 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 more restrictive definition is consistent with No Child Left Behind (NCLB) Act requirements for adequate yearly progress (AYP) in both subjects.

Education Trust defined "high-poverty" schools as those in which the proportion of students eligible for free or reduced-price lunches was at least 50 percent and ranked in the top third among all schools at that grade level. The study defined "high-minority" schools as those in which the proportion of African-American and Latino students combined was at least 50 percent and ranked in the top third among all schools in the state at that grade level. NCREL's case studies used The Education Trust definitions of high-poverty and high-minority to identify schools with predominantly low-income, African-American, or Latino student populations.

The research team identified 188 schools in the North Central region and 807 schools in California, Florida, New York, and Texas that met the high-performing, high-poverty and/or high-minority criteria. The states outside the North Central region were selected on the basis of geography—west, southwest, southeast, and east—as well as presence of significant numbers of schools with predominantly low-income, African-American, or Latino student populations.

In order to determine the extent to which these schools use technology, the research team conducted a telephone survey of principals in the regional sample and a mail survey of principals in the national sample.

Based on the results of the telephone and mail surveys, 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 high-performing, high-poverty and/or high-minority schools in Texas that met these criteria, high-technology in that state was defined as schools that reported 90 percent or more of all teachers use and assign technology every school day. The research team then conducted telephone interviews with the technology coordinators of all schools that met the high-technology criteria based on the principal interview or survey data and eliminated schools in which the technology coordinator did not corroborate the level of technology use reported by the principal.

The research team was able to establish that 41 schools met all the criteria for high-performing, high-poverty or high-minority, high-technology schools. Twenty of the eligible schools accepted an invitation to participate in the case studies—12 in the regional sample and eight in the national sample. None of the schools in New York met all the criteria and agreed to participate in a case study. After site visits were conducted, one middle school and high school in the same building in a small rural district were combined for analysis because of their extensive interdependence. As a result, this report presents findings based on case reports for 19 schools. In order to encourage administrators and principals in the case study schools to be as forthcoming as possible, we pledged that the schools would remain anonymous in all research reports. This report presents findings of a cross-case analysis of case reports that were written for the 19 high-performing, high-technology schools.

According to Education Trust, 7 of the 19 schools were high-poverty and high-minority (C, D, H, L, M, N, and P). Seven schools were high-poverty only (Schools E, G, I, O, Q, and R) and six schools were high-minority only (Schools A, B, F, J, K, S). Seven case study schools were located in rural areas (Schools C, E, G, I, O, Q, and R), five were located in medium cities (Schools A, J, M, N, and P), and seven were located in large cities (Schools B, D, F, H, K, L, and S). Twelve cases were elementary schools (Schools A, B, D, E, G, H, J, L, M, N, P, R). One case was a middle school (School C), three cases were high schools (Schools F, K, and S), two cases offered Grades 6–12 or 7–12 within the same school (Schools O and Q) and one case was the combined middle school and high school (School I). Table 1 provides an overview of the basic demographics of each school in the study. The research team was not able to identify a high-performing, high-poverty urban middle or high school or a high-performing, high-minority rural elementary school for case study.

Table 1. Demographic Characteristics

	Elementary		Secondary	
	Urban	Rural	Urban	Rural
High-Poverty	D, H, L, M, N, P	E, G, R		C, I, O, Q
High-Minority	A, B, D, H, J, L, M, N, P		F, K, S	C

Data Sources

NCREL's case studies of high-performing, high-technology schools employed a mixed methodology case study research design (Creswell, 2003; Yin, 2003; Greene et al., 1989; Tashakkori & Teddlie, 1998). The case studies employed open-ended interview protocols, classroom observation protocols, and survey instruments that contain a mix of open- and close-ended items. Documents including school improvement plans and technology plans were collected at each site when available. The use of quantitative methods builds on the findings of previous studies of what technologies schools have implemented (Anderson & Ronnkvist, 1999), how those technologies are used (Becker et al., 1999), and conditions under which technologies have helped raise student achievement (Mann et al., 1999; Chang et al., 1998; Wenglinsky, 1998). On the other hand, the use of qualitative methods enables a more exploratory approach to discovering and understanding characteristics of high-performing, high-technology schools that may contribute to the academic achievement of low-income, African-American, and Latino students.

Administrators and teachers were interviewed and classrooms were observed during two-day site visits conducted from October 2002 through January 2003. Interviews and classroom observations were scheduled by the principals of the schools. The research team requested that principals schedule six teachers for interviews and observations, and suggested two teachers who have had a particularly strong effect on student achievement, two teachers who were the most technology proficient in the school, and two who were most representative of the average teacher's technology proficiency. The research team did not request that teachers be identified by these categories during the site visits. Interviews were scheduled for approximately 30 minutes each and classroom observations were between 20 and 25 minutes each. The number of administrators interviewed in each school ranged from one to seven and the number of teachers interviewed ranged from 6 to 17. Most of the classrooms that were observed were those of the same teachers who had been interviewed, but in some cases it was not possible to schedule an observation in the classroom of every teacher who had been interviewed. The number of classrooms observed in each school ranged from 3 to 16; however, between six and nine classrooms were observed in all but three of the schools. Two researchers visited one large high school and conducted twice the normally scheduled number of interviews and observations.

Survey instruments were distributed to all administrators and teachers after site visits were completed. Principals were briefed by telephone on data collection procedures before printed surveys were mailed to the schools. At least two subsequent telephone calls were made to each teacher to improve response rates. Additional printed surveys were mailed to some schools at the request of the principals. The number of surveys returned by administrators in each school ranged from one to eight and the number of surveys returned by teachers ranged from 6 to 45. In addition, each school's technology specialist was mailed one printed infrastructure survey to collect data on hardware, software, and networking. Final response rates were 60 percent for administrators, 56 percent for teachers, and 74 percent for technology specialists. Finally, technology plans and school improvement plans were collected during the winter site visits whenever they were available and other documents were collected when offered. In summary, data were collected from the following sources:

- 144 teachers and 52 administrators were interviewed during site visits.
- 152 classrooms were observed during winter site visits.
- 345 teachers returned a technology inventory survey.

- 29 administrators returned a technology inventory survey.
- Technology specialists returned infrastructure surveys for 14 schools.
- 14 school improvement plans and 11 technology plans were collected.

Case reports for each site were drafted based on the triangulation of the four basic types of data sources: interviews, observations, surveys, and documents (Yin, 2003; Greene et al., 1989). The draft case reports addressed each of the original research questions and identified primary and secondary characteristics of each of the high-performing, high-poverty schools for 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 reports were returned to the principals of the high-performing, high-poverty schools for review and revised based on comments received from the schools.

Follow-up site visits to the 19 schools were conducted from February 2003 through April 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. Principals were asked to schedule three teachers for a 40- to 45-minute lesson observation, with 30-minute interviews before and after the lesson. A total of 63 lessons were observed in the 19 schools. The number of observations

in each school ranged from two to six; in all but three of the 19 schools, three observations were conducted. Two researchers visited a large high school, conducting twice the normally scheduled number of observations. We also conducted informal interviews with administrators and collected additional documents from some schools. Lessons that provided examples of educational technology use were written up as vignettes and appended to the case reports.

Cross-Case Analysis

A content analysis of the case reports was conducted by one researcher who had participated in site visits and one researcher who had not visited any of the sites. These two researchers reviewed the case reports for Schools A–S and generated a list of codes based in part on categories the research team had developed to code open-ended interview and survey data collected for the case reports. Redundant codes were combined and all codes were organized according to six distinct themes present in one form or another at each of the high-performing, high-technology schools. The six themes were as follows:

- School culture.
- Curriculum, instruction, and assessment.
- Teacher qualities.
- Administrative leadership.
- School improvement and student achievement.
- Parent and community involvement.

Educators at the high-performing, high-technology schools indicated they use technology as a means to promote each of these themes, but do not regard technology as an end in itself. This finding suggested research on educational technology may be more productive when embedded within studies of school effectiveness. A review of the school effectiveness literature identified several other sources that generally corroborated the six themes identified by the NCREL research team. A 10-year study of school effects (Teddle & Stringfield, 1993) identified four universal characteristics of effective schools: clear academic mission and focus; orderly environment; high academic engaged time-on-task; and frequent monitoring of student progress. The study also reported the following characteristics of schools that were effective with students of low socioeconomic status:

- Promote high present educational expectations.
- Hire principals who are initiators and who want to make changes in the schools.
- Increase the external reward structure for academic achievement.
- Focus on basic skills first and foremost, with other offerings after basic skills have been mastered.
- Carefully evaluate the effect of the community on the school.
- Hire younger, possibly more idealistic, teachers.

A summary of international school effectiveness research (Reynolds & Teddle, 2000) identified the following nine important process variables that were consistent across studies conducted in the United States, the United Kingdom, and the Netherlands:

1. The processes of effective leadership.
2. The processes of effective teaching.
3. Developing and maintaining a pervasive focus on learning.
4. Producing a positive school culture.
5. Creating high and appropriate expectations for all.
6. Emphasizing student responsibilities and rights.
7. Monitoring progress at all levels.
8. Developing staff skills at the school site.
9. Involving parents in productive and appropriate ways.

A recent study (Reynolds et al., 2002) of schools in nine countries on three continents found that principal leadership, expectations for students, the way children experience school, instructional style, school goals, and interstaff relations were the dimensions on which researchers were most able to distinguish more effective from less effective schools across countries. Marzano (2003) summarized school effectiveness research and collapsed many factors that different researchers have reported into a list of the following five characteristics of effective schools:

1. Guaranteed and viable curriculum.
2. Challenging goals and effective feedback.
3. Parent and community involvement.
4. Safe and orderly environment.
5. Collegiality and professionalism.

According to Marzano, “These categories represent the most current thinking on school-level factors, and the order in which I list them represents their order of impact on student achievement” (p. 15).

The research team determined that the characteristics reported in the school effectiveness literature showed sufficiently consistent overlap to corroborate the six themes derived from the case reports on high-performing, high-technology schools. After an additional review of the case reports for Schools A–S, the six themes were refined to better describe the common characteristics of the case study schools. The six characteristics that will be used in this report are as follows:

1. Challenging and cohesive learning environment.
2. Coherent instructional program.
3. Professional community of teachers.
4. Effective school leadership.
5. Emphasis on improvement.
6. Parent and community involvement.

These six characteristics each describe a distinct dimension of the explanations that educators in the high-performing, high-technology schools offered for the success of their schools. Moreover, the six characteristics are listed in the order in which these educators generally emphasized their importance to their schools’ success with predominantly low-income, African-American, and Latino student populations.

In order to ensure reliability for the coding of the case reports, specific descriptors were derived for each of the six characteristics (see Appendix A). Two researchers independently coded the case report for one school, indicating whether each descriptor was present in the school, and achieved an average percent-agreement of 76.1 across all characteristics. In the discussion following the initial coding, the researchers decided that the discrepancies in coding were the result of overlap in the descriptors. Descriptors for each characteristic, therefore, were further collapsed to streamline the coding process and increase reliability between the coders. After all discrepancies in the coding of the case report were resolved through this discussion and revision process, four more case reports were coded independently by both researchers. The average rate of agreement between coders across these four schools was 87.5 percent. At this point, the research team decided that descriptors had been refined sufficiently for meaningful similarities and differences among the schools to be reliably captured in the cross-case analysis and the two researchers coded the remaining case reports independently.

FINDINGS

Challenging and Cohesive Learning Environment

Teachers and administrators at each of the participating schools often indicated that their school was a special place to be and it was the school's overall environment that contributed to student learning and achievement. Survey and interview respondents mentioned teacher and student attitudes (including high expectations, motivated students, and teacher and student excitement and beliefs about technology use); the physical surroundings (including school and classroom size and physical space) and facilities (including classroom computers or computer laboratories, or other available technology); and unique programs (including college preparation, service learning, and enrichment or remediation) as being central to their school's success. The characteristic, "Challenging and Cohesive Learning Environment," encompasses the sometimes physical, but more often affective, influences on a school's culture.

Description

Sixteen of the 19 schools mentioned their family-like atmosphere or ambience as a special quality of the school that contributed directly to student achievement. In these schools, teachers and administrators described a strong sense of community shared by students, parents, teachers, and administrators, and marked by a shared vision and a sense of belonging to something special and unique. The cohesiveness of the school seemed to be influenced by several factors: school or class size, the nature of the community and students the school serves, and the instructional purpose of the school.

Seven schools (Schools C, E, G, I, K, O, and Q) reported that their family-like atmosphere stemmed from their small size and the nature of the surrounding community. Of these seven schools, five are located in areas that are relatively isolated from other communities. Schools C, G, I, O, and Q are located in remote rural areas where the student populations are drawn from multiple counties or where one or two schools serve the entire PK–12 district population. At these schools, the teachers often discussed the importance of "expanding the horizons" of their students and of making certain that they did not fall behind their peers because of their isolation; this unity of purpose appeared to contribute to the cohesiveness of the environment. Two others (Schools E and K) were not as isolated but also served unique populations. School K is a relatively small high school located in a large city and in the second largest school district in its state. School E is located in a small and changing coastal community, where with the decline of the fishing industry, traditional fishing families have come to increasingly value education.

At all seven of these schools, teachers reported that their knowledge of the students, their families, the geographic area, and the community circumstances helped them focus on meeting the unique needs of the students. All but one (School E) of the seven schools mentioned small class size as an important element of their school learning environment. By having small classes, either by design or necessity, even larger schools (Schools D, F, and J) were able to create the intimacy and family-like atmosphere valued by teachers and students. Some of the schools also created a cohesive learning environment through their focused instructional approach or program. For example, Schools F and K are magnet schools that have career-focused curricula (business and health-related, respectively) and attract students who share these interests. Schools A, B, H,

J, and S either are magnet schools (though not necessarily with selective enrollment) or have programs for gifted children, and School C serves increasing numbers of limited English proficient and low-literacy students. School N has a focus on scientific thinking, with its halls designed around three habitats and that thematic structure permeating most instructional activities. These schools have created a cohesive learning environment by adjusting their philosophies, curricula, and teaching approaches according to the needs of their students.

The success of many high-performing, high-technology schools was attributed to teachers, administrators, students, and parents sharing the priorities of orderly classrooms and strong effort. Of the 19 participating sites, 11 had teachers and administrators who credited consistent classroom management (Schools B, E, F, G, I, J, L, M, N, and Q) or a schoolwide discipline plan (School H) for maintaining the type of positive environment that is most conducive to learning. Teachers and administrators at 16 of the schools (Schools A, D, E, F, G, H, I, J, K, M, N, O, P, Q, R, and S) also cited their high expectations of students as being central to their achievement; while survey and interview respondents at 11 of the schools (Schools A, B, C, F, H, I, K, L, Q, R, S) attributed their success to the hard work of their motivated students. Not surprisingly, teachers at Schools A, K, R, and S drew connections between the high expectations shared by the school community and the high motivation shown by the students; and teachers at Schools F, H, I, and Q also linked their high expectations with the classroom management that, in turn, instills self-discipline and a strong work ethic in their students.

The 19 schools in the study provided information about their facilities and the resources available to them. As in many schools, space was mentioned frequently. While only the teachers in Schools A, D, and L specifically discussed their inadequate space as having a negative impact on their ability to teach, respondents at 14 of the 19 schools (Schools B, C, D, F, G, I, J, K, L, M, N, O, R, and S) mentioned space as a consideration in planning their lessons, or their own creative use of limited space and other physical characteristics of their classrooms as contributors to student achievement.

The 19 schools have a variety of technology resources such as computers, peripherals, VCRs, and digital cameras available to students and teachers. All schools in the study have one or more computers in each classroom that may be used by both students and the teacher. At Schools H and R, the decision was made to put computers in classrooms instead of a central computer laboratory because teachers believed that the technology would be more accessible to students this way; and at School L, teachers and administrators chose to purchase a larger quantity of older equipment and to establish “mini-computer laboratories” in each classroom. These three schools (Schools H, R, and L) do not have a computer laboratory where an entire class uses the computers at once. Of the 16 remaining schools, 8 (Schools A, C, D, E, F, J, M, and N) have one computer laboratory available to students, and 8 (Schools B, G, I, K, O, P, Q, and S) have two or more laboratories available for use. Schools B, I, J, and P also have either media production facilities or a broadcast studio available for use by students, teachers, and administrators.

Special programs often contribute to the cohesiveness of the learning environment and reflect the priorities of the school community and the ways in which school personnel strive to meet the needs of the students they serve. Of the participating schools, 14 (Schools A, C, D, E, F, H, I, J, M, N, O, P, Q, and S) provide enrichment and/or extended day programs that expand student experiences; and seven (Schools A, C, E, F, H, J, and S) provide specific tutorial or remedial programs designed to help students catch up with their peers and meet state standards. Survey and interview respondents at several of the schools also mentioned unique programs that

contribute to student achievement. Schools F, K, and S provide a strong college preparatory curriculum and in some cases, dual college credit courses for their business and health-related career-oriented students. Teachers at Schools E, I, and M credit their primary teachers for giving students a strong foundation in basic academic and technology skills, which then enables them to take students to higher levels of learning in the content areas. Teachers at School H mentioned the service learning opportunities available at their school as being significant experiences that contribute to student success. In terms of program design, survey and interview respondents at Schools G and P specifically discussed how their administration focuses resources toward programs that provide direct impact on student achievement.

At each of the 19 schools, administrators and teachers view technology as a tool to support the overall learning environment rather than as an end in itself. At many of the schools, students and teachers have developed attitudes and beliefs about technology use that permeate the school culture and contribute to its cohesiveness. Twelve of the 19 schools (Schools A, E, F, G, H, I, K, M, N, P, R, and S) reported specifically that their students use technology frequently during the instructional day, and of these, eight schools (Schools G, H, I, K, M, N, R, and S) also indicated that their students were motivated by technology. Seven other schools (Schools B, C, D, J, L, O, and Q) reported that their students were motivated by the technology they used, although student technology use was not reported as frequent by the respondents. At 10 of the schools (Schools A, B, F, G, H, I, J, O, P, and Q), teachers reported that students have free or equal access to class computers or laboratories, which allows them to choose to use technology to complete assignments even when they may not be expected to use it; however, at Schools I and Q, teachers specifically said that they do expect students to use technology in the completion of their assignments. Teachers at Schools J, M, N, Q, and S said they believe that technology use helps prepare students for the future, in their career and life skills, and teachers at Schools I and O specifically discussed the ways technology use appears to build student confidence.

Analysis

The challenging and cohesive learning environment at the case study schools is attributed primarily to affective factors; most frequently to an atmosphere of caring and high academic expectations. However, physical characteristics of the schools support the challenging and cohesive learning environment in general and the use of technology resources within that environment in particular. All of the high-performing, high-technology schools have computers in classrooms and almost all have at least one computer laboratory. Teachers very rarely describe problems with inadequate physical space or inadequate access to computers.

Table 2 shows descriptors of challenging and cohesive learning environments that were coded for at least 4, but not more than 15, of the high-performing, high-poverty schools. These descriptors were analyzed for possible patterns of similarities and differences among the learning environments of the high-performing, high-technology schools.

Table 2. Selected Descriptors for Challenging and Cohesive Learning Environment

Descriptor	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
Structural Descriptors																			
<i>Small School Size</i>			X		X		X		X		X				X		X		
<i>Small Class Size</i>			X	X		X	X		X	X	X				X		X	X	
<i>Classroom Management</i>		X			X	X	X	X	X	X		X	X	X			X		
<i>Enrichment or After-school</i>	X		X	X	X	X		X	X	X			X	X	X	X	X		X
<i>Remedial or Tutorial</i>	X		X		X	X		X		X									X
Affective Descriptors																			
<i>Highly Motivated Students</i>	X	X	X			X		X	X		X	X					X	X	X
<i>Technology Motivates Students</i>		X	X	X			X	X	X	X	X	X	X	X	X		X	X	X
<i>Technology Prepares Students</i>										X			X	X			X		X
Technology Descriptors																			
<i>Frequent Student Use</i>	X				X	X	X	X	X		X		X	X		X		X	X
<i>Equitable or Free Access</i>	X	X				X	X	X	X	X					X	X	X		
<i>Two or More Computer Labs</i>		X					X		X		X				X	X	X		X

One factor that immediately seemed to distinguish the learning environments of the high-performing, high-technology schools was small class sizes. Schools with small class sizes indicated that physical space or characteristics contribute to the learning environment in greater proportion (90 percent) than other schools (50 percent). They also reported that students are motivated by technology in greater proportion (90 percent) than other schools (67 percent) but, surprisingly, reported that students use technology frequently in smaller proportion (50 percent) than other schools (78 percent). The factor that appears to be most associated with student access to technology is having two or more computer laboratories, but this influence does not extend to student use or motivation. Schools with two or more computer laboratories reported that students have equitable or free access to technology in greater proportion (75 percent) than other schools (36 percent), but reported that students use technology frequently and are motivated by technology at about the same rates as other schools.

Another factor that did not seem to have a consistent effect across the high-performing, high-technology schools, but did seem to be associated with important differences among the schools that have small class sizes, is an emphasis on classroom management. All of the schools that have both small classes and an emphasis on classroom management (Schools F, G, I, J, and Q) reported that students have free and equitable access to technology and three (Schools F, G, and I) reported frequent student use. Only one of the schools that have small class sizes but do not emphasize classroom management (Schools C, D, K, O, and R) reported free and equitable access to technology, but two of these (Schools K and R) reported that students use technology frequently. There are two possible interpretations of the interaction between classroom management and access to technology: (1) strong classroom management facilitates access to technology, and (2) free and equitable access to technology facilitates classroom management. Schools that reported both small class sizes and classroom management indicated frequent student use of technology in somewhat greater proportion (60 percent) than schools that only reported small class sizes (40 percent), but the association was not particularly strong.

The six schools that emphasize classroom management but do not have small classes (Schools B, E, H, L, M, and N) reported frequent student use of technology at about the same rate as other schools although only one (School R) has two or more computer laboratories and two (Schools H

and L) are among the three schools with no computer laboratory. All three schools that exhibit neither small class sizes nor strong classroom management (Schools A, P, and S) reported that students use technology frequently. However, two of these (Schools A and S) reported highly motivated students and two (Schools P and S) have two or more computer laboratories. The overall effect of strong classroom management would be much stronger if these schools were removed from consideration. More research is needed to understand fully the relationship among small class sizes, classroom management, and student technology use in high-performing, high-technology schools.

Conclusion

It appears that the challenging and cohesive learning environment at each of the participating schools is established primarily through the attitudes of the teachers, students, administrators, and, to a lesser extent, families and community served by the school. In the majority of cases, teachers and administrators are sensitive to the unique needs of their students and families, and develop instructional programs that meet their needs and challenge them to achieve at a higher level. A shared vision unites the teachers and students, and results in high expectations and motivation to do well for all members of the school community. Access to technology for teachers and students is an important part of the physical learning environment in most, but not all, of the schools and positive attitudes toward technology often contribute to the challenging and cohesive quality of the learning environments in these schools.

Coherent Instructional Program

The content of the curriculum, the instructional approaches and methods employed by the teachers, and the ways in which student learning is assessed are critical elements of the learning experiences provided at each school. Survey and interview respondents often mentioned the ways in which teachers meet individual student needs, specific instructional emphases (such as on literacy, basic skills, or higher-level thinking), the alignment of curriculum with state standards, and the use of technology for instructional purposes as being significant contributors to student achievement. The characteristic “Coherent Instructional Program” also includes the purposes for which teachers assign students to use technology and the activity structures that were observed in the classrooms or mentioned by teachers on the surveys or in interviews.

Description

It is important to remember that case study schools were selected on the basis of their students’ performance on state achievement tests. These tests are designed to measure the extent to which students are meeting, exceeding, or falling short of the academic standards set by the state. In order to ensure that their students succeed on these tests, most schools nationwide design their curricula to meet the state standards. However, some schools are more direct in their approach than others. In this study, 16 of the 19 schools (Schools A, B, C, D, E, G, H, I, J, L, M, N, O, Q, R, and S) specifically mentioned that their curriculum is aligned with state standards, although some teachers (Schools C, D, E, G, H, J, and M) reported a more focused and explicit emphasis on the standards than others (Schools B, I, and S), who said they used the standards more as a guide in their instruction. Of the three schools (Schools F, K, and P) in which educators did not specifically mention that their curriculum was aligned with state standards, two (Schools F and K) are specialized high schools with career-oriented curricula, although teachers at School K mentioned that they focus on the standards. Educators at School P simply mentioned that their curriculum was related to the state standards.

Many of the participating schools have placed a deliberate emphasis on particular aspects of their curriculum, which often is based on educators' perceptions of the strengths or weaknesses of their students. Ten schools (Schools B, D, E, F, G, J, L, M, O, and P) reported an instructional emphasis on the development of basic skills in reading and mathematics or on literacy skills in particular. Of these, Schools D, E, G, L, M, O, and P appear to focus on basic skills or literacy to counteract the deficiencies with which many students enter school; and although Schools B and J have high numbers of gifted children, they also focus on basic skills and literacy in order to establish a strong foundation for their students and to prepare them for the next level of schooling. Teachers at School F emphasize basic skills in relation to its business curriculum. Teachers at six schools (Schools A, I, K, N, Q, and S) place a strong emphasis on higher-order thinking in their instructional approach, and teachers at School H report a dual emphasis on basic skills and higher-order thinking.

Teachers at 14 schools (Schools C, D, E, F, G, I, J, K, L, M, N, P, Q, and R) said that they integrate technology into their instruction. However, it appears that the extent to which the integration occurs, the instructional purposes for the technology use, and even the content areas in which it is used varies across the schools. Schools E and J specifically mentioned very frequent use of multicurricular instruction software as the primary means of students practicing and mastering basic skills, and Schools E, G, J, and M make extensive use of reading and mathematics assessment software as instructional tools to help children learn and master basic literacy and mathematics skills. Schools D and E also provide regularly scheduled computer time for students to specifically practice basic skills. All of the schools that reported an emphasis on basic skills or literacy also reported a high use of print resources. Interview and survey respondents also mentioned other aspects of technology integration. Regular computer laboratory instruction is given to students at Schools B, N, P, and S; computer or technology courses are required at School F; and elective computer or technology courses are offered at Schools B, O, and Q. Finally, students at Schools B and K also participate in technology or media competitions.

Teachers at 14 of the 19 participating schools (Schools A, C, E, F, G, H, I, J, K, M, N, O, P, and R) reported that they differentiate instruction to meet individual students' needs, while teachers at School B said that their academically gifted students move at their own academic pace. Six of these schools (Schools A, B, F, H, I, and N) accomplish at least some of this differentiation through the use of computers or other technology that allow the students to individualize practice, assessment, and progression through content area concepts and skills. Four other schools (Schools D, L, Q, and S) also reported the use of technology for self-directed student learning. None of these four schools are among those that rely heavily on educational software for reading and mathematics instruction or assessment, suggesting that educators in these schools prefer student technology use that is more exploratory and less focused on skills development.

Other instructional methods also were reported as having an impact on student learning. Teachers at Schools A and B reported valuable class discussions, and teachers at School J reported the use of direct instruction. Teachers at nine schools (Schools A, F, G, K, L, M, N, P, and S) said they use both hands-on activities and open-ended interdisciplinary projects in their instruction; while teachers at Schools D, I, and O mentioned only hands-on activities, and teachers at Schools B, E, and H reported only project-based, open-ended assignments. Teachers at School H mentioned that they provide students with rubrics for these interdisciplinary project assignments.

When making instructional decisions, teachers choose not only what content to include and what materials to use, but also how they will present the material and group the students for their work activities. While some schools used a wide variety of instructional and grouping strategies, others relied on more traditional means of content delivery and student work. All 19 schools use adult-led large groups and individual student work as primary instructional groupings. Sixteen schools (Schools A, B, D, E, F, G, H, I, K, L, M, N, O, Q, R, and S) use collaborative pairs as another common activity structure with their students, and of these, 12 schools (Schools A, E, F, H, K, L, M, N, O, Q, R, and S) expand this grouping strategy to include collaborative small groups. School P also uses collaborative small groups for instruction. Ten schools (Schools A, F, G, I, J, K, L, P, Q, and R) use adult-led small groups, and nine schools (Schools A, D, H, L, M, N, O, P, and R) make use of rotating centers in their instruction. Nine schools (Schools A, B, C, E, G, L, M, Q, and R) also use adult tutoring to instruct students, and peer tutoring is utilized by eight schools (Schools A, B, E, G, H, M, N, and O). The least used activity structure was student-led large groups, used by only four schools (Schools B, K, N, and R).

While no schools employed all of the different activity structures, many used a wide variety of approaches to reach their students. Teachers in Schools A and R reported or were observed using a combined total of eight different activity structures; Schools L, M, and N used seven; Schools B, E, G, H, K, O, and Q used six; and Schools F and P used five different approaches. Two schools (Schools C and J) rely most on the traditional instructional structures of adult-led large groups and individual student work, with School C adding only adult tutoring, and School J adding only adult-led small groups. Also primarily traditional in their instructional approaches, School D adds only collaborative pairs and rotating centers, and Schools I and S add the use of collaborative pairs and small groups.

In interviews and on surveys, teachers were asked about the purposes for which they assign students to use technology. A wide variety of purposes were reported, with some used almost universally and others more rarely. Teachers at all 19 schools reported having their students use technology with content-specific strategies or software, and to improve their computer keyboarding skills or technology skills in general. Eighteen of the schools reported having students use technology for five common purposes: creating documents or writing (all but School J), mastering skills just taught (all but School C), remediating skills not previously learned (all but School I), researching or gathering information (all but School J), and working independently (all but School N).

Other frequent uses were also reported. Fifteen schools (Schools A, B, C, D, E, F, H, J, K, L, N, P, Q, R, and S) reported the use of technology for the practice of standardized tests and 14 schools (Schools A, B, D, E, F, H, I, J, K, L, M, O, R, and S) reported its use to help students learn to work collaboratively. Teachers at 13 schools (Schools A, B, D, E, H, I, J, K, L, M, P, Q, and R) assign technology use to students as a reward for good behavior or as a free time activity. Slightly less frequent uses include analyzing information or problem solving by 12 schools (Schools A, C, E, F, J, L, M, N, O, P, Q, and S); interactive learning by 10 schools (Schools A, H, I, K, L, N, O, Q, R, and S); exploring concepts, models, or simulations by nine schools (Schools B, C, D, E, F, J, N, P, and Q); graphically organizing ideas or information by eight schools (Schools B, C, D, F, N, O, P, and S); and presenting information to an audience by seven schools (Schools C, F, K, O, P, Q, and S). The least frequent uses of technology by students include creating multimedia presentations (Schools Q and S) and communication (School S). Most schools reported having students use technology for between 10 and 13 different purposes. The schools reporting the widest variety of purposes were School S with 16 different purposes and School Q with 15 different purposes. School G reported eight different student uses of technology, which was the least number reported by any school in the study.

Analysis

The high-performing, high-technology schools have crafted an instructional program that reflects a coherent approach to curriculum, instruction, and assessment, and is supported by administrators and teachers throughout the school. These approaches are almost always driven by state standards but shaped by teachers and administrators at each school based on their own beliefs and priorities as well as their view of what students need to succeed on both state assessments and in their lives. All but two of the schools place a strong and consistent instructional emphasis on either basic skills or higher-order thinking skills, with only one of these schools emphasizing each as strongly as the other. Instruction in general and student technology use in particular are consistent with the instructional emphasis chosen by the school, although there are several factors that are common across the schools.

All of the schools emphasize use of technology within content areas and describe uses of technology that are specific to certain content areas. Almost all of the schools have students use technology to master skills just taught and remediate skills not learned, regardless of whether they emphasize basic skills or higher-order thinking skills. They also assign students to use technology to write and create documents, conduct research or gather information, and improve computer skills; again, regardless of instructional emphasis. Nearly all of the schools instruct students in adult-led large groups and give students individual work assignments, including independent work at computers. Almost all of the schools also assign students to work in collaborative pairs. The high-performing, high-technology schools very rarely have students use computers to create multimedia presentations or to communicate with others. It is unclear whether this is because administrators and teachers do not believe that these uses have a strong effect on student achievement or they are simply more difficult or time-consuming to provide.

Table 3 shows descriptors of coherent instructional programs that were coded for at least 4, but not more than 15, of the high-performing, high-poverty schools. These descriptors were analyzed for possible patterns of similarities and differences among the instructional programs of the high-performing, high-technology schools.

Table 3. Selected Descriptors for Coherent Instructional Program

Descriptors	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
Instructional Descriptors																			
<i>Basic Skills and Literacy</i>		X		X	X	X	X	X		X		X	X		X	X			
<i>Higher-order Thinking</i>	X							X	X		X			X			X		X
<i>Differentiated Instruction</i>	X		X		X	X	X	X	X	X	X		X	X	X	X		X	
<i>Hands-on or Project-based</i>	X	X		X	X	X	X		X		X	X	X	X	X	X			X
<i>Technology Integrated</i>			X	X	X	X	X		X	X	X	X	X	X		X	X	X	
Activity Structures																			
<i>Adult Tutoring</i>	X	X	X		X	X	X		X	X	X	X	X			X	X	X	
<i>Collaborative Small Groups</i>	X				X	X		X			X	X	X	X	X	X	X	X	X
<i>Peer Tutoring</i>	X	X			X		X	X					X	X	X				
<i>Rotating Centers</i>	X			X				X				X		X		X		X	
<i>Student-led Large Group</i>		X									X			X				X	
Student Technology Use																			
<i>Analysis or Problem Solving</i>	X		X		X	X				X		X	X	X	X	X	X		X
<i>Explore Concepts</i>		X	X	X	X	X				X				X		X	X		
<i>Graphically Organize</i>		X	X	X		X								X	X	X			X
<i>Interactive Learning</i>	X							X	X		X	X		X	X		X	X	X
<i>Standardized Test Practice</i>	X	X	X	X	X	X		X		X	X	X		X		X	X	X	X
<i>Present to an Audience</i>			X			X					X				X	X	X		X
<i>Publish Work on the Web</i>																			
<i>Reward or Free Time</i>	X	X		X	X			X	X	X	X	X	X			X	X	X	
<i>Self-direct Learning</i>	X	X		X			X		X	X		X		X			X		X
<i>Work Collaboratively</i>	X	X		X	X	X		X	X	X	X	X	X		X			X	X

One factor that would presumably distinguish the way the schools approach curriculum, instruction, and assessment is whether they emphasize basic skills or higher-order thinking. Only one school (School H) indicated an emphasis on both basic skills and higher-order thinking. Although a majority of schools clearly emphasize one or the other, this choice did not appear to be associated with other features of the schools' instructional programs in predictable ways. For example, basic-skills schools seemed to differentiate instruction, use a variety of activity structures, and provide opportunities for hands-on or project-based learning at about the same rates as higher-order schools. The most reasonable interpretation is that basic-skills schools often use educational software to provide individualized instruction, as well as to collect data that teachers use to differentiate their face-to-face instruction. Teachers in these schools may regard individual student use of educational software as hands-on learning, but they also were observed providing some students with opportunities for more open-ended work in centers or other alternative activity structures while other students were in small groups with the teacher and working individually on computers.

Instructional emphasis did seem to have some effect on whether teachers indicated that technology was integrated into curriculum and instruction, but not necessarily in the direction one would expect. Teachers in basic-skills schools reported that technology was integrated into their curriculum and instruction in somewhat greater proportion (70 percent) than schools that emphasized higher-order thinking (50 percent). Eight schools emphasized basic skills and integrated technology into curriculum (Schools D, E, F, G, J, L, M, and P) and three schools emphasized basic skills but had not integrated technology (Schools B, H, and O). Four schools emphasized higher-order thinking skills and integrated technology into curriculum and instruction

(Schools I, K, N, and Q) and two emphasized higher-order skills but had not integrated technology (Schools A and S). One possible interpretation is that teachers in higher-order schools did not feel that technology was integrated because it is more difficult or time-consuming to provide students with opportunities to use productivity and creativity tools to develop higher-order thinking skills than to use educational software to develop basic skills.

Instructional emphasis also affected student technology use in the high-performing, high-technology schools in some unexpected ways. Basic-skills schools reported that students use technology to explore concepts, models, or simulations in greater proportion (50 percent) than higher-order schools (30 percent); this effect is probably due to greater use of educational software in basic-skills schools. It is perhaps not surprising that higher-order thinking schools reported at higher rates that students use technology to analyze information or solve problems (80 percent to 60 percent) and for self-directed (90 percent to 50 percent) and interactive learning (100 percent to 30 percent). It may be less expected, however, that the higher-order schools reported assigning students to use technology to practice standardized tests in somewhat greater proportion (90 percent) than basic-skills schools (70 percent). One possible interpretation is that the higher-order schools believe that technology provides an efficient and effective way to prepare students for standardized tests, while leaving as much instructional time as possible for higher-order thinking skills.

As one would expect, student technology use also is affected by whether technology is integrated into curriculum, instruction, and assessment; however, the direction of this effect may be counterintuitive in some respects. Schools that reported technology integration indicated at higher rates that students use technology to explore concepts, models, or simulations (60 percent to 20 percent) and as a reward for good behavior or during free time (80 percent to 60 percent). However, technology-integrated schools reported at lower rates that students use technology to graphically organize ideas or information (30 percent to 60 percent), work collaboratively, (70 percent to 100 percent) or learn interactively (40 percent to 80 percent). The last effect is probably due to higher-order schools being somewhat less likely to be technology integrated and also more likely to report that students use technology to learn interactively. There is no obvious explanation, however, for the finding that these students may be less likely to use technology to graphically organize ideas or information or work collaboratively unless it is simply more difficult and time-consuming to provide students with opportunities to develop higher-order thinking with productivity and creativity software.

Conclusion

Each of the 19 schools demonstrated a coherent approach to the development of its curriculum, instructional methods, and assessment measures. The approaches generally corresponded to the instructional emphases, either basic skills or higher-order thinking, named by the teachers and administrators. In general, the schools that have a stronger skills emphasis tended to use more traditional means of content delivery and use technology to develop and assess basic skills; and in general, the schools that have an emphasis on higher-order thinking tended to use a wider variety of instructional activity structures and had students use technology for higher-level thinking processes like analysis and problem solving. However, the majority of the schools fell somewhere in between these two extremes and there were several notable exceptions to these patterns. In each case, the high-performing, high-technology schools have developed a coherent instructional program that reflects the priorities of the teachers and administration, the needs of the student population, and the mandates required by the district and state.

Professional Community of Teachers

The teachers in the high-performing, high-technology schools recognized their own professionalism as a significant contribution to their students' learning. The characteristic "Professional Community of Teachers" includes such elements as teacher caring for students and sense of responsibility for their learning; competence and autonomy; experience; teamwork and collaboration; professional development; and commitment to the use of technology. Teachers also were asked in interviews and on a survey about the uses of technology that most contribute to their own practice, and these results are included in the discussion of this characteristic.

Description

In interviews and on surveys, teachers at each of the 19 schools credited themselves as being significant to student achievement, although often for different reasons. Sixteen of the schools (Schools A, B, C, D, E, G, I, J, L, M, N, O, P, Q, R, and S) have teachers that cited their own competence as a primary influence on their students' success. At 15 schools (Schools A, C, D, E, F, G, I, K, L, M, N, O, P, Q, and R), teachers discussed how much they care about their students, are dedicated to them, and feel responsible and accountable for their students' learning. Interestingly, teachers at 14 of these schools (all but School C) discussed the caring feelings they have for their students as a primary cause of the general ambience and family-like atmosphere of the school, which indicates the importance of the teacher's attitudes toward the overall affective climate of a school. Thirteen schools (Schools A, C, D, E, G, I, L, M, N, O, P, Q, and R) named the combination of caring and competence as being most effective for their students. Years of experience at the school made a difference, too. Teachers at Schools D, G, I, and P mentioned their veteran staff as playing an integral part in the success of their students. Teachers at these schools believed that because they had been there so long, they knew the families, the students, and the community better than less-experienced teachers could, and therefore, were able to reach the students more effectively.

Some teachers mentioned their own beliefs as being significant to the success of the school. A sense of empowerment was important to teachers at Schools C and N and they discussed their autonomy as being integral to their ability to teach. Other teachers said that the commitment of their staff to school improvement (Schools D and R) and to the use of technology (Schools G, H, I, J, K, M, N, P, Q, and S) gave them a unity of purpose that made them more effective with students.

Teachers at 16 schools (Schools A, B, D, E, F, G, H, I, J, K, L, M, N, O, P, and R) mentioned the collaborative nature of their staff as an important element of the school's success. Two of these (Schools J and L) specifically mentioned the team teaching that occurs in their schools as being beneficial for their students. At School J, in fact, the teachers value the reading resource teacher working in their classrooms so much that they were willing to cut other areas of the budget so that the resource teacher's position could be continued.

Many teachers who were interviewed or surveyed discussed their views on state standards and related achievement tests, and how they approach the task of preparing their students to do well on these assessments. Many teachers felt that teaching directly to the state standards was necessary in order to adequately prepare their students and ensure that students were able to perform to their potential. Teachers at nine schools (Schools C, D, G, H, I, K, M, P, and S) mentioned an instructional focus on the standards or their use of the standards and practice tests as resources for their instruction. Some teachers also believed that, either in addition to content preparation or

to supplement their regular instruction, students need to be prepared for the actual test format and testing situation. Teachers at Schools B, C, E, F, and I prepare their students for standardized testing by teaching them specific test-taking skills and strategies. At Schools B, C, and S, teachers made a point of stating that they do not “teach to the test.” These teachers believe that if they use the best materials and methods, students will do well on the tests without being taught specific test content. However, their understanding of the best materials and methods may include standards (Schools C and S) and even teaching students how to take tests (School C).

Professional development for teachers in both content area instructional methods and in the use of technology was important to the teachers who were interviewed and surveyed in this study. Teachers at 18 of the 19 schools (all but School J) discussed how their schools and districts provided professional development opportunities for them, and at School F, how they were required to complete a certain amount of professional development each year. Two of the schools (Schools G and P) also assessed their teachers in the use of technology in order to ensure that their skills were adequate for the systems they use and for teaching students to use technology effectively.

In interviews and on surveys, teachers were asked about the ways in which they use technology to improve their teaching practice. Although teachers discussed a wide variety of uses, across the 19 schools there are more similarities than differences in how teachers use technology to increase their own efficiency and to better instruct their students. The three uses that were reported most frequently by teachers were: (1) communicating with parents, guardians, colleagues, or others; (2) presenting information to others; and (3) finding, creating, or updating instructional resources and assessments. Teachers at 18 of the 19 schools (all but School R) also use technology frequently for managing student records and tracking student data or grading; while teachers at 17 of the schools reported using technology for two other purposes: researching topics or gathering information (all but Schools J and N) and accessing information on best practices (all but Schools J and Q). These uses appear to be universal among all the schools in the study and contribute most to teacher efficiency and effectiveness.

Other uses were reported less frequently, however. At 12 of the 19 schools (Schools A, D, E, F, G, I, J, N, O, P, Q, and S), teachers reported using technology to create documents or for general writing. Teachers at 10 schools (Schools A, B, C, F, I, J, K, M, N, and O) use technology to find professional development resources and at 9 schools (Schools E, G, H, J, L, M, N, Q, and R) to assess or document student learning. The least frequent uses of technology by teachers in the study are expanding experiences through enrichment or virtual field trips (Schools C, D, H, and R), publishing student work or class information on the Web (Schools D, F, J, and Q), engaging students in inquiry (School S), and pursuing funding (School I).

It should be noted that while much of the technology data collected for the study was related to the use of computers or computer-related technology and software, teachers at 12 of the 19 schools (Schools D, G, H, I, K, L, M, N, O, P, Q, and S) specifically mentioned or were observed using the more traditional forms of technology, such as overhead projectors, in their daily instruction.

Analysis

Teachers in the high-performing, high-technology schools are professional in their approach to education, seeking to stay current in their fields and to use methods and materials that are most conducive to student learning. The professional community of teachers is most frequently demonstrated by teachers’ strong belief in their own competence and collaboration or teamwork

among teachers. Teachers use technology as a tool to make their professional practice more efficient and effective, and cite the availability of technology professional development as an important support. Teachers at all of the schools use technology to locate and prepare instructional resources, present information to students, and communicate with parents or guardians. Teachers at almost all of the schools use technology to access information on best practices, conduct research or gather information, manage student grades or other assessment data, and manage administrative records.

Table 4 shows descriptors of professional communities of teachers that were coded for at least 4, but not more than 15, of the high-performing, high-poverty schools. These descriptors were analyzed for possible patterns of similarities and differences among the professional communities of the high-performing, high-technology schools.

Table 4. Selected Descriptors for Professional Community of Teachers

Descriptor	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
Teacher Descriptors																			
<i>Teacher Caring</i>	X		X	X	X	X	X		X		X	X	X	X	X	X	X	X	
<i>Focus on Standards</i>			X	X	X		X	X	X		X		X			X			X
<i>Commitment to Technology</i>							X	X	X	X	X		X			X	X		X
<i>Teach Test-taking Skills</i>		X	X		X	X			X										
<i>Veteran Staff</i>				X			X		X							X			
Teacher Technology Use																			
<i>Create Documents or Artifacts</i>	X			X	X	X	X		X	X				X	X	X	X		X
<i>Extensive Traditional Technology</i>				X			X	X	X		X	X	X	X	X	X	X		X
<i>Find Professional Development</i>	X	X	X		X				X	X	X		X	X	X				
<i>Assess or Document Learning</i>					X		X	X		X		X	X	X			X	X	
<i>Standardized Test Preparation</i>					X	X		X		X	X			X					
<i>Diminish Student Isolation</i>			X				X											X	
<i>Publish Student Work on Web</i>				X		X				X							X		

Teachers at most of the high-performing, high-technology schools expressed a strong sense of caring for students along with their strong sense of efficacy (Schools A, C, D, E, F, G, I, K, L, M, N, O, P, Q, and R). These teachers expressed a commitment to technology at lower rates (40 percent to 75 percent) and reported preparing students for standardized tests at lower rates (27 percent to 50 percent) than the remaining four schools. Teachers at some of the schools indicated that they have a strong and explicit focus on standards (Schools C, D, E, G, H, I, K, M, P, and S). These teachers expressed a commitment to technology at higher rates (70 percent to 22 percent) and to report extensive use of traditional technologies such as overhead projectors (80 percent to 44 percent) than teachers at the remaining nine schools. An explicit focus on standards among teachers seems to be strongly associated with both a commitment to information technologies and extensive use of traditional technologies. More research is needed to understand the connection between teachers' emphasis on standards and commitment to technology in the high-performing, high-technology schools.

There were some important differences between the eight schools where teachers expressed both a strong sense of caring and a focus on standards (Schools C, D, E, G, I, K, M, and P) and the seven schools where teachers expressed a strong sense of caring without a focus on standards. The former reported in greater proportion teaching students test-taking skills (38 percent to 14

percent) and using technology to find professional development resources (64 percent to 43 percent). The former expressed a commitment to technology at a substantially higher rate (63 percent) than the latter (14 percent). Only one (School Q) of the seven schools that reported teacher caring, but did not focus on standards, expressed a commitment to technology, whereas five (Schools G, I, K, M, and P) of the eight that reported both expressed a commitment to technology. It is interesting to note that teachers at four schools believe that having a veteran staff contributes to the success of the school (Schools D, G, I, and P) and all four of these schools expressed both a strong sense of caring and a focus on standards. The extent to which teachers emphasize standards appears to have the strongest influence on the role of technology in professional communities of teachers, but that influence seems to be increased significantly when teachers report the affective attribute of caring for students.

Conclusion

A professional community of teachers includes the affective aspects of the teaching staff, which appear to set the tone for the school. The care of the staff for students and each other, as well as the collaborative approach they take when helping students learn, contributes to the cohesion of the learning environment and the coherence of the instructional program (the two previous characteristics). These two elements also establish a level of professionalism that influences all facets of the teaching day. Teachers in these schools approached their positions professionally. They valued their own competence and experience, and sought professional development in order to continue growing and to stay current in their respective fields.

Teachers also valued the professional development they receive in technology, knowing in many instances that their students may be more knowledgeable than they are with computers, and that in order to adequately prepare their students for the future, they need to enhance their technology skills as well. The teachers in this study used technology most frequently in ways that streamlined the day-to-day tasks that every teacher engages in; but in some cases, they also were involved in uses that more creatively engaged either themselves or their students.

Effective School Leadership

Teachers at the high-performing, high-technology schools often mentioned the importance of school leadership as a strong contributor to student achievement and their ability to teach effectively. Whether it came from the principal or other school administrators, the characteristic “Effective School Leadership” included specific support for the teachers, the close monitoring of student achievement, the development of school improvement plans and technology plans, and the support of technology use. As a part of the study, administrators also were asked to discuss the priorities they had for the school and for technology use, as well as to describe the ways in which they use technology to improve their administrative practice, and the discussion of this characteristic includes these elements. It should be noted that the term “administrators” often refers to the principal or assistant principal of the school, but in some cases, other administrators at the school and district level were included in the interview and survey process.

Description

Administrators at the 19 participating schools demonstrated varying degrees of involvement in the daily lives of their teachers and students. Some of this variance could be attributed to the organizational structure of the school and district, and the responsibilities the administrators were

assigned to accomplish. However, effective school leadership was valued highly by the teachers whose administrators were actively involved with and supportive of their instructional efforts. At eight schools (Schools A, C, E, H, L, N, R, and S), teachers discussed the supportive nature of their administrators and commented on how these administrators trust the teachers to do what is right for the students and seek out ways to help finance or otherwise enable the activities the teacher wants to implement.

Teachers at 12 schools (Schools B, C, D, E, F, G, H, J, K, P, Q, and S) said their administrators were supportive of technology use and encouraged them to use it not only with their students but for their own professional tasks as well. Once again, this support often included funding for special projects or equipment, building partnerships, or finding other resources that would supply what was needed for teachers to successfully integrate technology into their instruction. At Schools F, G, and H, teachers said that their administrators closely monitor class achievement, and sometimes even attendance, to ensure that students are able to meet the standards and achieve to their potential.

Administrators of the high-performing, high-technology schools are instructional leaders. They work with their staff to articulate a vision for what their school can become and often to develop school improvement plans to realize that vision. Some administrators may be involved in the development of technology plans for the school or for the district. Although administrators were not specifically asked about their leadership in these endeavors, school improvement plans were collected or a unified vision mentioned at 17 of the 19 schools (all but Schools E and M), and technology plans were collected from 14 (Schools A, B, C, D, E, G, I, K, N, O, P, Q, R, and S).

Administrators were asked on a survey to rank their priorities for the use of technology from a list of 17 ideas that focused on the ways technology might be used for school improvement and increased achievement. Administrators clearly approached this task differently, with some ranking a large majority of the items, others half of the items, and some only a few as being of the highest priority. The schools that named the highest number of items were School D (12), and Schools B and S (11 each). The schools that named the least number of high priorities were Schools J and R (4 each), School L (3), School E (2), and School C (1). Other schools ranked between six and nine priorities, and administrators at School H did not return a survey, so information on that school's priorities is unavailable.

The highest priority by the majority of administrators was placed on items that referred to technology use and its effect on student learning and achievement. Twelve schools each named the following three items as being of the highest priority: (1) improve student achievement on standardized tests or state assessments (Schools A, B, D, E, F, G, I, K, M, O, P, and S), (2) improve students' basic skills as well as 21st century learning skills (Schools A, B, D, F, G, J, M, N, P, Q, R, and S), and (3) individualize student learning experiences (Schools B, D, F, G, K, L, M, N, P, Q, R, and S). Almost as frequently, administrators at 10 schools (Schools B, D, E, F, I, K, L, O, R, and S) place the highest priority on using technology to increase professional development opportunities for their teachers.

At nine schools, administrators want to use technology to improve career preparation for their students (Schools B, D, F, G, K, N, O, Q, and S), and to increase parent involvement (Schools B, C, D, F, G, I, K, L, and S). Administrators from eight schools ranked increasing the integration of technology (Schools B, D, F, G, N, O, Q, and S) and using technology in curriculum development,

instruction, and assessment (Schools I, J, K, M, N, O, Q, and R) as being of highest priority. At seven schools (Schools A, B, D, F, K, M, and N), administrators want to improve student computer skills. Administrators at six schools want to use technology to improve their own computer skills (Schools A, B, D, I, N, and S) and to publicize school and student accomplishments (Schools A, D, F, J, P, and S). Five school administrators (Schools A, B, D, F, and S) also named improving their own efficiency as a high priority for technology use.

Somewhat surprisingly, only five school administrators named making instruction more data driven (Schools B, D, F, G, and Q) and making school improvement decisions more data driven (Schools A, G, J, M, and Q) as being high priorities. The schools that place a high priority on using data not only to determine achievement to make changes in curriculum, instruction, or other areas of the school appear either to have already established systems for this type of data analysis and have experienced success when they have made changes to their instruction or materials based on school data (Schools A, B, F, G, and Q); or they have placed a heavy emphasis on skills mastery and test preparation and use their data to determine areas in which students need more practice in order to raise their achievement levels further (Schools D, J, and M).

Three items on the survey list were named as being of highest priority by only a handful of school administrators: (1) improving teachers' computer skills (Schools G, M, and O), (2) improving parents' computer skills (Schools A and K), and (3) increasing parent communication (School I). To summarize, the most important areas of priority for these school administrators have to do with the ways in which technology may be used to directly serve students, with the least important uses of technology being related to uses with parents.

When asked on the survey to list the uses of technology that have most influenced their own practice, administrators named an average of five or six uses that are most frequent or important to them. The largest number of uses (eight) was named by Schools C, I, and R; and the least number of uses (three) was named by School E. Administrators at Schools H and L failed to return this portion of the survey data. Administrators were in fair agreement when it came to the uses of technology that were most significant to them. Sixteen of the 17 administrators who returned this portion of the survey named creating administrative materials of presentations (all but School J); and 15 administrators named analyzing student data for school improvement (all but Schools K and O). It should be noted that neither of these schools placed a high priority on using student data for school improvement.

Fourteen of the 17 administrators who returned this information (Schools A, B, C, D, F, I, K, M, N, O, P, Q, R, and S) named accessing information on best practices as one frequent use of technology that has had an important influence on their practice; and 12 administrators (Schools A, B, C, D, I, J, K, M, N, P, R, and S) mentioned communication with other administrators, parents/guardians, or colleagues. Other frequent uses included presenting information to an audience (Schools B, C, D, F, I, K, M, P, Q, R, and S); keeping administrative records (Schools A, C, E, G, I, J, N, O, P, Q, and R); purchasing materials or services (Schools B, C, D, F, J, and S); publishing school information (Schools C, G, I, Q, and R); and doing research (Schools A, I, O, Q, and R).

Analysis

Teachers at the high-performing, high-technology schools attribute part of their success to effective school leadership from administrators; most frequently demonstrated by a unified vision for the school and often formalized in a school improvement plan or technology plan. Administrators,

like teachers, use technology as a tool to make their professional practice more efficient and effective. Almost all of the administrators use technology to access information on best practices, create administrative materials, and analyze student data for school improvement. Other common administrative uses that parallel teacher uses are communicating with parents and other educators, managing administrative records, and presenting information to an audience. Administrators consistently ranked various measures of student achievement as their highest priorities for technology use, most frequently improving students' 21st century learning skills, improving student achievement on state assessments, and better preparing students for careers.

Table 5 shows descriptors of effective school leadership that were coded for at least 4, but not more than 15, of the high-performing, high-poverty schools. These descriptors were analyzed for possible patterns of similarities and differences in school leadership among the high-performing, high-technology schools.

Table 5. Selected Descriptors for Effective School Leadership

Descriptor	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
Leadership Descriptors																			
Technology Planning	X	X	X	X	X		X		X		X			X	X	X	X	X	X
Supports Technology Use		X	X	X	X	X	X	X		X	X					X	X		X
Supports Teachers	X		X		X			X				X		X				X	X
Technology Priorities																			
Improve Test Scores	X	X		X	X	X	X		X		X		X		X	X			X
Improve Basic Skills	X	X		X		X	X			X			X	X		X	X	X	X
Individualize Learning		X		X		X	X				X	X	X	X		X	X	X	X
Professional Development		X		X	X	X			X		X	X			X			X	X
Improve Career Preparation		X		X		X	X				X			X	X		X		X
Increase Parent Involvement		X	X	X		X	X		X		X	X							X
Increase Technology Integration		X		X		X	X							X	X		X		X
Curr., Instruction, Assessment									X	X	X		X	X	X		X	X	
Student Computer Skills	X	X		X		X					X		X	X					
Administrator Computer Skills	X	X		X					X					X					X
Data-driven Instruction		X		X		X	X										X		X
Publicize Accomplishments	X			X		X				X						X			X
Improve Administrative Efficiency	X	X		X															X
Data-driven School Improvement	X						X			X			X				X		
Parent Computer Skills	X										X								
Administrator Technology Use																			
Use Data for School Improvement	X	X	X	X	X	X	X		X	X			X	X		X	X	X	X
Research Best Practices	X	X	X	X		X			X		X		X	X	X	X	X	X	X
Communicate With Others	X	X	X	X					X	X	X		X	X		X		X	X
Keep Administrative Records	X		X		X		X		X	X				X	X	X	X	X	
Present to an Audience		X	X	X		X			X		X		X			X	X	X	X
Purchase Materials or Services		X	X	X		X				X									X
Publish School Information			X				X		X								X	X	
Research	X								X						X		X	X	

Teachers in eight schools felt that their administration supported them (Schools A, C, E, H, L, N, R, and S) and teachers in 12 schools felt that their administration encouraged technology use (Schools B, C, D, E, F, G, H, J, K, P, Q, and S). Administrators whose teachers felt supported reported a variety of priorities for technology use in their schools at lower rates than those in the remaining 11 schools, including the following:

- Improve career preparation (25 percent to 64 percent).
- Improve student achievement on standardized tests (38 percent to 82 percent).
- Improve students' basic skills (50 percent to 73 percent).
- Improve students' computer skills (25 percent to 45 percent).
- Increase integration of technology (25 percent to 55 percent).
- Individualize student learning experiences (50 percent to 73 percent).
- Make instruction more data driven (13 percent to 45 percent).
- Make school improvement more data driven (13 percent to 36 percent).

This effect is primarily due to the fact that administrators whose teachers did not express feelings of support identified an average of $2\frac{1}{2}$ more priorities for technology use than those whose teachers did feel supported. It is possible that teachers in these schools perceive a lack of focus on a manageable number of priorities, which may undermine their feelings of support.

Administrators who were perceived by teachers as encouraging technology use reported a variety of priorities for technology use in their schools at higher rates than those in the remaining seven schools, including the following:

- Improve career preparation (58 percent to 29 percent).
- Increase integration of technology (50 percent to 29 percent).
- Make instruction more data driven (50 percent to 0 percent).
- Publicize student and school accomplishments (42 percent to 14 percent).

Again, this effect is probably due to the fact that these administrators reported an average of slightly less than $1\frac{1}{2}$ more priorities for technology use than those who were not perceived as encouraging technology use. It is possible that teachers in these schools perceive that administrators who have more priorities for technology use are more supportive of technology; though teachers may feel less administrative support for themselves as a result.

It is interesting to note that administrators who were perceived as both supporting teachers and encouraging technology (Schools C, E, H, and S) selected fewer priorities for technology use than any other group, including an average of almost one less priority than administrators who were perceived as supporting teachers but not encouraging technology (Schools A, L, N, and R). One school (School H) is excluded from this analysis because administrator priorities were not reported. Administrators who were perceived as encouraging technology use, but not supporting teachers, reported more priorities than any other group (Schools B, D, F, G, J, K, P, Q), including an average of almost five more priorities than those who were perceived as both supporting teachers and encouraging technology use. It seems clear that there is an association among the high-performing, high-technology schools between administrative focus on a relatively small number of priorities

and teacher perceptions of support from their administration. Furthermore, two administrators were perceived as encouraging technology use even though they indicated only one or two priorities for technology use in their schools.

Conclusion

The high-performing, high-technology schools have capable administrators who are instructional leaders for their teachers. Teachers appear to appreciate administrators who are openly supportive of their efforts and who translate that support into measurable action by finding funding or equipment or otherwise channeling resources into the areas that teachers have deemed most important for their students. Administrators are also involved in setting policy for their schools by leading their staff members in the development of a vision of what the school can become, and then often translating that vision into a workable school improvement plan or, in some cases, technology plan. Administrators in this study also set their priorities for technology use based on what would be best for student learning and for the development of teacher expertise, and they themselves used technology most frequently to streamline their daily tasks and to improve their own efficiency and effectiveness as a professional.

Emphasis on Improvement

The most significant focus of the study related to the use of technology by teachers, administrators, and students. Survey and interview respondents were asked about the ways technology contributed to their practice and to student learning and achievement; and technology use was observed in the classroom and other areas of the schools. The characteristic “Emphasis on Improvement” relates to the specific ways these schools used technology to determine and close achievement gaps, and to improve curriculum and instruction. Other descriptors include the active pursuit and dedication of funding for technology and in support of academic goals, and the unique ways in which each school and district promoted or hindered technology use.

Description

The high-performing, high-technology schools view and use technology not as an end in itself but as a means to an end. Specifically, the schools emphasize using technology to collect, analyze, and report data toward the ends of school improvement and student achievement. Many of the teachers and administrators in interviews said that they analyze student data and specifically use test scores to identify achievement gaps for individual students or groups of students (Schools C, E, F, J, K and P), and to improve curriculum and instruction or to set goals for student achievement (Schools B, C, D, F, G, H, I, J, K, M, N, O, P, Q, and R).

Beyond analyzing data, however, teachers use and assign technology so that their students may learn more efficiently, demonstrate their own learning more creatively, and have their learning assessed more accurately. Likewise, administrators use technology to meet the myriad of needs presented by their school community as effectively as possible. Teachers and administrators reported in interviews and survey responses the school, district, state, and federal policies that most contribute to their use of technology, as well as those that have proven to be obstacles to technology use. In all, respondents named 10 policy influences that promote and 13 that hinder their use of technology. Across the 19 schools, the largest number of policy practices that promote technology use was seven (School J), and the least was two (School Q), although neither of these schools reported frequent student use of technology. The largest number of policy

obstacles was seven, reported by School D, and the least number of obstacles was one (Schools F, P, and R). All three of the schools reporting the least number of hindrances also reported frequent student use of technology.

Among the most often reported aspects of their schools or districts that promote the use of technology, teachers and administrators at all 19 schools named the availability of funding or grants to support the acquisition and maintenance of technology. Only School F named a dedicated funding source that ensured that they would have up-to-date technology, which was provided because of their business-oriented curriculum. Other schools needed to make a stronger, more concerted effort to acquire the technology they needed. At Schools A and P, for instance, teachers mentioned that their administrators directly tie technology purchases to their academic goals and standards; and at eight schools (Schools B, E, H, M, N, P, Q, and R), teachers and administrators actively pursue grants and other sources of funding to support their technology acquisition. Only School P reported the connection between technology purchased in support of academic goals and the subsequent active pursuit of funding. School P has three computer laboratories, computers in every classroom, a video production laboratory, and a wireless word processing system, possibly acquiring this level and quantity of technology because the majority of students (as in Schools C, D, and I) do not have access to technology in their homes.

At 16 schools (all but Schools D, L, and Q), administrators and teachers named their technology plans or other district or school policies that either required the use of technology and/or specified the ways in which students were to use and become competent in technology. An obvious aspect that would promote technology use is the adequacy of the technology resources (both hardware and software) that is available to teachers and students, and 14 schools (Schools A, B, C, D, E, F, G, H, I, J, K, M, O, and S) named their resources as adequate or better. Available technology support for staff is essential in terms of saving a lesson if the equipment is not working properly or to help teachers learn new ways of integrating technology into their lessons, and 13 schools (Schools A, C, D, E, F, G, H, I, J, K, L, N, and R) said that the support they had available to them promoted the use of technology in their school. The ability of the technology personnel to acquire, evaluate, and maintain the technology infrastructure, equipment, and software also was mentioned by 10 schools (Schools B, C, E, J, K, L, O, P, Q, and S).

Other less frequently mentioned practices or policies that promote the use of technology in the participating schools include class schedules (such as block scheduling) or equitable scheduling of classes into the computer laboratory (Schools F, I, J, L, R, and S); the state providing laptops for teachers (Schools B, D, M, and R); the district technology plan being closely aligned with other state standards (Schools A, C, G, and K); and the availability of software to help provide extensive standardized test practice (Schools D, E, M, and R). Schools H and L mentioned that technology is beneficial because it can provide immediate feedback to students, which encouraged their use; and some teachers or administrators at Schools J, L, R, and S were unable to name any policies that contribute to technology use at their schools.

Most commonly, teachers and administrators (Schools A, B, E, I, J, K, L, M, O, and S) named inadequate funding for technology or technology-related supplies as being the most significant obstacle to technology use at their schools. Related to inadequate funding were inadequate technology resources or software, named by nine schools (Schools B, C, G, H, J, K, L, M, and S); and inadequate technology support for staff, named by eight schools (Schools A, B, C, D, G, L, O, and S). Eight schools (Schools B, H, J, K, L, N, P, and S) also named district plans or policies

(most often policies about equipment purchase, software installation, or the use of Internet filters) as obstacles; and six schools (Schools G, J, K, O, Q, and S) cited burdensome grant expectations. Several administrators and teachers were unable to name any policy that hinders their technology use—one or more at 15 schools (Schools C, D, E, F, G, H, I, K, L, M, N, O, Q, R, and S)—suggesting perhaps that a number of educators do not consider policy to be an important influence on their practice.

Other less frequently mentioned obstacles included inadequate time to use technology effectively or scheduling difficulties with the computer laboratory (Schools C, D, I, and M); malfunctioning technology (Schools C, D, and J); no computer teacher (Schools A and D); and the inequitable distribution of technology or the unequal access to technology in their schools (Schools B and D). Teachers at School B mentioned that their district controls all technology purchases to the detriment of its use. Two schools were limited by older facilities or equipment. Teachers at School K said their building was not designed to accommodate their growing level of technology, and teachers at School L said that the equipment they do have is not new enough to accommodate the latest software and CD-ROMs.

Analysis

Across the high-performing, high-technology schools, the emphasis on technology has shifted substantially from “boxes and wires” to using technology as a tool for school improvement and student achievement. Almost all of the schools use data to identify achievement gaps, often at the level of individual students, or to improve curriculum and instruction. The use of technology to collect, analyze, and report data for these purposes is consistent with administrators’ priorities for technology use as well as the professional use of technology to improve both administrative and teaching practice. However, about one half of the schools continue to struggle to some extent with inadequate funding for technology, inadequate technology resources, and inadequate support for technology. On the other hand, very few of the schools have problems with malfunctioning technology or facilities that do not accommodate technology. All of the schools cited some funding source, most commonly grants and e-Rate, as an important factor that has promoted technology use. Almost all of the schools also mentioned district policies, plans, or standards that have promoted technology use.

Table 6 shows descriptors of emphasis on improvement that were coded for at least 4, but not more than 15, of the high-performing, high-poverty schools. These descriptors were analyzed for possible patterns of similarities and differences among the high-performing, high-technology schools in how they view and use technology.

Table 6. Selected Descriptors for Emphasis on Improvement

Descriptor	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
Improvement Descriptors																			
Curriculum and Instruction		X	X	X		X	X	X	X	X	X		X	X	X	X	X	X	
Student Achievement			X		X	X				X	X					X			
Technology Supports																			
Adequate Technology Resources	X	X	X	X	X	X	X	X	X	X	X		X		X				X
Technology Support for Staff	X		X	X	X	X	X	X	X	X	X	X		X				X	
Acquire and Maintain Technology		X	X		X					X	X	X			X	X	X		X
Actively Pursue Technology Funds		X			X			X					X	X		X	X	X	
Scheduling (Computer Lab)						X			X	X		X		X		X			
No Supports or Unsure										X		X						X	X
Teachers Given Hardware		X		X									X					X	
Tech Aligned With Academics	X		X				X				X								
Standardized Test Practice				X	X								X					X	
Technology Obstacles																			
No Obstacles or Unsure			X	X	X	X	X	X	X		X	X	X	X	X		X	X	X
Inadequate Technology Funding	X	X			X				X	X	X	X	X		X				X
Inadequate Technology Resources		X	X				X	X		X	X	X	X						X
Inadequate Technology Support	X	X	X	X			X					X			X				X
Plans, Policies, or Standards		X						X		X	X	X		X		X			X
Burdensome Grant Expectations							X			X	X				X		X		X
Inadequate Time or Scheduling			X	X					X				X						

Nine of the high-performing, high-technology schools generally felt that they had adequate funding for technology (Schools B, E, F, H, M, N, P, Q, and R), although at least one educator at two of these schools (Schools B and E) disagreed. Schools with adequate funding reported in greater proportions that hardware provided by the state (33 percent to 10 percent) and extensive standardized test practice (33 percent to 10 percent) were factors that promoted technology use. It may be somewhat surprising that schools with adequate funding for technology referred at lower rates to adequate funding (56 percent to 90 percent) and technology support (56 percent to 80 percent) as factors that promoted technology use. However, the most reasonable interpretation is that teachers in these schools place greater value on adequate funding and technology support because they are not present to the same extent as in schools that do have adequate funding. It is certainly not a surprise that schools with adequate funding referred to a number of obstacles to technology use in smaller proportions than schools that did not report adequate funding, including the following:

- Burdensome grant regulations (11 percent to 50 percent).
- Inadequate technology resources (33 percent to 60 percent).
- Inadequate funding for technology (33 percent to 70 percent).
- Inadequate technology support (11 percent to 70 percent).

All nine of the schools with adequate funding for technology used technology to analyze data; all except one (School E) used data to improve curriculum and instruction and that school used data to identify achievement gaps. All but 3 (Schools A, L, and S) of the 10 schools that did not have adequate funding nevertheless used technology to analyze data to improve curriculum and instruction. There seems to be a strong association between adequate funding for technology and focusing technology use on school improvement and student achievement, but adequate funding is not a prerequisite for

this focus. The most important obstacles that schools without adequate funding seem to face include burdensome grant regulations and inadequate technology support.

Conclusion

Teachers and administrators at all 19 schools have important purposes in mind for their use of technology and seek to make it a more influential tool by using it not only to analyze data, but to improve curriculum, instruction, and achievement. Many factors contribute to the use of technology at each school; however, the most important factor is money. Schools that have adequate funding for technology and whose administrators channel those funds into the practical help that teachers need (technology support staff, adequate maintenance, and infrastructure) are more frequently able to use their technology effectively. Likewise, the biggest obstacle to technology is a lack of funding, which directly translates into inadequate technology support, equipment, and software. While grant money is available, only a handful of schools actively pursue it, possibly because the requirements and expectations for grants are considered burdensome by many schools. One other practical consideration is the ability of the school facilities to accommodate growing technology, a problem that is much more expensive to correct than others.

Parent and Community Involvement

Each of the 19 schools in the study had strong parent support, a variety of community partnerships, or both, although some teachers and administrators mentioned this characteristic as a contributor to student achievement more than others. Survey and interview respondents cited parent and community fund-raising and other material or financial support, classroom and school volunteers, collaborative partnerships with businesses or other community organizations, as well as the school providing services, information, and classes to parents and the community as examples of the sixth characteristic, "Parent and Community Involvement."

Description

Parents and community members are able to provide different types of support for schools. In some cases, parents and the greater community are very active outside the school. They may raise funds, provide material resources such as technology and other equipment, or support efforts for new programs or playgrounds. In other cases, parents and community members are active as volunteers, serving in the classrooms by assisting the teacher, tutoring children, or handling clerical tasks that ease the day-to-day burdens. In both these instances, parents and community members who support their schools are valuable members of the school community and contribute to the overall success of the school.

In this study, teachers and administrators at 15 schools (Schools A, B, C, D, E, G, H, I, J, M, N, O, Q, R, and S) said that parents and community members were active volunteers in their classrooms. Some examples of this involvement include volunteering for after-school and Saturday programs (School H), a "Wiring Weekend" when parents and community members wired the school for technology (School I), individual tutoring (School J), chaperoning field trips (School M), visiting classrooms (Schools M and R), providing rides for students (School N), coaching (School Q), and fulfilling clerical duties (School J). At 12 schools (Schools A, B, C, F, G, H, J, M, O, Q, R, and S), parents and community members are involved in fund-raising, program support, and governance roles. Examples of this level of involvement include extensive fund-raising (Schools B, C, and S); providing donations of other items (School D); voting in support of bond issues (School G); attending a student art show (School I); lobbying in Washington to protect the neighborhood (School L); providing winter clothing for students (School N); building a community center on campus (School Q); and serving in governance roles or on committees (Schools O, Q, and S).

Nine of the 19 schools (Schools A, D, F, H, J, M, O, Q, and R) have established active community partnerships with a variety of organizations, including large corporations (School A), other area businesses (Schools D, F, and O), churches (School M), and community organizations and agencies (Schools M, O, and R). Through these partnerships, students may job shadow (School F), receive mentoring (Schools D and F), receive scholarships (School O), and participate in recreation, arts, faith-based tutoring, or other programs (Schools H and J).

While schools receive much from their parents and the greater community, they also give back in a variety of ways. Six schools in the study (Schools A, D, J, N, O, and Q) also either provide classes for the community (Schools D and O), family support services (Schools A and Q), or regular information to parents and community about their use of technology (Schools J, N, and Q).

Analysis

All but three schools (Schools K, L, and P) had one of three forms of parent and community involvement: parents and the community provide funding and resources; parents and the community are involved in classroom activities and school events; and collaborations or partnerships with businesses and other community organizations. Six schools had all three forms of parent and community involvement (Schools A, H, J, M, O, and R). Six schools had two of the three forms of involvement (Schools B, C, D, F, G, S) and two schools had one form (Schools E and N). Five of the schools also provided some sort of service or support to the community (Schools D, J, N, O, and Q), whereas none of the four schools that did not have parent and community involvement provide services or support to the community. There does appear to be some association among these schools between parent and community involvement in the school and active school involvement in the community, but it is not a strong association. Table 7 shows all descriptors of parent and community involvement that were coded for the high-performing, high-poverty schools.

Table 7. Descriptors for Parent and Community Involvement

Descriptor	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
Community Involvement in School																			
<i>Involved in School/Classroom</i>	X	X	X	X	X		X	X	X	X			X	X	X		X	X	X
<i>Provide Funding or Resources</i>	X	X	X			X	X	X		X			X		X		X	X	X
<i>Collaboration With Community</i>	X			X		X		X		X			X		X		X	X	
<i>Any of the Above</i>	X	X	X	X	X	X	X	X	X	X			X	X	X		X	X	X
School Involved in Community																			
<i>School Supports Community</i>	X			X						X				X	X		X		
<i>Tech Information for Parents</i>										X				X			X		
<i>School Provides Classes</i>				X											X				
<i>Family or Community Services</i>	X																X		
<i>Any of the Above</i>	X			X						X				X	X		X		

Conclusion

The high-performing, high-technology schools have fostered parent and community involvement, and used it in creative ways that promote student learning. Teachers and administrators are aware of the time and financial limitations of their parents and community members, yet involve them in meaningful ways, sometimes being surprised themselves at how resourceful the families and community can be. It is this apparent mutual appreciation among the schools, families, and communities of each other's efforts on behalf of the children that sets these schools apart.

DISCUSSION

The high-performing, high-technology schools are most clearly and immediately characterized by a challenging and cohesive learning environment that is attributed primarily to caring teachers and high academic expectations. Although administrators and teachers most strongly emphasized affective factors, they also described physical characteristics that contribute to the learning environment in many of the schools and very rarely mentioned inadequate space or other physical characteristics as problems. All of the high-performing, high-technology schools had computers in classrooms, and almost all have at least one computer laboratory. Almost half of the schools had two or more computer laboratories, and three had media production facilities.

The high-performing, high-technology schools have developed an instructional program that reflects a coherent approach to curriculum, instruction, and assessment and is almost always based on standards. Teachers assign students to use technology within the core curriculum and employ content-specific strategies and software. They assign students to use technology to master skills just taught and remediate skills not learned, regardless of whether their instructional emphasis is basic skills or higher-order thinking. They also assign students to use technology for research and writing; the Internet and word processors are by far the technology resources most commonly used by students. Teachers in these schools universally employ large group instruction and have students work independently with and without computers. Almost all of the schools also have students work in collaborative pairs without computers, and with computers in many of the schools. Although these schools strongly emphasize technology use within the core curriculum, they also explicitly teach technology content and are concerned with improving students' computer skills.

Teachers at the high-performing, high-technology schools have a strong sense of efficacy based primarily on confidence in the competence of themselves and their colleagues and reinforced by collaboration and teamwork among teachers. They almost always refer to professional development in both content areas and technology as a factor that contributes to their professional community. These teachers universally use technology to make their professional practice more efficient and effective. They use technology for a number of professional purposes that are directly related to instruction: to conduct research; access information on best practices; present information to students; record grades and track student progress; and, most commonly, to find, update, and create instructional materials. They also use technology to communicate with parents and other educators and to keep administrative records.

The high-performing, high-technology schools have effective leaders who have crafted a unified vision for the school, which is often documented in a school improvement plan or technology plan. Administrators, like teachers, use technology to make their professional practice more efficient and effective. They use technology to create administrative materials and presentations, access information on best practices, and analyze data for school improvement. Their priorities for technology use in their schools are primarily focused on individualizing learning experiences and different aspects of student achievement, including basic skills, 21st century learning skills, and performance on standardized tests.

Although about half of the high-performing, high-technology schools continue to experience difficulties with inadequate funding and support for technology resources, most have found ways to work around these problems and shift their emphasis to using technology for school improvement and student achievement. Almost all of the schools use technology to collect and analyze data either to identify specific achievement gaps or to improve curriculum and instruction. These schools appreciate and exploit the ability of technology to individualize instruction, regardless of their instructional philosophy. All of these schools cite some source of funding, most often grants or e-Rate funds, as instrumental in supporting their use of technology. Many high-performing, high-technology schools also regard state or district plans, policies, and standards as helping to enable technology use.

Although these case studies were not instrumented specifically to collect data about parents and the community, their active involvement in many of these high-performing, high-technology schools emerged in interviews with administrators and teachers. Other than some reports of parents or community groups providing funding, technology did not seem to be as strong a factor in this characteristic as in others. In some cases, educators perceived a unique relationship between the school and the community. In the most extreme cases, these relationships seemed to be forged by geographic or economic isolation. In these cases, educators often believed that technology was a powerful tool to overcome this isolation and provide students with opportunities they otherwise would not be afforded in these communities. In these cases, educators often indicated that parents shared this view and were strong advocates for technology in their school.

There are two ways to interpret the finding that these factors are found in almost all of the high-performing, high-technology schools that were studied. On one hand, these factors could be the most essential supports for effective use of educational technology because they are found universally in high-performing, high-technology schools, provided they are not common in other schools as well. On the other hand, if they are common in schools that are not high-performing and high-technology, they would be more likely to be the least essential supports for effective technology use. It is also possible that some of these factors are characteristic of high performance, but not necessarily effective technology use, or vice versa. More research with appropriate designs is needed to determine if and how these factors may be correlated.

The factors that seem to account for the most important differences among the high-performing, high-technology schools include:

- The effect of small class sizes.
- The interaction effect of small class sizes and strong classroom management.
- The effect of emphasizing basic skills or higher-order thinking.
- The interaction effect of instructional emphasis and technology integration.
- The effect of caring teachers.
- The interaction effect of caring teachers and focus on standards.
- The effect of administrators supporting teachers.
- The interaction effect of administrators who support teachers and encourage technology use.
- The effect of administrative priorities for technology use.
- The effect of adequate funding.

Strong classroom management appears to be associated with frequent student use of technology, even in schools with small class sizes, although the direction of this effect is not clear. In particular, we were not able to discern whether strong classroom management facilitates student access to technology or free and equal student access to technology facilitates classroom management. More research is needed to understand fully the relationships among small class sizes, classroom management, and student technology use in high-performing, high-technology schools. These three descriptors seem to be important variables in the challenging and cohesive learning environments these schools provide for their predominantly low-income, African-American, and Latino student populations.

A majority of the high-performing, high-technology schools emphasized either basic skills or higher-order thinking, but not both, in their approaches to curriculum, instruction, and assessment. However, this choice did not seem to have a consistent effect on other descriptors of the cohesive instructional programs in these schools. For example, teachers in both groups of schools seemed to use a variety of activity structures and report that they differentiate instruction and provide opportunities for hands-on learning in equal proportion. Teachers reported that technology was integrated in basic-skills schools in somewhat greater proportion than teachers in higher-order thinking schools. One possible interpretation is that teachers in the basic-skills schools often use educational software to provide individualized instruction and collect data to differentiate their face-to-face instruction, while teachers in higher-order thinking schools often provide opportunities for students to use content-free software to analyze information or solve problems and for self-directed or interactive learning. However, it is interesting to note that teachers in higher-order thinking schools reported that students use technology to practice for standardized tests in somewhat greater proportion than those in basic-skills schools, possibly because they believe technology provides an efficient and effective way to prepare students for standardized tests and leaves as much instructional time as possible for the development of higher-order thinking skills.

The extent to which teachers emphasize standards appears to be closely associated with the role of technology in the professional communities of the high-technology, high-performing schools. Teachers in schools that reported focusing on standards expressed a commitment to both computer technology and traditional technology (such as overhead projectors) at substantially higher rates than others. Overall, teachers that reported a strong sense of caring for students reported a commitment to technology in smaller proportion than teachers in the remaining four schools. However, teachers in schools that reported both a strong sense of caring for students and a strong focus on standards expressed a commitment to technology in substantially greater proportion than those in schools that expressed a sense of caring without a focus on standards. It also is interesting to note that the four schools in which teachers indicated a veteran staff contributed to the success of the school reported both a sense of caring and focus on standards; three of the four schools also expressed a commitment to technology.

There seems to be an association between teachers' perceptions of effective leadership in the high-performing, high-technology schools and the number of priorities that administrators report for technology use. Administrators in schools where teachers did not specifically mention that they are supported by the administration reported an average of 2½ more priorities for technology use than those in which teachers did indicate that they feel support. It is possible that teachers' feelings of support may be undermined by a perceived lack of focus on a manageable number of technology priorities. On the other hand, administrators who were perceived by teachers as encouraging technology use reported a variety of priorities for technology use in greater proportion

that those in which teachers did not specifically mention that the administration encourages technology use. However, administrators who were perceived to both support teachers and encourage technology use selected fewer priorities for technology use than any other group. Furthermore, two administrators were perceived as encouraging use of technology even though they reported only one or two priorities.

The high-performing, high-technology schools view and use technology not as an end in itself but as a means of collecting, analyzing, and reporting data to improve curriculum and instruction, and identify achievement gaps for individual students and groups of students. However, about one half of the schools continue to struggle to some extent with inadequate funding or support for technology. It may be somewhat surprising that schools that reported adequate funding for technology referred to funding and technical support as factors that promote use of technology in smaller proportion than schools that did not indicate adequate funding. However, the most reasonable interpretation is that teachers place greater value on adequate funding and technical support when it is present to a lesser extent. Adequate funding for technology seems to be associated with an emphasis on improvement, but adequate funding is clearly not a prerequisite for this emphasis. The most significant obstacles that schools without adequate funding reported were burdensome grant regulations and inadequate technical support.

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APPENDIX A: DESCRIPTORS

DEMOGRAPHICS

Education Trust High Poverty
 Education Trust High Minority
 Poverty > 50 percent
 Minority > 50 percent
 K–5
 PK–5
 PK–6
 K–6
 K–8
 Middle School 6–8
 Middle/High School 6–12
 High School 9–12
 Magnet School
 Title I School

Specialized population (gifted)
 Specialized population (limited English proficient)
 Specialized population (low literacy)
 Specialized population (business/careers students)
 Specialized population (health-related career students)

Majority of students do not have computers at home
 Over 50 percent of students have computers at home
 Over 75 percent of students have computers at home

1. *Challenging and cohesive learning environment*

Ambience/family atmosphere
 Classroom management/school discipline plan
 High academic expectations
 High achieving/motivated/“on task” students
 Small class size
 Small school size

Physical space/characteristics
 Inadequate physical space

Computers in the classroom
 No computer laboratory
 One computer laboratory
 Two or more computer laboratories
 Media production facilities

Primary or elementary level preparation
 Resources are focused to provide impact on student achievement
 Service learning opportunities
 Strong college preparation

Enrichment/extended day programs
 Tutorial/remedial programs

Frequent use of technology/software
 Student excited/motivated/have positive attitudes about technology use
 Students are expected to use computers/technology
 Students have free/equal access to class computers or laboratories
 Technology aids job, life, future school skills
 Technology builds student confidence

2. *Coherent instructional program*

Differentiated instruction/specialized strategies to meet student needs
 Students move at their own academic pace

Class discussions
 Direct instruction
 Emphasis on basic skills development/literacy
 Emphasis on higher-order thinking
 Hands-on manipulatives/activities used
 Project-based, open-ended, interdisciplinary curriculum
 Students receive rubrics for project assignments
 Use of centers, workshops, or stations

Alignment of curriculum with standards
 Use of print resources
 Use of teacher-created materials

Courses in computer/technology are required
 District adoption of Open Court/minimal technology use permitted
 District adoption of Success Maker software for remediation
 Elective courses in computer/technology are offered
 Regular computer laboratory instruction is provided to students
 Regular computer time for skills practice is given to students
 Student participation in technology/media competition
 Technology integrated into curriculum and instruction

STUDENT USES OF TECHNOLOGY:

Analyze information or problem solving
 Communication
 Content-specific strategies
 Create artifacts or documents/general writing
 Create multimedia presentations
 Enrichment/virtual field trips

Explore concepts, models, or simulations
 Graphically organize ideas or information
 Higher-order thinking
 Improve computer/technology/keyboarding skills
 Interactive learning
 Master skills just taught
 Practice for standardized tests
 Present information to an audience
 Publish work on the Web
 Remediate skills not learned
 Research/gather information
 Reward for good behavior/free time
 Self-directed learning
 Work collaboratively
 Work independently

ACTIVITY STRUCTURES OBSERVED/MENTIONED:

Adult tutoring
 Adult-led large groups
 Adult-led small groups
 Collaborative pairs
 Collaborative small groups
 Individual
 Peer tutoring
 Rotating centers
 Student-led large groups

3. Professional community of teachers

Teacher care/accountability/dedication to students
 Teacher commitment to school improvement
 Teacher competence
 Teachers have autonomy
 Veteran staff

Staff teamwork/sharing and planning/collaboration
 Team teaching/resource teacher works in classroom

Teachers do not "teach to the test"
 Teachers focus on standards/use standards and tests as resources
 Teachers teach test-taking skills/prepare for test

Assessment of new staff technology skills
 Professional development provided in content and technology
 Professional development required in content and technology
 Teacher commitment to technology

TEACHER USES OF TECHNOLOGY:

Access information on best practices

Assess/document learning
 Communicate with parents/guardians/colleagues
 Create artifacts/documents/general writing
 Diminish geographic isolation of community/students' inexperience
 Engage students in inquiry
 Extensive use of traditional or technology other than computers (overheads, etc.)
 Find professional development resources
 Find, create, or update instructional resources/assessments
 Increase teacher efficiency
 Management/recordkeeping/administrative uses
 Prepare students for standardized tests
 Present information to students
 Publish student work on the Web
 Pursue funding
 Research/gather information
 Track student data/grading

4. *Effective school leadership*

Administrative support of teachers
 Administrator closely monitors class achievement and attendance
 School improvement plan or unified vision

Technology plan in development or in place
 Administrator supports and encourages technology use

ADMINISTRATIVE PRIORITIES:

Improve administrative efficiency
 Improve administrators' computer skills
 Improve career preparation
 Improve parents' computer skills
 Improve student achievement on standardized tests/state assessments
 Improve students' basic and future learning skills
 Improve students' computer skills
 Improve teachers' computer skills
 Increase integration of technology
 Increase parent communication
 Increase parent involvement
 Increase professional development
 Individualize student learning experiences
 Make instruction more data driven
 Make school improvement decisions more data driven
 Publicize student and school accomplishments
 Use technology in curriculum development, instruction, and assessment

ADMINISTRATIVE USES OF TECHNOLOGY:

Access information on best practices
 Align curriculum to standards
 Analyze student data for school improvement

Communicate with other administrators/parents/guardians/colleagues
 Create administrative materials or presentations
 Find professional development resources
 Keep administrative records
 Present information to an audience
 Publish school information
 Purchase materials and/or services
 Research

5. **Emphasis on Improvement**

Test scores used to improve curriculum/instruction/set goals for achievement

Dedicated funding source due to curriculum (business/career)
 Teachers/administrators actively pursue funds for technology
 Technology purchased in support of academic goals/standards

PROMOTES TECHNOLOGY USE:

Acquisition and maintenance of infrastructure/technology/software
 Adequate technology resources
 Beneficial scheduling/computer laboratory schedule
 Money or grants/E-rate
 Plans/policies/standards—benefit
 State provides hardware for teacher use
 Technology can provide immediate feedback to students
 Technology plan aligned with standards/academic expectations
 Technology support for staff
 Technology use/preparation in the primary grades
 Technology used extensively for standardized test practice

OBSTACLES TO TECHNOLOGY USE:

Building is not designed to accommodate growing technology
 Burdensome grant expectations
 District controls technology purchases
 Inadequate funding for technology/technology-related supplies
 Inadequate technology resources or software
 Inadequate technology support for staff
 Inadequate time/scheduling difficulties
 Inappropriate class size
 Malfunctioning technology
 No computer teacher
 No obstacles/unaware/unsure
 Plans/policies/standards—obstacle
 Technology availability/access not equal throughout school

6. Parent and community involvement

Parents/community involved in funding/providing resources/support

Parent involvement in school/classroom activities

Collaboration with businesses or community organizations

School provides classes for community

School provides family support or other services

District provides information to parents about technology use

CASE STUDIES OF HIGH-PERFORMING, HIGH-TECHNOLOGY SCHOOLS:



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