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

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Methods and Data Sources

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

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

• What effects on student achievement do administrators and teachers in high-performing, high-technology schools attribute to educational technology?

• What types of educational technology do administrators, teachers, and students use in high-performing, high-technology schools?

• What educational technology practices do administrators and teachers in high-performing, high-technology schools employ?

• What educational technology policies do administrators and teachers in high-performing, high-technology schools implement?

• How does the technology capacity of high-performing, high-technology schools affect administrator, teacher, and student use of educational technology?

• What resources, strategies, and structures do schools use to become high-performing and high-technology; to what extent are these integrated with other school improvement efforts?

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

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

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

A member of the research team visited each school during the winter of 2002. Open-ended interview protocols provided qualitative data, while classroom observation protocols and survey instruments contained a mix of open- and close-ended items that provided both qualitative and quantitative data. Principals were asked to schedule at least six teachers for 30-minute interviews and 20- to 25-minute classroom observations. Technology plans and school improvement plans were collected during the winter site visit whenever they were available and other documents were collected when offered. Surveys were distributed to all administrators and teachers in each school after site visits were completed. Principals were briefed by telephone on data collection
procedures and asked how many printed administrator and teacher surveys should be mailed to the school. Response rates were calculated based on the number of surveys principals requested, and at least two subsequent telephone calls were made to each teacher to improve response rates. A case report was drafted based on the triangulation of interview, observation, survey, and documentary (Yin, 2003; Greene et al., 1989). The draft case report addressed each of the original research questions and identified primary and secondary characteristics of each school based on each question. In general, attributes that were reported by a majority (at least one half) of respondents in the school were classified as primary and attributes reported by a substantial minority (at least one fourth) were classified as secondary. Attributes reported in multiple data sources were assumed to be more reliable than those reported in one data source. The draft case report was returned to the principal of each school for review and revised based on comments received from the school.

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

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

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

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

School O’s district serves more than 300 K–12 students from three counties. The school’s current enrollment is about 170 students, most of whom are white with a comparatively small constituency of African-American, and Latino students represented as well. While there are no limited English proficiency students, approximately one fifth of the students qualify for special education services, and nearly one half qualify for free or reduced-price lunches.

School O is located in a small village that was settled and incorporated in 1905. Although the town population has exceeded 1,000, it is now estimated to be less than 700; many residents are elderly, retired people. During the 1940s and through the 1960s, the village had several locally owned and operated businesses, which are no longer in existence. As a result, the school population has decreased and the area has become more impoverished.

The village farming community values education highly and technology has been emphasized as a high priority. The Eagles, Lions, and American Legion clubs are among several service organizations that support the school system. They, and approximately 20 other organizations and businesses, provide the senior class with local scholarships each year. Community education classes are well attended and there is a Curricular Advisory Committee, whose members represent diverse age groups.

Case Summary

Teachers and students at School O have developed a close, family-like atmosphere. Class sizes are small and teachers are able to give students individualized attention. Teachers tend to prefer using a hands-on approach that focuses on building basic skills and literacy. Teachers also use a variety of grouping strategies (e.g., adult-led large groups, collaborative groups, and individual work) to offer students a range of classroom experiences. Teachers at School O know students and their families well. Teachers care about students, take responsibility for student learning, and feel that their competence contributes to student achievement. Teachers collaborate on lesson planning and participate in professional development activities.

Teachers also use technology to support their professional activities. When asked in interviews which professional activities were most influenced by technology, most respondents mentioned communicating with staff and parents/guardians, finding and creating instructional resources, and tracking student data. Teachers who were surveyed stated that creating instructional resources, gathering information for planning lessons, communicating with colleagues, and accessing information and research on best practices were the uses of technology that have most significantly influenced their practices. Teachers reported using technology most frequently to create instructional materials and keep administrative records.

The School O administrator views technology as a tool that is used to complement the work teachers do in the classroom. The administrator who returned the survey named several priorities for teacher and student technology use at the school including improving teachers’ computer skills; improving the integration of technology; and using more technology in curriculum and instruction. Similar to teachers, the administrator reported that technology has affected the
creation of administrative materials, accessing information and research on best practices, and keeping administrative records. The administrator also reported using a Web browser, spreadsheet, software suite, and e-mail applications on a daily basis. Both teachers and administrators use technology to analyze test scores in order to improve the curriculum and instruction.

Administrators and teachers support the use of technology at School O. Students are enthusiastic about using technology and teachers believe that it builds confidence. School O has three computer laboratories, computers in the classrooms, and laptops are available to be checked out for home use. Teachers also use other hardware available in their classrooms (e.g., overhead projectors, TV, and VCRs) in addition to computers. Many teachers reported that student use of technology to conduct research, write, and master new skills have most impacted student achievement. However, most technology use appears to occur on a monthly basis. When teachers assign students to use technology, a Web browser, word processor, and software suite are most frequently assigned because these are believed to have the most influenced student achievement.

Interview respondents stated that the acquisition of hardware and software, in addition to the adequacy of technology resources, contributes to technology use at the school. The school consistently upgrades technology, often seeking grant funding to accomplish this. The availability of E-Rate and other grants are seen as beneficial resources.

Parents and the local community are actively involved in the school. The community values education. For example, 90 percent of parents participate in parent-teacher conferences. In this rural area, there is little for the students to do in their free time. The school has become a recreational source for students by offering as many clubs, activities, and sports as possible, in addition to the basic academic program. The principal feels that the school is unique in that students are given a great deal of individual attention regarding academic and other issues, with good teachers, counselors, and programs that ensure students are not left behind.

Because of the small student population, there are not enough students for the athletic program, and the school has begun combining teams with other schools. Although this move has been a help to the athletic program, it also has been a source of diminishing student and family identity, because many parents and grandparents in the area used to playing against the other teams. A high percentage of students from School O continue their education after they graduate, whether it is through college attendance or through technical training. One administrator noted that student success after graduation is partially due to the school’s counseling department, in addition to the teamwork among the network of teachers, the administration, the school board, and the majority of parents.
### Academic Achievement

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

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<tr>
<th>Primary Characteristics</th>
<th>Secondary Characteristics</th>
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<tr>
<td>One half of interview respondents identified student use of technology for research purposes as having a significant impact on student achievement at School O.</td>
<td>Two fifths of interview respondents cited parental involvement, small school size, and teacher concern for students as school characteristics that contribute to student achievement.</td>
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<td>Teacher survey respondents most frequently reported a Web browser, word processor, and software suite as the software titles with the greatest effect on student achievement. Reported purposes of software use were related to writing, research, and creating documents.</td>
<td>About one fourth of interview respondents mentioned high academic expectations; teacher competence; meeting students’ individual needs; communication with staff, parents, and others; and other community characteristics as contributing to student achievement.</td>
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<td>Teacher survey respondents ranked conducting research as one of the top three purposes for student technology use that has the greatest effect on student achievement. About one half ranked express themselves in writing among the top three purposes.</td>
<td>Two fifths of interview respondents referred to student use of hardware other than computers as having a significant impact on student achievement. One third cited computers in general, and about one fourth identified content-specific strategies as student uses of technology that impact student achievement.</td>
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<td>Two fifths of survey respondents reported that they assign students to use technology at least weekly to express themselves in writing, conduct research or gather information, and learn to work independently. At least one third reported they assign students to use technology to master skills just taught, remediate skills not learned, and improve their computer skills at least weekly. One fourth reported assigning technology use for students to learn to work collaboratively, analyze information or solve problems, and graphically organize information or ideas at least weekly.</td>
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<td>One third of teacher survey respondents ranked mastering skills just taught among the top three purposes of student technology use with the greatest effect on student achievement.</td>
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When asked about the characteristics of School O as a whole that have the greatest impact on student achievement, four (44.4 percent) of the nine teachers and administrators who were interviewed cited parental involvement, small school size, and teacher care for students. Two (22.2 percent) participants reported high academic expectations, teacher competence, meeting the individual needs of students, communication with staff, parents, and others, and other community characteristics. Small class sizes help facilitate the provision of individual instruction tailored to the specific needs of each student. Further, given that School O is situated in a small local community, teachers tend to know the students and their families well, which provides a basis for the individualization of instruction by teachers. The close-knit environment at School O fosters within this community a climate of teacher concern about the success of all students and accountability for student academic performance. According to one teacher, “I would have to credit the whole staff and support staff. I think, as a whole, and I mean everybody from bus drivers all the way to the administration, we are very concerned about our kids.” As a result of its strong community ties, parental involvement is also a defining characteristic of School O. For instance, approximately 90 percent of parents of School O students participate in parent-teacher conferences on a regular basis.

When asked what student uses of technology have the greatest impact on student achievement, five (55.6 percent) of the nine interviewees reported research by students, largely through the use of technology, the Internet, or e-mail. Four (44.4 percent) respondents cited general technology resources such as cameras, camcorders, and calculators; three (33.3 percent) indicated computers in general; and two (22.2 percent) indicated content-specific strategies, and other ways in which technology aids in learning. Interviews with teachers also revealed that, in addition to using technology for conducting research, students also use technology to engage in hands-on activities, perform collaborative work, peer-tutor, and create presentations. At School O, technology is viewed as a strong motivator and confidence builder that facilitates student achievement. Further, technology use at School O also helps enable students to see the world beyond the small, isolated, rural environment in which their school is situated.

Teachers at School O recognize that not all of their students will attend college and, as a result, this school’s curriculum emphasizes general life skills applicable to an array of contexts, including college, employment, and the household. As one teacher states, “We are a very small school, but I think we are offering a pretty broad range of classroom experiences and curriculum so that we are graduating students … who are very well equipped to compete in the college world, in the working world, and even I think should they choose marriage as soon as they graduate.” Expectations for student performance are set high, and students are expected to work hard to attain the goals set forth for them. One administrator observed, “… We just have high expectations, our teachers tell our kids ‘you can achieve’ and they say it with conviction. And ‘We expect you to achieve, don’t give me this I-can’t-do-it attitude. You will do it and we will make sure you do.’” Overall, this school is driven by a guiding sense of place within, and responsibility to the local community. There is a strong independence between school and community, and the school’s mission, and teachers’ expectations concerning student achievement are built upon the belief in the collective responsibility of each to educate students and prepare them to become confident, productive, and successful members of society.
Student achievement in School O school district is measured by a variety of instruments. The district uses the Iowa Tests of Basic Skills (ITBS) for local assessments in Grades K–6 because they relate directly to the district’s broad instructional goals in mathematics, reading, and the language arts. Third graders take comprehensive assessments in mathematics and reading; fifth graders take the exams in mathematics, reading, and writing. In eighth grade, students take tests of basic skills in reading and mathematics; and in 10th grade are tested in composition. Students are required to pass these tests in all areas before being allowed to graduate.

Teachers and administrators at School O attribute high student achievement to the value placed on education within their community, the teamwork of staff, ongoing professional development, and the use of test data to improve curriculum and instruction. Although the importance of tests and assessments within the guidelines set forth by the state is stressed, School O does not focus too heavily on tests. Teachers and administrators tended to view the size of the school, one-on-one teacher-student contact, and the integration of school and community as factors that contribute as much, if not more so, to student achievement than formal test preparation. Furthermore, instead of situating content standards and standardized assessments as the driving factors in classroom activities, School O focuses more on incorporating writing and literacy skills into its curriculum, which is also thought to contribute to student performance on state tests.

One administrator stated that the school’s student achievement is based more on the instruction and relationships in the classroom than on the use of technology. He feels that technology is a tool and a complement to what the teachers are doing in the classroom, and that technology helps teachers accomplish things at a faster rate: “I don’t know that teachers are doing things that much differently [with technology], but I think that what they are doing just happens more efficiently, it happens more rapidly.” Some of the software the school uses is best for students who need repetition and practice. The school attempts to address student weaknesses and provide teachers with software instrumental in addressing those weaknesses.

When asked about student software that has had the greatest effect on student achievement, respondents most frequently listed a Web browser (n=16), word processor (n=15), and software suite (n=9) among the three software titles with the greatest impact on student achievement. Respondents also indicated multimedia (n=3), presentation (n=2), reading assessment (n=2), and digital media (n=2) applications. Teachers also were asked to indicate what they assign their students to use this software to do. The reported uses were coded by researchers into categories. Respondents most frequently listed purposes that were coded as writing (n=21), research (n=15), document creation (n=13), instruction (n=6), and literacy (n=3).

The technology inventory survey also asked teachers to indicate how often they assign their students to use educational technology for each of 16 given purposes. Among all of these specified purposes, the majority of technology use at School O appears to occur on less than a monthly basis. However, 12 respondents (40 percent) reported that they assign students to use technology at least weekly to express themselves in writing, conduct research or gather information, and learn to work independently. At least 10 respondents (33.3 percent) reported that students use technology at least weekly to master skills just taught, remediate skills not learned, and improve their computer skills. Finally, eight respondents (26.7 percent) reported
assigning technology use at least weekly for students to learn to work collaboratively, analyze information or solve problems, and graphically organize information or ideas. At least 23 teachers (76.7 percent) reported assigning students to use technology on a monthly basis or less for the following purposes: create multimedia presentations, create publications, communicate with people outside the classroom, explore concept models or simulations, present information to an audience, and publish their work on the Web.

The survey then asked teachers to select the three purposes from the list of 16 that have had the most significant effect on student achievement, ranking them in order from one to three. Eighteen (60 percent) teachers selected conducting research or gathering information as having the most significant effect on student achievement. Of these, five (16.7 percent) teachers ranked this purpose first, nine (30 percent) ranked it second, and four (13.3 percent) ranked it third. Fourteen (46.7 percent) respondents ranked expressing themselves in writing among the top three purposes, and 10 (33.3 percent) ranked mastering skills just taught in the top three.

**Technology Use**

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<th>Research Question: What kinds of educational technology do administrators, teachers, and students in School O use?</th>
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<td><strong>Primary Characteristics</strong></td>
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<td>Teacher survey respondents most frequently reported using computers, printers, and digital cameras. Respondents reported using most hardware in a daily basis, primarily in the classroom, but also at home.</td>
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<tr>
<td>Teacher survey respondents most frequently reported using a Web browser, word processor, and software suite. Respondents reported using software on a daily or weekly basis, primarily in the classroom with some use at home.</td>
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<tr>
<td>Teacher survey respondents most frequently reported assigning students to use computers, printers, and digital cameras. Respondents reported assigning hardware use weekly or monthly, in the classroom, computer laboratory, and library.</td>
</tr>
<tr>
<td>Teachers most frequently reported assigning student to use a Web browser, word processor, and software suite applications. Respondents reported assigning most software use on a weekly and monthly basis, in the classroom, computer laboratory, and library/media center.</td>
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The two administrators who returned a technology inventory survey reported daily use of a computer and printer, monthly use of a handheld personal digital assistant, and less than monthly use of a projector. Most commonly, this technology is used in the office and at home. Software reported by the administrators include daily use of word processing, Web browser, spreadsheet, software suite, and e-mail applications, with weekly use of student information, database, and presentation software also reported. Again, the majority of these applications are used either at the administrators’ office or at home.

In three of the seven classroom observations made at School O, teachers were observed using no hardware. Two observations were made of teacher use of televisions/VCRs, and overhead projectors, with one observation made of camera/camcorder, calculator, and other hardware use. Teachers were not observed using computers in any of these classroom situations. Three observations were made of teacher technology use for more than 15 minutes. Teachers were not observed using any software applications.

Teachers who returned a technology inventory survey most frequently reported using a printer (n=26), computer (n=25), and digital camera (n=16). Other hardware listed by at least two teachers included LCD (n=3), and overhead projector (n=2), scanner (n=4), digital video camera (n=4), and other projector—type not specified (n=3). The majority of this hardware is used on a daily basis (n=48), with some weekly (n=18), monthly (n=15), and less than monthly (n=11), reported as well. Hardware is primarily used by teachers in the classroom (n=73), and at home (n=34). Among software titles, teachers most frequently reported using a Web browser (n=28), word processor (n=20), and software suite (n=19) applications. Other software applications reported by at least two teachers include curriculum management (n=11), presentation (n=6), print creativity (n=5), digital imaging (n=4), digital media (n=3), keyboarding (n=2), technology management (n=2), language arts (n=2), and drawing and design applications (n=2). Teachers reported using most software daily (n=61) or weekly (n=33). Software is primarily used in the classroom (n=96) and at home (n=27).

In three of the seven classroom observations made at School O, students were not observed using computers. Of those that were observed using computers, three observations were made of one student per computer, and another three observations were made of two students per computer. Three observations were made of students using computers that lasted at least 15 minutes. In terms of other technology use, two observations were made of students using a calculator, and one observation was made of each of the following: printer, camera/camcorder, and other technology use. Three observations were made of students using a Web browser, two observations were made each of search engine and operating system use, and one observation made of use of word processing, presentation, notepad, e-mail, and calculator software applications.

Teachers who returned a technology inventory survey most frequently reported assigning students to use a computer (n=27), printer (n=26), and digital camera (n=10). Additional hardware used by students as reported by at least two teachers include projector (n=4), digital video camera (n=4), calculator (n=2), scanner (n=2), and VCR (n=2). The majority of hardware is used by students on a weekly (n=27) and monthly (n=23) basis in the classroom (n=52), library (n=35), and computer laboratory (n=40). The most frequently used student software
includes Web browser (n=22), word processor (n=18), and software suite (n=16) applications. Other software listed by at least two teachers includes spreadsheet (n=3), digital media (n=3), keyboarding (n=4), multimedia (n=5), presentation (n=5), and language arts tools/applications (n=3). Software is mostly used weekly (n=34) and monthly (n=27) in the classroom (n=58), computer laboratory (n=46), and library/media center (n=41).

School O is located in an extremely rural and poor area, and many families in the area simply do not have access to such technology at home. Hence, the school is heavily focused on providing this accessibility to students at school through fixed and mobile computer labs. The school owns 15 laptops that students can check out for overnight use at home. Provided that the student has a telephone line at home (many do not), they can gain free Internet access from home (the school is billed for off-campus Internet access through the use of school laptops).
# Educational Technology Practices

**Research Question:** What *education technology practices* do administrators and teachers in School O employ?

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<td>Two thirds of teacher and administrator interview respondents reported that the use of technology that most significantly impacts their professional practices includes communication with staff, parents, and others. One half of respondents reported that finding, creating, and updating instructional resources as a professional use of technology with the greatest effect on their practice. Teacher survey respondents ranked a Web browser, word processor, and software suite applications among the software titles that have had the greatest effect on their practice. Respondents most commonly reported using software for conducting research, developing instructional materials, artifact creation, and for instructional purposes. More than four fifths of teacher survey respondents reported that they use technology on a daily or weekly basis to communicate with teaching colleagues. Three fourths reported weekly use of technology to create instructional materials and two thirds reported using technology to keep administrative records at least weekly. More than two thirds of teacher survey respondents ranked creating instructional materials among the top three most significant uses of technology that contribute to teaching practices and student achievement. More than one half ranked gathering information for lesson planning, and communicating with teaching colleagues and other professionals among the top three purposes.</td>
<td>At least one third of interview respondents reported that professional uses of technology to track student data, access professional development opportunities, software use, and general technology resources contribute to student achievement. Survey respondents reported use of presentation, keyboarding, language arts, and curriculum management applications. Survey respondents reported use of software for communication and administration has significantly affected their practice. One fourth of teacher survey respondents ranked accessing information and research on best practices for teaching among the top three professional purpose of technology which significantly affect teaching practices.</td>
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When asked about the professional uses of technology that have the greatest effect on their practice and student achievement, six (66.7 percent) of the nine administrators and teachers who were interviewed mentioned communication with staff, parents, and others, largely through the Internet and e-mail. Given the strong community ties School O has with its surrounding areas,
this is no surprise. Finding, creating, and updating instructional resources was listed by five (55.6 percent) participants, four (44.4 percent) participants cited tracking student data, three (33.3 percent) delineated professional development opportunities, software, and general technology resources, and two (22.2 percent) reported student research, Internet, generation of tests/assessments, administrative/teaching practices, finding professional development resources, the motivational capacity of technology to direct student achievement, and other administrative or teaching practices.

The administrators who completed a technology inventory survey reported that word processing and student information software has had the greatest effect on his/her professional practices. When asked to rank the top technology uses from a specified list of administrative purposes, the administrator cited creating administrative materials, accessing information and research on best practices, and keeping administrative records as the top three most significant uses. In addition to using technology for these purposes, administrators also use technology to research legal issues and practices of other schools, assist with scheduling, report data to the state, and process payroll and account payable/receivable tasks.

Teachers who returned a technology inventory survey most frequently listed a Web browser (n=22), word processor (n=17), and software suite (n=12) among the three software titles that have had the greatest effect on their teaching practice. Other software reported more than once included presentation (n=5), keyboarding (n=2), language arts (n=2), and curriculum management (n=3) applications. No other software title was coded for more than two participants. Teachers also were asked to list what they use this software to do. Multiple purposes for a software title were coded into the appropriate category. The most commonly reported purpose was for conducting research (n=23). Other common uses cited include instructional materials (n=20), document creation (n=15), instruction (n=14), communication (n=10), and administration (n=7).

The technology inventory survey also asked teachers to indicate how often they use technology for each of 10 specified purposes. Twenty-seven (90 percent) reported using technology at least weekly for communicating with teaching colleagues and other professionals. Twenty-three (76.7 percent) reported at least weekly technology use for creating instructional materials, and 18 (60 percent) reported weekly use for keeping administrative records such as grades and attendance. Twelve (40 percent) teachers reported at least weekly use of technology for gathering information related to lesson planning and presenting information to students. In addition, eight teachers (26.7 percent) reported that they communicate with students’ parents or guardians at least weekly. Less than monthly, 28 (93.3 percent) teachers use technology for publishing student work on the Web, while 27 (90 percent) teachers use technology at this frequency to publish class information on the Web.

The survey then asked teachers to select the three purposes from the list of 10 that have had the most significant effect on their practice, ranking them in order from one to three. Twenty-one (70 percent) of the 30 respondents ranked creating instructional materials in the top three purposes, 15 (50 percent) of whom ranked this purpose as number one. Twenty (66.7 percent) ranked gathering information for planning lessons among the top three purposes, eight (26.7 percent) of whom listed this item as number two. Sixteen (53.3 percent) respondents listed communicating
with teaching colleagues and other professionals in the top three, eight (26.7 percent) of whom listed this item as number three. Eight respondents (26.7 percent) ranked access information and research on best practices for teaching among their top three purposes.

Seven classroom observations were made at School O; one of a 10th grade class, two of a 12th grade class, and four of a mixed-grade class at the high school level. Five observations were made in a classroom setting, and one was made in a computer laboratory, mobile computer laboratory, and another unspecified setting. In two of the observations, language arts was the dominant subject observed. One observation also was made in each of the following content areas: physics, computers/technology, foreign language, social studies, mathematics, speech, American history, journalism, and science. Five different activity structures were observed in these classes. The adult-led large group structure was observed five times, collaborative pairs and individual structures were each observed four times, and collaborative small group and peer tutoring structures were each observed once. Individual and adult-led structures were each recorded as the dominant structure in three observations, while the collaborative pair structure was recorded once as the dominant structure observed.

**Educational Technology Policies**

<table>
<thead>
<tr>
<th>Research Question: What educational technology policies do administrators and teachers in School O implement?</th>
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<tbody>
<tr>
<td><strong>Primary Characteristics</strong></td>
</tr>
<tr>
<td>Two thirds of administrator interview respondents reported that at the state and federal level, plan, policies, and standards are benefits of state polices. Two thirds were unsure of any policy-related obstacles that limit this school’s use of technology.</td>
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The administrator technology inventory survey asked respondents to indicate the priority of 20 given objectives for educational technology for their school on a scale of one to five, with one being the lowest priority and five being the highest priority. The administrators at School O indicated the highest priority for eight of the 20 objectives: improving teachers’ computer skills, improving teachers’ strategies for integrating technology, using more technology in curriculum and instruction, increasing professional development opportunities for teachers, improving student achievement on state assessments and standardized tests, and better preparing students for careers. Of lowest priority to administrators at School O are improving students’ 21st century
learning skills, improving administrators’ computer skills, improving administrative efficiency, improving parents’ computer skills, and increasing parental involvement.

The school consistently upgrades and adds technology; the school seeks funds from a variety of sources and had received a $50,000 grant for technology the previous year. The school’s telecommunications access has previously been funded by E-Rate (80 percent contribution), and the state (20 percent contribution). However, the state has just eliminated its funding, which means that the school may have to resort to a slower Internet connection. Although grants play a significant role in the acquisition and maintenance of School O’s technology plan, many teachers and administrators feel that they struggle with grant competitiveness. Because School O is so small, participants expressed the concern that granting agencies might prefer to allocate funds to larger schools where the perceived effect of that money is experienced by a larger number of students.

The school district’s Technology Committee has achieved significant outcomes through careful planning. They have developed a vision of why technology is important and an understanding of its role in educating students; they have communicated that vision to stakeholders in the district and community; and they have developed a framework of definite action plans and timelines for achieving the results they want. Some of the key issues were identified as staff development, technical support and maintenance, funding, purchasing hardware and software, equity and access for all students, and networking. The district technology plan addresses these issues with specific objectives and activities.

When asked specifically about school or district policies that help School O use technology in ways that contribute to student achievement, three (33.3 percent) of the nine participants interviewed cited both the school’s Internet use policy, and other plans, policies, and standards. When asked about school/district obstacles that limit technology use on campus, seven (77.8 percent) of the nine respondents cited that they were unsure of any obstacles of this nature.

When administrators were asked about state policy benefits that influence the use of technology at School O, two (66.7 percent) of the three administrators interviewed referred to plans, policies, and standards. In terms of federal policy benefits, no response was coded for more than one administrator. In terms of state and federal policy obstacles that preclude this school’s use of technology, two (66.7 percent) of the three administrators cited that they were unfamiliar with any specific obstacles per se.
Technology Capacity

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

<table>
<thead>
<tr>
<th>Primary Characteristics</th>
<th>Secondary Characteristics</th>
</tr>
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<tbody>
<tr>
<td>School O has three computer labs and a mobile laboratory that can travel within the school. The school has strong networking and connectivity due to E-Rate funding. School O seems to have adequate computing power that is accessible to students. School O owns a combination of older and newer computers. School O owns a 23 software applications, including productivity, communication, and media tools, educational software, and administrative software titles. About four fifths of interview respondents cited the school’s technology laboratory as the most significant aspect of the school’s technology environment contributing to student achievement. Two thirds of respondents cited the school’s general technology resources such as calculators, laptops, and other hardware as well.</td>
<td>Two fifths of survey respondents cited computers in general and Internet access as significant aspects of the school’s technology environment contributing to student achievement. One third mentioned software.</td>
</tr>
</tbody>
</table>

School O has three computer labs and one mobile laboratory that travel within the school. Teachers may access computers at any time. In addition, there are several digital projectors, digital cameras, digital camcorders, and various software programs. Students may use the computers in the labs if they are available during their free periods. Laptops may be checked out for students or teachers who want to take one home to use. Multicurricular instruction software is used to supplement remedial and hard-to-schedule courses, which enables students to make up classes they would not ordinarily be able to attend.

The school employs a full-time technology coordinator, who is integral to the acquisition of funds that support all facets of the school’s use of technology. Teachers and administrators are generally pleased with the technology capacity of the school, and reportedly have access to the technology and related resources that they need to do their jobs. As one teacher explained, “The technology person and I sat down and made a list of things that we thought we absolutely had to have and I don’t think anything on that list was denied me. And you know, for a district that had to really govern its finances carefully, I was very pleased that they were willing to be able to provide all of that.”
On the technology infrastructure survey, School O reported having an average of four computers in each administrative office, one computer in the staff office, seven computers in the library, 17 computers per computer laboratory, 11 computers per mobile computer laboratory, and 1.6 computers per classroom. Approximately 45 percent of all computers on campus are older models; four are located in the administrative offices, one in the staff office, three in the library, 36 in computer labs, and 24 in classrooms. About 55 percent of the school’s computers are newer models capable of running current software applications: the majority of these computers are located in the computer labs (mobile and stationary) and classrooms. School O reported that all of its computers are connected to at least 10 MB local area network (LAN) and all computers on campus have a T1 or faster Internet connection. The school reported having four laser jet printers in administrative offices, one in the staff office, two in the library, three in the computer labs, and two in the mobile computer labs; and four computers shared between all classrooms. The library and classrooms also share a minimum number of inkjet printers as well, and also have LCD projectors. The school also reported having LAN, e-mail, and Web servers.

On the software inventory section of the survey, School O reported owning a total of 21 different software titles. The school owns two productivity software titles (both software suites), one communication tool (e-mail application), five media tool applications (used for digital imaging, digital media, print creativity, and desktop publishing), seven educational software titles (multicurricular instruction, language arts, and keyboarding applications), and one administrative software application (title not coded).

When asked what characteristics of School O’s technology environment facilitate the use of technology in ways that contribute to student achievement, seven (77.8 percent) of the nine participants who were interviewed cited the school’s computer laboratory. Six (66.7 percent) participants indicated the school’s general technology resources, including laptops, calculators, and other hardware, four (44.4 percent) reported computers in general and the Internet, three (33.3 percent) cited software such as word processors and spreadsheet applications, and two (22.2 percent) specified students’ skills and positive attitudes toward technology use, student research, professional development, evaluating technology resources and needs, and other ways that technology aids in teaching.
Resources, Strategies, and Structures

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

<table>
<thead>
<tr>
<th>Primary Characteristics</th>
<th>Secondary Characteristics</th>
</tr>
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<tbody>
<tr>
<td>All of the teacher interview respondents reported the school’s general technology resources as the key resource that has contributed substantially to the creation of their classroom environment in ways that contribute to student achievement. At least one half of respondents reported that overall classroom ambience, physical classroom space, and classroom materials as resources that also contribute to the learning environment.</td>
<td>One third of teacher interview respondents each cited a caring, family-like environment, teacher concern for students, hands-on project-based/interactive learning, student grouping strategies, content-specific strategies, computer laboratory, computers in general, and students’ basic technology skills as other resources that have contributed to the development of School O’s environment.</td>
</tr>
<tr>
<td>All of the administrator interview respondents reported that grant money has been essential to the development of School O’s technology environment.</td>
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</table>

When asked about their classroom learning environment and the resources, strategies, and structures they have used to create that environment, all (100 percent) of the six teachers interviewed reported that general technology resources of the school substantially contribute to the development of this environment. Although technology is limited in some classrooms, teachers value student interaction and frequently use learning stations when there isn’t enough equipment to go around. Also cited by five (83.3 percent) out of six teachers interviewed was the overall ambience of the classroom. Physical space was reported by three (50 percent) teachers. Interviews revealed that physical size of the building is small vis-à-vis the number of students it accommodates, but it clearly contributes to the close-knit, family-like environment that is characteristic of this school. As one teacher stated, “I just keep reinforcing that we are just one big family here and we’ll make it work one way or another because we have to.” Also, three (50 percent) teachers reported classroom materials and resources, two (66.7 percent) of whom reported that these are adequate given their instructional objectives. Other responses provided by two (33.3 percent) participants included a caring, family-like environment, teacher concern for students, hands-on project-based/interactive learning, student grouping strategies, content-specific strategies, computer laboratory, computers in general, and students’ basic technology skills.

When administrators were asked about the resources used to develop school characteristics, 14 responses were provided, including community characteristics; administration leadership; high academic expectations; school improvement plan and unified vision of that plan; student research; money/grants; professional development; computer laboratory; software; finding, creating, and updating instructional resources; acquiring and maintaining technology; and
alignment of curriculum and instruction with standards. None of the responses, however, were coded for more than one administrator. When asked about the key resources used to develop School O’s technology environment, all three (100 percent) administrators interviewed cited money/grants.

**Classroom Vignettes**

Three classroom observations were made during the second site visit at School O. The first observation was of a computer and technology class (with a secondary emphasis on mathematics) of 16 students in grades 11 and 12; a mobile computer laboratory was present in this classroom. During this observation, both teachers and students were observed using computers and two other adults present in the classroom during this lesson were observed using computers. The second observation was made in a classroom during a mathematics lesson directed toward 14 11th graders. The third observation was a mathematics class of 11 10th, 11th, and 12th graders, with a secondary focus on computers and technology. In all lessons observed, the teachers and students were comfortable and relaxed with each other, the teachers worked individually with students, and peer assistance was welcomed and beneficial.

For each of the three observations made at School O, teachers were interviewed before the lesson to establish a context for the lesson observation that follows and an understanding of how instructional strategies and technology will be integrated to facilitate student learning. Teachers also were interviewed following each observation to provide a lesson interpretation and an understanding of the role of technology in achieving specific lesson outcomes.

**Eleventh- and Twelfth-Grade Computers and Technology Lesson**

<table>
<thead>
<tr>
<th>Class 1</th>
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<tbody>
<tr>
<td>Grade:</td>
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<tr>
<td>Subject:</td>
</tr>
<tr>
<td>Setting:</td>
</tr>
<tr>
<td>Teacher Hardware Used:</td>
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<tr>
<td>Teacher Software Used:</td>
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<tr>
<td>Student Hardware Used:</td>
</tr>
<tr>
<td>Student Software Used:</td>
</tr>
</tbody>
</table>

The focus of this lesson was personal finance. The Junior Achievement organization developed the lesson, which uses a Web-based program that incorporates interactive learning techniques with Internet-driven instructional strategies and assessment tools. The program consists of 16 activities, and this day’s lesson focused on the eighth activity in the program. Collectively, these 16 activities serve as the foundation and preparation steps for the state’s standards in the areas of technical reading and writing. The program also correlates with national education standards in the personal finance, economics, technology, communications, reading, and writing.

In the preobservation interview, the teacher indicated that students would use an educational software application to review the content of the day’s lesson, accessing this software on the Internet through the use of computers and a wireless laboratory equipped with laptops and a
print. Then, students were to work in groups to conduct research on the Internet, with each group assigned to one of four finance areas (such as auto, home, or groceries); students would then share their findings with the class. Students would be asked to choose among spending alternatives, including housing, transportation, and consumer goods, and develop a comprehensive budget based on the research they gather online.

During this lesson, 16 junior and senior students worked collaboratively in groups of four. Six students worked on desktop computers and 10 students worked on wireless computers, using a software program created by the Junior Achievement organization. The teacher instructed from the center of the room, and was joined by a representative from the area’s Junior Achievement and the local bank representative.

This classroom was equipped with six desktop computers, 11 wireless laptops, and one printer, audio player, video player, television, and calculator. The teacher was briefly observed using a computer and printer, as well as a Web browser. The Junior Achievement representatives present during this lesson briefly used a computer and calculator, as well as a Web browser. All students worked at their own computer for the majority of the lesson, with several also briefly using a printer and calculator. Using a Web browser, students accessed the Junior Achievement Web site through which the personal finance program is accessible. They also used the information to collect information to inform the development of their personal budgets.

The lesson began with students working in teams at the computer, accessing the Junior Achievement’s Web site, to develop their budgets for items such as rent, food, utilities, car payment, insurance, and so on. Students created their budget for their group, and submitted a total to the teacher. The teacher began the lesson by describing the status of the prototype student at 21 years old, listing the typical assets, employment, and debt of a person this age. Each group developed a budget for the prototype student. When this activity was completed, students were then introduced to the Web-based research they will be doing to further inform the development of their budgets.

The representatives of Junior Achievement talked with the class about using various Web sites to collect budgetary information, and how much money would be appropriate to include in various aspects of a budget. The teacher then assigned to each group a specific budget area (such as home payment, utilities, or groceries). The teacher and other adults assisted individual groups as they worked on the details of their budgets (for instance, whether to pay the minimum amount or a larger amount on bills). Students asked various questions, including which types of furniture or cars to invest in, and why they should get a credit card. The teacher reminded students that this was a realistic study, and that they should imagine themselves in a few years when they will be faced with managing their own money. Students voiced their concerns about being independent.

After the lesson, the teacher stated that the lesson’s goal was accomplished, and that students had learned what a necessary budget would be and how to make wise choices. She also indicated that the technology program was strong and to the point, but that it did not offer sufficient specific Web-based resources that students could use with minimal adult assistance. The benefits of the program included an understanding of technical reading, technical writing, foundations in mathematics, inquiry, problem solving, decision making, and resource management. The teacher
reported that the majority of the students in this class will either immediately enter the workforce or attend one- to two-year trade program upon graduation from high school. Given the future goals of many students in this class, the teacher felt that this personal finance program was very effective in providing them with the basic money management skills they will require for success in their career and personal lives.

Eleventh-Grade Mathematics Lesson

<table>
<thead>
<tr>
<th>Class 2</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade:</td>
<td>11</td>
</tr>
<tr>
<td>Subject:</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Setting:</td>
<td>Classroom</td>
</tr>
<tr>
<td>Teacher Hardware Used:</td>
<td>Calculator, overhead</td>
</tr>
<tr>
<td>Teacher Software Used:</td>
<td>None</td>
</tr>
<tr>
<td>Student Hardware Used:</td>
<td>Computer, calculator</td>
</tr>
<tr>
<td>Student Software Used:</td>
<td>Spreadsheet</td>
</tr>
</tbody>
</table>

The second class observed was a mathematics lesson that focused on probability. Before the lesson, the teacher explained that these higher achieving students would be applying earlier learned knowledge to new skills on the calculator. One objective of the lesson was for students to see that their data would be different than that of others. The lesson included students conducting a series of coin tosses and measuring the outcome (heads versus tails); students would then compare their outcomes with those of their classmates to address the concept of variability and chance among observations within a data set. The teacher noted that technology standards were embedded in the lesson, because the students would use graphing calculators to solve the problems, spreadsheets to analyze information, and word processors to report their activities.

During this lesson, 14 high-achieving junior students worked at desks in the classroom, which was equipped with two desktop computers, 15 calculators, and one printer, overhead projector, video player, and television. The teacher was observed using a calculator and an overhead projector for a substantial portion of the lesson. Every student also was observed using both a calculator and a computer during this lesson; approximately six students worked at every one computer in the classroom.

As the lesson began, the teacher directed students to draw a bell curve based on the average weight of the school’s football team. The teacher then indicated the location of the mean, median, and mode on the bell-shaped curve, and marked off the standard deviation units on the curve as well. The teacher connected her graphing calculator to the overhead projector, and showed students how to calculate the mean and standard deviation from a sample set of data. After this, students worked in pairs to analyze the variability of coin tosses. Students were then asked to create a histogram and calculate descriptive statistics based on the results of their coin toss simulation. While they continued working in pairs, students lined up at one computer to check their histograms and the statistics that were displayed on that computer. The teacher provided a comfortable working atmosphere where she and the students socialized while remaining focused on the lesson.
After the lesson, the teacher indicated that the students were able to calculate variability, seeing the results immediately. The teacher also reported that, as a result of the lesson, students had advanced in their operation of the calculator. The teacher saw this lesson as a culmination of several lessons, first doing probability by hand, and then using calculators to analyze data. The teacher was hopeful that this lesson also taught students of the importance of making a connection between the theory and vocabulary that underlies probability and how those concepts and ideas can be applied in practical, everyday situations.

Tenth, Eleventh and Twelfth Graders in a Mathematics Class

<table>
<thead>
<tr>
<th>Class 3</th>
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</thead>
<tbody>
<tr>
<td>Grade:</td>
<td>10, 11, 12</td>
</tr>
<tr>
<td>Subject:</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Setting:</td>
<td>Classroom, mobile computers</td>
</tr>
<tr>
<td>Teacher Hardware Used:</td>
<td>Computer, calculator</td>
</tr>
<tr>
<td>Teacher Software Used:</td>
<td>Web browser</td>
</tr>
<tr>
<td>Student Hardware Used:</td>
<td>Computer, printer, calculator</td>
</tr>
<tr>
<td>Student Software Used:</td>
<td>Web browser, spreadsheet</td>
</tr>
</tbody>
</table>

In the preobservation interview, the teacher stated that the lesson was to be a culmination of students’ work in the area of data analysis. The focus of this class was to be a final project in which students would present their data and analysis to the class. The teacher would be in the role of advisor, conferring with students about any last-minute details relating to their projects. The teacher reported that approximately one half of the students in this class were classified as special needs students, and about one third were limited English proficient. The teacher indicated that this lesson was connected to state mathematics standards in the areas of probability and data analysis, and national mathematics standards for data analysis. Students would use graphing calculators and software that links calculators to computers.

This observation of 11 sophomores, juniors, and seniors was made in a classroom equipped with two desktop computers and printers, six wireless laptops, 12 graphing calculators, and an overhead projector. The teacher was observed briefly using a computer, calculator, and Web browser. All students worked at their own computer for the majority of the class, and also used both a printer and a calculator at some point during the lesson. Students also used a Web browser and spreadsheet.

The teacher began the lesson by directing students to work with their data to calculate the basic descriptive statistics of mean, median, and mode. The teacher encouraged students to use a computer or calculator. As students worked on this, the teacher consulted with students about the individual topics they had chosen for their projects. The project required students to collect data about a topic of interest and apply principles learned during the class to analyze and interpret that data. Students relied heavily both on the spreadsheet and graphing calculator to chart and graph their data, frequently experimenting with various graphs that visually represent their data in different ways. During this process, the teacher offered one-on-one assistance to students in need of help; in some situations, other students even offered assistance to their classmates. The teacher made a conscious effort to check in with every student at least once during the class session, and
when encountering a student with a question or concern, the teacher responded with a series of leading questions to enable the student to actively participate in arriving at an appropriate answer.

In the postobservation interview, the teacher reported that this lesson helped to address some problem areas that students were struggling with and that impeded their progress on this project to date. The teacher indicated that the combination of one-on-one assistance and students’ hands-on work with their own data were strategies that were helpful to students in making connections between and summarizing the results of their data. The teacher felt that the use of technology alleviated the pressure of the final component of this project. The most difficult part for the students had been deciding how to organize the project and make sense of the data and once this was sorted out, the use of computers and calculators facilitated that process of getting the data analysis for this project accomplished.
References


