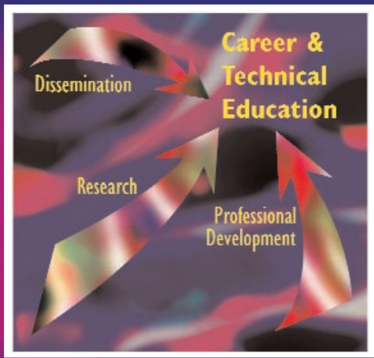

Internet Integration in High Schools: Patterns, Opportunities, and Barriers

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Ruth Thomas, Principal Investigator
Marilyn Adams, Research Associate
Naheed Meghani and Maria Smith, Research Assistants

National Research Center for Career and Technical Education
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EXECUTIVE SUMMARY

Research Objectives and Design

The Internet represents a new dimension of computer technology that is prompting rapid expansion of computer distribution throughout K–12 schools. The distribution of Internet access has very recently encompassed nearly all K–12 schools (98% in 2000) and most high school classrooms (79% in 2000; National Center for Education Statistics, 2000a, 2000b). Because it is now possible for many high schools to move toward integration of the Internet throughout the curriculum, data regarding Internet integration in schools are needed on multiple levels. Classroom-level data can further our understanding of how the Internet affects teachers' practices, teaching and learning processes, and student learning. School-level data can give insights into what is entailed in school-wide Internet integration, what patterns emerge as schools move to this level of implementation, and the forces and conditions that support or impede it. Both classroom- and school-level data can illuminate how educators and schools mediate Internet access and use by students. Finally, data concerning schools' contexts (both internal and external) can add to understanding of forces and conditions within and beyond schools that affect their Internet integration efforts.

This research report examines the integration of the Internet on a school-wide scale in five high schools in order to shed light on the patterns of Internet use, what affects it, and its consequences. The study summarized here was initiated in early 2000. It focused on high schools, where the concentration of Internet connections is highest and where career and technical education programs are focused.

The study addressed the research needs outlined above through in-depth, detailed case studies of five schools engaged in school-wide Internet integration. The objectives were to identify:

1. Internet-based learning opportunities potentially available to and perceived as useful to professional educators and students;

2. Patterns of participation by professional staff and students in Internet-based learning opportunities, including the kinds of opportunities used and the characteristics of professional staff and students who use the Internet to varying extents or not at all;

3. Reasons of professional staff and students for using the Internet, and specific factors that facilitate and hinder their participation in Internet-based learning opportunities;

4. The impact of participation in Internet-based learning opportunities on student and professional staff learning, motivation for and engagement in learning, and the teaching-learning system within schools;

5. The impact of the school teaching-learning system and its contexts on participation by professional staff and students in Internet-based learning opportunities;

6. Theoretical models that contribute to interpreting and explaining findings regarding the preceding five objectives.

Research Methods and Procedures

Five public high schools from across the United States were chosen for in-depth study based on the following criteria: a mix of urban, suburban, and rural schools located in different geographic areas; a range of student demographic characteristics; Internet use in the school for at least 2 years and across the curriculum; comprehensive curriculum, including career and technical education programs; and accessibility within project resources. The multifaceted search process used to select the schools included examination of Web 66 (a Web site that registers Web sites of schools), solicitation of nominations from site directors of the National Research Center for Career and Technical Education and individuals involved in state- and national-level efforts regarding technology in schools, and recommendations from a consultant.

Data were collected in two phases. In the first phase, survey questionnaires were provided to all professional staff and students at each school. Survey data were collected from 322 teachers, 19 administrators, 19 counselors, 7 technology coordinators, and 3,822 students in the five schools. African American and Asian students were equally represented, and together made up 30% of the student respondents; Hispanic students accounted for 10%, Caucasian students for 43%, and other groups for the remaining 16%. In the second phase, 219 on-site interviews with school professional staff and students were conducted, the schools were observed by investigators, and school documents were obtained.

The Five Schools

Midwest Inner City

Located in a midwestern city, this new comprehensive high school was in its 4th year of operation. It had been designed to be a high-technology career academy for students across the school district who were interested in technology and the career-focused curriculum it offered, but instead had come to serve a more general inner city student population in its own neighborhood. Computers and other technology were widely available throughout the school. The school's physical and curricular design centered around smaller groupings of students within the larger school. Students representing minority groups constituted 78% of the student body. Many of the school's students were from immigrant families new to the United States and for whom English was a second language. Two thirds of the student body was eligible for free or reduced-price lunch.

West Coast Inner City

In addition to being a comprehensive high school, this West Coast inner-city school provided an industrial education magnet program for its school district. The school had recently received a state grant to boost its technology, and was purchasing computers and auxiliary equipment. It had recently upgraded its infrastructure with a special local bond measure. It was an active participant in technology-focused efforts initiated by its school district. Students representing minority groups made up 80% of the student body. Many students were from immigrant families new to the United States and for whom English was a second language. Three-fourths of the students were eligible to receive free or reduced-price lunch.

Midwest Rural

A small consolidated school located adjacent to a village in a Midwestern agricultural area, this high school was part of a pre-K–12 school that was about a decade old and included a more recent addition. Providing students with opportunities to experience technology was a very high priority in this school. Classrooms throughout the school (including pre-K) were equipped with multiple computers, and teachers were required to use them. The school provided Internet service to the community, and school personnel provided leadership in the state for technology integration in schools. About half of the high school students were from a minority group, and about half were eligible to receive free or reduced-price lunch.

West Coast Community

This school was located in a growing, midsize West Coast community. It emphasized college preparation, and also provided a state-sponsored occupational program for older high school students and adults, as well as more typical high school career and technical education programs. This school had the longest history of computer use among the five schools. It had recently received a state grant to boost its technology, and was in the process of purchasing computers and upgrading its infrastructure. Students representing minority groups made up 43% of the student body, and 14% of the students were eligible to receive free or reduced-price lunch.

Southeast Suburban

Located in an upscale suburb in the southeastern United States, this school offered a comprehensive curriculum, including both academic and vocational programs. The school emphasized its gifted program, and also provided a district-wide special education magnet program. As part of the site-based management at this school, teachers were centrally involved in decisions made about technology in the school. School personnel were well informed about technology-based projects around the country, and were participating in several of them. Students representing minority groups comprised 20% of the student body, and 2–3% of the student body was eligible to receive free or reduced-price lunch.

Selected Findings, Conclusions, and Implications

Six technical reports detail study findings. Five are case-study reports detailing the findings for each school (Thomas, Adams, Meghani, & Smith, 2002b, 2002c, 2002d, 2002e, 2002f). The sixth identifies findings that are similar across schools, and compares differences among the schools (Thomas, Adams, Meghani, & Smith, 2002a). Highlights from the findings are presented below.

Several educational change theories were relevant in interpreting and explaining the study findings. They included theories regarding implications of the nature of a specific change, the change process, stages of change, and schools' internal and external contexts. Selected study findings, conclusions, and implications are summarized in the following three sub-sections organized around these theories.

Implications of the Nature of the Internet

School-wide integration of the Internet in high schools, like most school reforms, is a complex phenomenon. It is a more complex and pervasive change than was the introduction of microcomputers into schools in the 1980s, because school-wide integration of the Internet affects all curriculum areas and requires extensive infrastructure, whereas the use of microcomputers during the 1980s was oriented toward specific software programs that usually required only computers, and were used only in certain subject areas. Given this complexity, it is not surprising that *integration of the Internet in schools takes time*. Each of the five schools had been involved in using the Internet for several years, and had built up a fund of experience, but only one had fully achieved school-wide integration of the Internet and moved into a stage of change that focused on refinements and improvements.

Benefits of the Internet. *Teachers in all of the schools and across all subjects found what was available to them on the Internet useful in their teaching*. In no school, however, did all teachers agree that the Internet was useful, and teachers varied in their degree of enthusiasm for what they obtained from the Internet. Moreover, teachers in all schools were concerned about a lack of validation processes for material published on the Internet.

Teachers used the Internet to update their own knowledge, create assignments, find lesson ideas and plans, and enhance their lessons with photos, graphics, and video. The most common uses of the Internet in school reported by both teachers and students were obtaining information, working on projects, seeking expertise, and communication. Teachers in both academic and career and technical education subjects used the Internet to help students learn about careers. Teachers used the Internet for their own personal and professional purposes much more frequently than they used the Internet in the classroom with their students. The limited Internet use in the classroom was in many cases due to teachers' perceptions that having only one computer for 30–40 students constrained the possibilities. Teachers did take their students to school computer labs to use the Internet for a variety of purposes, including exploration, preparation for upcoming units and experiences, self-assessment, communication, and the development of products such as reports, presentations, Web sites, and material for on-line publication. Students of all ability levels and with varying special learning needs used the Internet in school.

E-mail and the World Wide Web were the Internet-based technologies used by the most teachers and students. Many of the on-line learning opportunities perceived by teachers as useful to them were Web sites that compiled links to high-quality, Web-based resources relevant to their subject areas. These sites saved teachers searching time, and organized Internet-based resources, which teachers appreciated.

Many of the attractions of the Internet for teachers and students also had negative connotations. Teachers and students turned to the Internet because it was comprehensive—but it was also clear that they found the wealth of material overwhelming and unorganized. The Internet was fast—but the systems teachers and students used to gain access to it could be frustratingly slow. The Internet was easy and convenient to use and saved time and effort—if one knew how to use it. It could be fun and rewarding to use—but also frustrating and unsatisfying at times. It could broaden students' awareness—but also distracted their attention from their learning tasks. It expanded teachers' knowledge and skills—but also intimidated some teachers. Teachers saw that use of the Internet was expected and demanded as part of the culture—but some also felt it was overrated as a learning tool. Many teachers and students developed a personal interest in the Internet—but not all did. These somewhat paradoxical contrasts suggest that *the Internet is not a panacea. Like most solutions and most technology, it introduces new problems as it addresses old ones.*

Demands introduced by the Internet. Use of the Internet in schools provided benefits and addressed needs, but also introduced demands. In order to use the Internet, schools needed operational, Internet-capable computer systems and networks, which required acquiring and upgrading equipment and infrastructure, and engaging technical support staff. In order to learn about the Internet and its possibilities, teachers needed training. Meeting these needs required funds beyond those in the regular budget of each of the schools.

Once initiated, Internet use in the schools gave rise to an array of continuing resource demands. The more teachers saw the Internet's possibilities for their teaching, the more they wanted to expand their equipment and their use of the Internet. As software for using the Internet became more complex, and as Internet graphics and plug-in requirements became more elaborate, more computer memory, higher processing speeds, and greater network capacity were needed. Thus, schools found themselves in a spiral of rising costs over which they had limited control because some of the demands originated outside the school system. *When schools embark upon significant acquisition of technology to provide Internet access to teachers and students, they are making a continuing and long-term financial commitment.*

The Internet as a Transformative Agent

Internet availability in schools broadened opportunities for teachers and students. The data revealed a mixed and paradoxical picture of the impact of the Internet on learning outcomes. Changes the Internet induced in the schools' teaching-learning systems ranged from infusing enhancements and complexities into existing arrangements and practices to fundamental shifts.

Expanding opportunities. *The Internet expands teachers' professional development opportunities, and broadens the range of providers of in-service teacher education.* Teachers participated in programs, took courses, and used self-directed learning resources that were provided on-line by their schools and school districts, universities, private vendors, and regional, state, and federal agencies. Using the Internet as a new delivery mechanism for professional development activities lowered or eliminated barriers of time, cost, and distance teachers faced in gaining access to more traditional opportunities. The Internet's broadening of potential providers of in-service teacher education is consistent with a trend that has been observed in the United States for several years.

Use of the Internet created new career path opportunities for teachers with technology expertise, and expanded their conception of their career possibilities. Qualified teachers were filling the need for new support roles that increasing use of the Internet in the five schools created. Teachers knowledgeable about computers and the Internet were sought out for support and assistance regarding the Internet by a significant portion of their colleagues and students. In experiencing these new roles, teachers realized that this knowledge represented new possibilities for their own careers.

The Internet also expanded avenues available for parent-school communication. E-mail provided an easy, convenient way for parents and teachers to interact regarding questions or concerns about a student, and the schools' and teachers' Web sites gave parents easy access to school-related information. *This role of the Internet in home-school communication raises concern about inequities between parents with access to the Internet and those without.*

Equalizing opportunities. *The Internet's ability to remove barriers to access to repositories of information is a significant step toward equalizing access to resources across schools, teachers, and students—no matter where they are located.* The Internet is available 24 hours a day and does not require travel, thereby removing limitations associated with traditional information repositories such as libraries. Students and teachers in all five schools, including a remote rural school and schools in large metropolitan areas, had equal access to Internet-based resources. Similarly, location was no longer as limiting a factor in teachers' professional development as in the past. Teachers in remote areas could participate in virtual communities of professionals, and in both formal and informal learning opportunities on-line.

In the United States, cultural-level support for Internet integration in schools is linked to beliefs about the practical value of technology skills and the democratic ideal of equality—especially equality of opportunity. Because technology skills are in demand by employers, it is believed that giving students a chance to learn technology skills will improve their economic opportunities, including students whose economic opportunities might otherwise be limited. Study findings indicated that *students in all five schools had improved their technology skills as a result of having opportunities to use the Internet and to take courses the schools offered to help them learn a range of computer and Internet skills.*

The schools differed in the extent of students' home and school use of the Internet and in the importance students ascribed to having Internet access in school. Fewer students in the schools with the largest concentrations of students eligible for free or reduced-price lunch (the inner-city schools and the rural school) reported using the Internet at home, compared to the students in the schools with more affluent students (the suburban and the community school). A greater proportion of the students in the inner-city schools and the rural school used the Internet in school, and indicated that Internet access at school was very important, compared to students in the suburban and the community school. These data suggest that *providing Internet access in school to the extent reflected in the five study schools alleviated disparities in access among students.*

Nonetheless, disparities still existed. Teachers pointed out that Internet access at school did not provide the same amount or kind of access as Internet access at home. Because teachers in three of the schools were uncertain whether students who lacked home Internet access would have sufficient access at school to complete their work, they were reluctant to require Internet-based work in their classes, which limited the Internet-based learning opportunities for all students in these schools. *This suggests that the digital divide affects all students, not only those without Internet access at home.*

<u>Changing student learning.</u> *Use of the Internet helped students improve their technology skills*. Beyond the learning of technology skills, however, *the Internet did not appear to be a "magic bullet" that improved learning just because students used it in their schoolwork*. Learning in school subjects appeared to be improved for some students, but not others. Findings suggested that *use of the Internet may have a positive impact on learning for students whose learning with more traditional materials and tools has not gone well*.

The Internet did appear to capture many students' interest, and lead at least some students to exert more effort and spend more time on learning tasks. Other data indicated, however, that *students were also distracted by the Internet,* and that *the Internet made engaging in plagiarism easy for students*.

<u>Changing social status</u>. Because it was valued in the five schools, *technological expertise enhanced social status and peer recognition for both teachers and students*. Teachers reported that the Internet (and technology, in general) provided a new arena in which technologically capable students who had been socially marginalized in the past, or who had not excelled in the traditional arenas of school achievement (such as academics or sports), could find acceptance. This finding suggests that technological know-how may improve the social aspect of the school experience for some students.

<u>Changing teaching-learning systems.</u> The Internet enhanced curriculum, encouraged some teachers to modify their teaching practices, and made teachers' planning and management tasks more complex.

Curriculum. Teachers perceived the Internet as enriching their curriculum. The Internet was part of the teaching-learning system and curriculum in all, or almost all, subject areas in each of the study schools. The Internet enriched subject-area curricula by providing new or enhanced experiences for students within the established curriculum content. Teachers took advantage of the ability of the Internet to bring the real world into the classroom, and to give students virtual experiences that were geographically or otherwise inaccessible, or that would have been dangerous for students to experience directly.

New curriculum content resulting from use of the Internet was largely focused on learning to use computer-related technology and the Internet. Through new technology-focused courses and components within subject areas, students were taught to operate computer technology and software, search the Internet effectively for information, critically evaluate information obtained, and design Internet-based products (such as Web pages). *Use of and learning about technology was not unique to career and technical education and science programs, but rather was infused across the curriculum*.

The Internet's capacity for portraying text, images, graphics, streaming video, and sound, its potential for up-to-the-minute updating, and its wealth of free resources made it a serious competitor with books. *A decline in the use of books by students and by teachers in favor of using Internet resources was apparent, but teachers' concerns about the validity and depth of Internet material led them to use and require students to use both Internet resources and books in the teaching-learning process*.

Teaching practices, and teachers' and students' roles and relationships. Use of the Internet did not automatically reform teachers' approaches to teaching. It was clear that teachers could incorporate the Internet within their present mode of teaching, which for some was a teacher-centered lecture with Internet-based illustrations and Internet-posted worksheet. Whether or not the Internet transformed teaching practices depended on the flexibility of teachers' views of teaching and learning, and of their own and students' roles. Some teachers reported that their use of the Internet had led them to reorient their teaching style toward a more facilitative, student-directed approach. Because many students could operate the Internet and get information themselves, teachers were able to see other teaching roles for themselves beyond that of information provider. Students' superiority regarding technology use relative to many teachers led teachers to learn about Internet technology from their students. Teachers in all of the schools drew on their students' technology expertise when problems or questions arose, or when it was difficult to obtain timely help from over-burdened technical support staff. These findings suggest that *changed teaching practices and styles may not necessarily result directly from integrating the Internet, but may be an indirect result of a shift in student-teacher relationships that occurs when teachers depend on students' knowledge of technology that exceeds their own. In this dependence, a true shift in power, and new roles for both teachers and learners, were evident*.

Planning and management. The Internet provided new resources and tools for curriculum planning, and alternative ways of handling student work and grades, that complicated teachers' planning tasks and the management of teaching. New tasks were necessary in order to use the Internet, such as moving students to a computer lab or moving computers into the classroom. The threat of equipment, network, or Web site unreliability meant that teachers had to make contingency plans, and constantly check Web sites for availability and continuity. Students' tendencies to be distracted when working on the Internet by Web sites unrelated to their task at hand, and to misuse computer equipment and systems, added to the complexity of teachers' classroom supervision responsibilities.

Contextual Influences on Schools' Internet Integration

The internal context of the school (e.g., school climate, norms and patterns of behavior, leadership) influenced the degree of technology integration that schools had achieved and how teachers viewed technology integration. Likewise, schools' external contexts (e.g., the community, higher education, state and federal governments) were also influential in supporting or discouraging schools' technology integration efforts.

Commitment and leadership. *Commitment and leadership were two central factors linked to funding and other resources supportive of Internet integration in the schools*. Committed leadership helped to develop funding to support technology integration. Seeking funds beyond the school's regular budget, and encouraging staff to apply for grants, were critical functions of leaders because of the financial demands of technology integration. Leadership was also critical in how smoothly and effectively technology integration proceeded. *Technology integration was facilitated by leadership that established clear and effective strategies for bringing it about.* Effective strategies included, but were not limited to, obtaining the needed equipment and infrastructure, creating needs and incentives for teachers to use the equipment, providing teachers with training, and recognizing teachers who used and integrated the Internet. *Leadership* *for technology integration came from a variety of sources*, including administrators, technology staff, and teachers. It was easier to protect teachers from a proliferation of agendas that competed with technology integration and to focus school resources on technology integration when administrators led, or at least were committed to, technology integration.

Interpersonal climate. *Schools that provided a supportive interpersonal climate made it easier for teachers to take the risks associated with learning something new*. Teachers in these schools were able to find colleagues to help and support them in their technology integration efforts.

Access, time, competing priorities, training, and support. The degree to which the school was able to supply teachers with Internet access in their classrooms, with appropriate training and with adequate technical and curricular support, directly affected teachers' satisfaction in using the Internet—and their satisfaction in turn affected their propensity to continue its use**.** *Access was a necessary, but not a sufficient, condition for teacher Internet use*. Teachers reported that they lacked the time to use the Internet access provided to them at school. Many responsibilities competed for their time. In one school in particular, district and state mandates focused teachers' attention and curricula toward other goals and activities, leaving little time or energy for Internet integration. Teachers who did not receive what they considered to be sufficient training felt that they lacked the know-how to use the Internet effectively and efficiently. Participation by teachers in training was encouraged when schools provided training during school hours and required participation, brought credit-based technology training applicable to a graduate degree into the school, paid teachers for participating if training were offered outside of school hours or in the summer, matched the training to teachers' technology skill levels, and geared the training toward teachers' subject-area teaching responsibilities. Teachers in schools that were unable to provide sufficient technical support had unsatisfying, frustrating experiences in using the Internet because of equipment and network problems. These experiences discouraged teachers' further use of the Internet.

Shared responsibility. *Technology integration in schools is not the responsibility of schools alone. Communities, states, higher education, and the federal government play important roles in supporting or discouraging technology integration in schools*. The schools whose internal and external contexts were the most supportive of technology integration had progressed the furthest in achieving technology integration. Even schools committed to technology integration had difficulty accomplishing it unless they had support for their agenda in at least some of their external contexts. Support that the schools received from their external contexts included funds, equipment, services, and teacher training. Federal programs, such as the Technology Innovation Challenge Grant Program, the National Science Foundation's Supercomputer Program for Educators, and the E-Rate Program, were important influences on technology integration in four of the five schools. Technology Innovation Challenge Grant products, such as repositories of Internet-based lessons, the Virtual High School, and Generation WHY, supported the Internet integration efforts of teachers and schools that were aware of them. States in which some of the schools were located provided special funds to assist with technology integration. Higher education institutions provided some of the schools with technology training for teachers, and access to infrastructure and computer labs, and initiated or cooperated with schools in projects that furthered Internet integration in the schools.

School district, state, and national policies can unwittingly impede the Internet integration efforts of schools. For example, states and school districts whose policies reduced or eliminated teacher in-service days reduced the opportunities for schools to provide technology training for their teachers. Questions on mandated standardized tests that assume that students use traditional tools (such as a traditional library card catalog) put students who use computer-based tools (such as on-line searches of the school library) at a disadvantage. Mandated standardized tests also led some teachers to feel that they had to focus their instruction on test content, rather than allow students to work with the Internet.

Crisis. *Schools that had faced a crisis in relation to their external contexts in the past, and in which technology integration was linked to resolving the crisis, had made the most progress toward technology integration*. One school faced a current crisis, but technology integration was seen as aggravating, or at least not alleviating, the situation. This school's technology integration agenda was superseded by, rather than integrated with, its agenda to resolve the crisis.

Recommendations

- *Strategies for closing the digital divide should continue to focus on providing access to the Internet for students in schools, but should also strive to increase Internet access available in the community*. Schools are a logical place to seek to equalize opportunities for using and learning about the Internet, but access to the Internet in schools alone may not be sufficient to equalize access opportunities for students. In addition, all parents should have access to school information and personnel via the Internet. Community-based computer centers accessible to students and their parents should be developed. In some communities, the school may become such a center, with after-school and evening hours that make its computers available to students, parents, and community members. Public libraries could serve such a function, if they have sufficient computer facilities.

- *Studies are needed regarding the Internet's potential to transform educational practices and improve student learning, and the conditions under which it does so*. Desirable transformations as a result of integrating the Internet in schools include equalizing and expanding opportunities, and improving teaching and learning. Findings reported here address these areas, and point to avenues of further research that could enhance understanding of the Internet's potential as a transformative technology.

The impact of use of the Internet on learning is likely to be a complex issue to unravel. Because many factors affect learning, isolating the impact of the Internet will be difficult. Although the findings suggest that the Internet may have a positive impact on some kinds of learning (e.g., learning of technology skills), they also suggest that the Internet may interfere with other learning intended by teachers. Different kinds of data than the teacher and student reports discussed in this study will be needed to pursue answers to the question of the Internet's impact on learning. The study findings can help to guide the development of classroom-level studies that investigate the impact of using Internet-based learning opportunities with various kinds of students, teaching methods, and curricula.

Longitudinal and time-series studies in schools that are in the process of Internet implementation are needed to determine how the impact of the Internet on the teaching-learning system evolves over time. Studies of the evolution of teacher-student relationships, teaching practices, teachers' planning and management tasks, and resource demands would help to clarify the Internet's impact. Research on Internet-based teaching should examine the potential of the Internet to infuse the real world into the classroom. Career and technical education programs that have traditionally emphasized real-world experience provide an excellent context for exploring the potential contributions and limitations of the Internet in providing this dimension in students' learning experiences.

- *The impact of students' technological expertise on their social status and social experience in school that was suggested by the findings reported here should be examined in more detail.*

- *Information about the products of federal technology integration projects should be disseminated more widely and more effectively to states, school districts, and schools.* These projects represent a form of contextual support beneficial to the teachers and schools that are attempting Internet integration and are aware of them, but they remain unknown to others. Considerable money and effort have been invested in these projects, and it is important that those who can benefit from them be informed about them.

- *New technology initiatives should include plans for future funding on an ongoing basis.* Technology upgrading, technical and curricular support, teacher training, and time for teachers to do the necessary curriculum work are continuing needs that schools' technology integration plans should address.

- *Mentor training opportunities should be developed and provided for teachers with technology expertise who provide significant assistance to their colleagues.* Teachers' expertise expands the technical and curricular support base in schools. *Ways of organizing such teachers' work assignments should be found so they can aid their colleagues without being overburdened.*

- *Student support that helps to fill the gap between the technical support teachers feel they have available, and what they need, should be recognized and supported.* Students are an important resource, and should be recognized as such and given opportunities to learn from helping others with technology. Schools can support students' overall development by helping them develop their technology expertise, connecting students who have developed expertise with those who need their help, and providing students with training regarding teaching others. The Generation WHY program developed through the Olympia School District Consortium's Technology Innovation Challenge grant may provide a model that schools would find helpful. (Olympia School District, n.d.)

- *This study's findings provide guidance for schools seeking to accomplish school-wide integration of the Internet, and for those seeking to support their efforts by creating a context conducive to achieving that goal.* Simplistic approaches are unlikely to be successful, and should be avoided. A one-time allocation of funds for equipment, for example, is not likely to produce sustained technology integration if the underlying school system is not helped to develop needed characteristics and capacities, and teachers are not trained. Commitment, leadership, funding, technical and curricular support, teacher training, and a collegial school climate are all important to achieving school-wide Internet integration.

- *Context-focused studies that extend beyond the school are needed.* The findings from the study reported here suggest that contexts external to the school play important roles in supporting Internet use in schools, and that without support from these contexts, schools are likely to have difficulty initiating and sustaining school-wide integration of the Internet. A deeper understanding of these contextual influences is needed. Studies should include experiments that introduce a change in a contextual element, and observe the impact on technology integration in schools. Findings from such experiments would be useful in guiding the actions of policy makers who wish to support Internet use in schools.

- *Development of mutually beneficial relationships supportive of schools' Internet integration efforts should be encouraged among schools, higher education institutions, and community entities.* Cooperative projects that facilitate Internet access for high school students and staff, explore and test models for integrating the Internet into curriculum, and develop Web sites useful to high school teachers and students should be developed. Teachers, higher education faculty, and community representatives working together to create research and development projects focused on use of the Internet in high schools could help to answer questions raised, and to address needs revealed by this study.

- *Preservice and in-service teacher education programs should provide explicit instruction regarding use of the Internet in teaching, and ways of integrating the Internet into curriculum.* Teachers' needs for training span several areas, including the kinds of educational purposes that are served by use of the Internet, the types of on-line learning opportunities that are available and appropriate for students, searching on the Internet, creating Web-based resources, and developing familiarity with relevant Web sites and on-line lesson repositories. Higher-education faculty can help teachers see possibilities for integrating the Internet by using the Internet in classes high school teachers take, and they can spur their own learning by giving high school teachers opportunities to share their Internet-based work and knowledge, and to be co-investigators for Internet-focused studies.

- *Teacher educators' conceptions of teacher education need to encompass the new opportunities that teachers and schools have for Internet-based professional development.* Teacher education programs should incorporate the Internet as one delivery mode for reaching teachers with professional development opportunities, and should focus the professional development opportunities they provide for teachers on areas in which their strength is greatest, compared to other providers of technology-focused instruction for teachers. These areas are likely to include curricular integration of technology, mentoring programs for teachers who want to help other teachers integrate technology, and graduate degree programs with technology as a focus or component.

- *Programs that prepare school administrators should help administrators recognize their key leadership role in technology integration in schools, learn effective strategies for supporting and managing technology integration, and recognize and support changes in teaching practices and teacher-student roles and relationships that may accompany Internet integration.*

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CHAPTER 1: RESEARCH OBJECTIVES AND DESIGN

The National Information Infrastructure (NII), or the Internet, existed as a communications network well before what is now known, almost synonymously, as the World Wide Web, a graphical interface that makes it easy to navigate on the Internet. Internet use has soared since 1993 (Fetterman, 1998). The release in 1994 of World Wide Web browsers Mosaic and Netscape contributed to this surge by making it possible to download text, graphical, video, and audio material on a personal computer (Barker, Hall, & Wood, 1995). The U.S. Department of Commerce's National Telecommunications and Information Administration reported that the percentage of U.S. households having a modem rose from 11% in 1994 to 26.3% in 1997, and that 41.5% of all U.S. households had Internet access by August 2000 (National Telecommunications and Information Administration, 1998, 2000). Public K–12 schools, too, have increased their access to the Internet with astonishing speed. Between 1994 and 2000, the percentage of public schools in the United States with Internet access rose from 35% to 98%, and the percentage of secondary-level classrooms in public schools with Internet access rose from 4% to 79% (National Center for Education Statistics, 2000a, 2000b).

The Internet represents a new dimension of computer technology that is prompting expansion of computer distribution throughout homes and schools. Advantages of the Internet over older media include its interactive interface and its ability to combine video and computer technologies (Montgomery, 2000). The Internet's capacity as a medium of communication, ability to provide an enormous variety of types of information instantaneously, and potential for keeping this information current are other features that make it attractive to educators. In addition, programs that manipulate data and perform other processing functions, which were previously available only in software packages, are now available on the Internet. These characteristics of the Internet induce teachers to use it for their own information, in lesson planning and preparation, and in classroom teaching. The communications features of the Internet provide new avenues for K–12 schools to maintain connections beyond the school—with the community and with parents (Bauch, 1998; Elkhoury & Murphy, 1998; Weiss & Nieto, 1999).

In addition to characteristics of the Internet itself, a number of beliefs have helped to fuel the rapid expansion of Internet access in K–12 schools. One is the belief that technology integration can bring about broader school reform (Blau, 1993; Glennan, 1998). Teaching with technology is seen as a way to induce teachers to change teaching practices. Another belief that is encouraging increased technology use within schools is a sense that the *digital economy* is moving the nation toward greater prosperity, and that workers with the technology skills needed for information technology jobs will be in short supply (National Telecommunications and Information Administration, 2000). One government-sponsored document reported that in 1999 nearly 720,000 information technology positions went unfilled (Web-Based Education Commission, 2000). Closely related beliefs are that those without technology skills will miss out on both economic and educational opportunities (National Telecommunications and Information Administration, 2000), and that schools play a critical role in providing equal opportunity to learn these skills (Becker, 2000). Another widely held view is that technology is becoming such a pervasive part of the culture in the United States and in much of the world, students need to be technologically literate in order to live and thrive in society. As Blanton, Moorman, and Trathen (1998) state:

> *We have entered an era when computer-based technology and telecommunications have affected virtually every institution in our culture and connected us with other cultures across the globe. To send young adults into a global community without the knowledge of when, how, and why to use these emerging technologies is unthinkable.* (p. 236)

Beliefs such as these have encouraged federal and state governments to formulate goals and programs that focus on eliminating disparities in accessing and learning about technology. The gap in Internet access between schools in which students from poor families, students from families with lower educational attainment, and students representing minority groups predominated and other schools during the 1990s was almost closed by the end of that decade (National Center for Education Statistics, 2001b). The gap, often referred to as the *digital divide*, still persists, however, in classrooms and in homes, although it has lessened (National Center for Education Statistics, 2001a, 2001b; National Telecommunications and Information Administration, 2000). As Internet and computer use has become more ubiquitous across societal institutions, concern about this gap has intensified (Becker, 2000; Montgomery, 2000). Because students from poor families are less likely than their more affluent peers to have access to computers and the Internet at home, these students' primary opportunity to develop their computer and Internet-related skills and understanding is likely to be at school. Consequently, national technology standards intended to influence the kinds of technology learning opportunities available to all K–12 students have been developed (International Society for Technology in Education, 1998). Resources have also been made available to help schools provide opportunities for all students to use the Internet, including those with disabilities and those whose first language is not English (Bayha, 1998). Despite efforts to provide equal opportunity for learning about technology to all students (such as the Common Knowledge project sponsored by the National Science Foundation), research has revealed how difficult this goal is to attain (Schofield & Davidson, 1998).

The use of the Internet in K–12 schools has led to some new phenomena, such as the development of "virtual schools" that offer Internet-based enrichment courses to students in traditional high schools, courses that a student's school may not offer or that a student cannot take because of scheduling or other problems, and remedial courses. The Virginia Internet High School, Cyberschool, and the Virtual High School are examples of this phenomenon in the United States (Rutkowski, 1999). Examples beyond the United States include three virtual schools in the Edmonton area of Alberta, Canada, that provide support to home-schooled students and those who, for one reason or another, are not able to participate in the community's schools (Gibson & Oberg, 1997).

Internet use in K–12 schools has also introduced some new issues. One is a concern that students using the Internet in school may be exposed to material that parents and teachers find inappropriate for children (Blau, 1993; Schofield & Davidson, 1997). Restrictions on other electronic media designed to protect children from what is considered harmful or indecent material are difficult to transfer to the Internet environment, and have not been imposed on the

Internet. This issue highlights the need for schools to make decisions and policies about management of student access (Dillon, 1996; Ingvarson, 1996; Maddux, 1998).

Previous Research Regarding the Internet in K–12 Schools

The burgeoning accessibility of the Internet in K–12 classrooms generates a number of questions: To what extent do teachers and students have access to the Internet in school? To what extent and why are teachers integrating the Internet into classroom- and laboratory-based instruction? What factors encourage and discourage teachers' use of the Internet by themselves and in their classes? What training opportunities are available to teachers? What impact is the Internet having on student learning, on teachers' professional development, and on the teaching-learning systems in schools?

Because most schools are still in the process of expanding Internet access, little research has been completed on the integration of the Internet in high school curricula, on factors that affect this integration, or on how learning has changed. Windschitl (1998) observed that the research literature regarding the incorporation of Internet-based technologies in education mainly describes specific efforts that have been made, why they were undertaken, and the reactions of participants.

Teachers' Use of the Internet

One report of yearly surveys of K–12 language teachers indicated that use of the World Wide Web increased dramatically—from 26% of the respondents in 1994 to 97% in 1996 (Fidelman, 1998). In another study, however, researchers spent 3 years and more than 500 hours observing and videotaping 84 teachers in grades 5–12 in schools in Florida and Georgia (Baines, Deluzain, & Hegngi, 1998). These states were reported to be among the most sophisticated in the nation regarding the integration of technology. Teachers included in the study were nominated by administrators as their most effective teachers. Computers were used in only 3 of the 84 classrooms. The researchers point out that this classroom usage rate contrasts dramatically with the usage rates reported by teachers on surveys. In a case in point, a survey-based study reported that only 11% of the 102 teachers in the study indicated they were integrating the Internet into classroom studies—less than half of those who said they were frequent Internet users (Hack & Smey, 1997).

Going beyond the extent of teacher use, some studies have tried to ascertain the purposes for which teachers use the Internet. Teachers interviewed in a study of selected Edmonton-area schools in Alberta, Canada, reported that they used the Internet for professional development (to stay in touch with professional groups, download professional documents, and research educational issues) and to fulfill their teaching role (develop lesson plans, deliver lessons via e-mail, find educational software in on-line catalogs, and communicate with administrators, students, and parents); and for personal communication and leisure interests (Gibson & Oberg, 1997). Teachers also report using the Internet to keep up with new technologies, to gain access to resources not available elsewhere, to increase student participation in their own learning, to give students without computers at home opportunities to use them, to give students skills they will need in college, to help students feel more a part of the global economy, to learn about teaching practices that might be useful, to reduce professional isolation through e-mail or collaboration with others, to support broader school change efforts by using the Internet as a catalyst, to fulfill students' and parents' expectations, to overcome geographic remoteness and isolation, and to overcome a lack of specialized staff or limited program offerings in their own schools (Ravitz, 1998).

Reasons teachers give for using the Internet in their teaching include the perception that all students would benefit from knowing how to use it, the observation that students enjoy learning more when they use the Internet and thus try harder and accomplish more, and the belief that they are preparing students for life in an increasingly technological society (Ravitz, 1998). School staff report that they appreciate the immediate access to current, relevant information and the worldwide connection that the Internet provides, as well as the opportunities the Internet offers for individualizing learning and for alternative education delivery (Gibson & Oberg, 1997).

Reasons for teachers' nonuse of the Internet have also been reported, including lack of equipment, lack of Internet connection, lack of training, and lack of time to plan for Internet integration and to do the necessary curricular preparation (Baines et al., 1998; Hack & Smey, 1997; Ravitz, 1998). Additional reasons for teachers' not using the Internet have been proposed, including some teachers' view that the technology is too difficult for their students, and a felt need on the part of some teachers to teach to statewide standardized tests (Love & McVey, 2000).

Researchers assessing Internet implementation found that math and science teachers and males used the Internet more than humanities teachers and females (subject-area/gender interdependencies are likely reflected in these data), that teachers were more likely to use the Internet at home than at school, and that e-mail was the most common use of Internet-based technology reported by teachers (Gibson & Oberg, 1997; Hack & Smey, 1997; Roblyer, 1997). Schofield and Davidson (1998) reported that integration of the Internet into the school curriculum has been slowed by teachers' use of it as an add-on enrichment rather than as part of the core curriculum, and as a privilege and reward for good behavior or strong academic performance rather than as a basic resource to which all students should have access.

Factors Affecting Teachers' Use of the Internet

Gibson and Oberg's (1997) case-based study indicated that classroom access to the Internet encouraged teachers' use of it, as did up-to-date equipment that could access Internet sites in a reasonable amount of time and that was in working order. Administrative vision and support was also mentioned by teachers as an important factor encouraging their use. Ravitz (1998) surveyed high-Internet-using teachers and found that both classroom access to the Internet and Internet access on 20–30 computers in a computer lab increased their use of the Internet. He also found positive correlation between extrinsic rewards or incentives (e.g., providing equipment to teachers interested in the Internet, giving release time from teaching to do Internet integration work and participate in training, reimbursing staff for participating in professional development courses, public recognition, career ladder opportunities for Internet-using teachers) and teachers' use of the Internet. Teachers' involvement in decisions about Internet implementation in the school was also positively correlated with their use of the Internet. Math and science departments received some of the early funding provided for Internet-related curriculum efforts, which may account for the greater involvement in Internet use by teachers in these areas reported in the previous section (Rogan, 1996).

Case studies reveal that technical problems and inadequate technical support are barriers teachers face in using the Internet, and that lack of time to prepare Internet-related activities for teaching is an especially challenging barrier (Gibson & Oberg, 1997; Roblyer, 1997; Rogan, 1996). Teachers have also reported a lack of time in the curriculum to integrate Internet-based activities (Ravitz, 1998). The time required to deal with the vast resources on the Internet frustrates teachers' efforts to find sites relevant for students and to their teaching, and having to schedule and supervise a computer lab in order to use the Internet discourages teachers' Internet use (Gibson & Oberg, 1997). Other problems that limit teachers' Internet use include the unreliability of the Internet's and Web sites' availability, at least during the school's scheduled time for a particular subject, and the resulting need for teachers to prepare a backup plan (Rogan, 1996; Schofield & Davidson, 1997). The potential of the Internet for exposing youth to material considered inappropriate is a major concern of teachers (Gibson & Oberg, 1997). In classrooms with just a few computers, multitask organization (where students are doing different activities) is typically necessary, which adds to the complexity teachers must deal with (Schofield & Davidson, 1997). Other barriers that have been identified include insufficient funding for computers, software, infrastructure, and teacher training; state-controlled technology planning; classrooms without computers; inadequate preparation of preservice teachers to use the Internet; emphasis on standardized tests that encourages teachers to teach to the test; a view of teaching as telling, and learning as listening; and the poor quality of many Web sites (Maddux, 1998).

Students' Use of the Internet

Teachers interviewed in Gibson and Oberg's (1997) case study of Internet use reported that the predominant student uses of the Internet in school were exploring Web sites and visiting sites identified by their teachers. Teachers and administrators in this study reported that students learned to use the Internet by first exploring and then seeing a purpose for using it to complete a particular task. Teachers seldom reported that students published their work on the World Wide Web. Ravitz's (1998) survey of high-Internet-using teachers found similar results. Gibson and Oberg (1997) reported high levels of Internet use by academically gifted students; they also reported that teachers expressed concern that students without Internet access and a computer at home would not have the same educational opportunities as those who did. These researchers also reported teacher concerns about students engaging in plagiarism to an alarming degree because the Internet made it easy to do so, and because students had come to expect the computer to provide them with answers, rather than doing their own thinking.

Schofield and Davidson (1998) reported that despite teachers' desires that all students should have equal access to the Internet, some teachers' belief that academically weak students should not spend their time on the Internet exacerbated inequalities in students' Internet access. These researchers also found that teachers tended to give more Internet access opportunities to students who had more skills in using the Internet, and who therefore made fewer demands on teachers for help. Such students were typically males and among the more affluent students in the school who had home Internet access. Rogan (1996) reported that teachers bemoaned the ability of the Internet to attract students away from learning tasks and into exploring and surfing.

Students have reported that they appreciate the speed of the Internet, the variety of information it contains in one spot, and the ease of access to it, and they believe that information on the Web is more up-to-date than that in books (Fidel et al., 1999; Parr, 1998). High school students told researchers that they thought it was easier and more interesting to find information on the Web than in the library, and that they did not plan their Internet searches (Fidel et al., 1999). Observations of students' search behavior confirmed a lack of planning, but revealed that students did have some idea about how they would start to search. Students were also observed to communicate with each other a good deal during their searching processes, but were nevertheless highly focused in their searching. This study and another study that directly examined younger students' search behaviors on the Internet (Bilal, 1998) revealed that students' lack of success in performing searches was often due to spelling errors; the use of overly broad or overly specific concepts; failure to fully examine the results of a search, and instead moving on to a new search especially when the list was long; or failure to scroll down to the bottom of Web pages they did explore. Students expressed frustration with their inability to find information relevant to their question or purpose. Fidel et al. (1999) concluded that students and their teachers need to be trained to conduct Web searches.

Parents and the Internet

In a study of parental concerns about the Internet and expectations about having the Internet in the classroom would help their children succeed in school and in the workplace, Grimm (1998) found that parents believed the Internet greatly increased access to information and people, expanding their children's resources for completing school assignments and making it easier for students to get information and direct their own learning. This access also concerned parents because students could wait until the last minute to do projects without going to the library. Parents also felt that the volume of information available on the Internet necessitated helping students learn how to find information and evaluate its quality. Parents were also concerned about the risks that chat rooms pose in exposing students to strangers who may intend to harm youth. Parents expected that having the Internet in the classroom would make the classes more group- and project-oriented than lecture-focused, and that students would have opportunities to learn technology skills; however, they perceived that Internet-based instruction would be useful only if teachers were prepared to use it effectively. Parents expected e-mail to facilitate communication among students, between teachers and students, and between parents and teachers.

Teachers' Professional Development

The need for training teachers in how to use the Internet is documented in several studies (Roblyer, 1997). Teacher certification processes in 32 states are reported to have a technology requirement (Kent & McNergney, 1999). Gibson and Oberg (1997) reported that teachers who had Internet access at home were more comfortable and more skilled in using the Internet than those who did not. These researchers also found that teachers learned about technology from their students, and also taught themselves. Having a mentor to help, especially as they started to learn to use the Internet, was important in encouraging teachers to explore, and demonstrations of uses for it by other teachers induced teachers to try it themselves. Teachers in schools that provided opportunities for groups of staff to sit down together and explore the Internet found this collaborative approach to learning about available resources especially helpful. The schools in this study designated lead teachers to help others, and some of the schools gave these teachers release time. Teachers were reluctant to invest the amount of time required to learn to use the Internet and to participate in in-service workshops all on their own time, and schools provided some release time for these purposes and held in-service sessions on staff development days.

Although it is noted throughout the literature that gathering information is one of the most prevalent uses that teachers and students make of the Internet, it is also widely reported that both teachers' and students' Internet search skills are underdeveloped. Teachers who do not have good search skills are unable to help students improve theirs. Some professional development efforts for teachers have focused on developing and testing instruction that addresses this problem (Pierce, 1998).

A technology survey of member institutions of the American Association of Colleges of Teacher Education (AACTE) and the National Council for Accreditation of Teacher Education (NCATE) conducted in the fall of 1996 revealed considerable variation in the degree to which schools/colleges/departments of education used contemporary educational technologies, including the Internet (Persichitte, Tharp, & Caffarella, 1997). Most units (87%) reported having Internet connections established for their faculty and administration. Almost one third of the units reported that students were not required to incorporate technology within their instruction during student teaching. Students in 85% of the units, however, were required to take a course on computer applications, and 61% of the units included instruction on computer use, communications, and instructional integration in the required course. Students were reported to use e-mail to communicate with faculty at 77% of the responding institutions, and in 64% students were also able to submit their work via e-mail. Students at 26% of the institutions were able to obtain assignments and syllabi from the unit's Web site. About half of the responding units indicated that faculty used interactive communication technologies for distance communication with students; 42% said that their classrooms had Internet access; and the faculty in 67% of the responding units used e-mail to collaborate on projects and communicate with other faculty outside the institution. More than half of the responding units reported that their faculty did not use the unit's Web site, or that the unit did not have a Web site. Most (87%) indicated that their faculty used the World Wide Web to search for articles and other items. These patterns have undoubtedly changed in the years since this study was done, but the data suggest that recent teacher education graduates differ greatly in their degree of exposure to Internet-based technologies within their programs

Higher education institutions are exploring and using the Web as a way to deliver professional development opportunities to preservice and in-service teachers (Blackhurst, Hales, & Lahm, 1998; Blanton et al, 1998; Shotsberger, 1999). A number of these opportunities have focused on helping teachers learn to integrate the Internet and other technology into their classrooms (Tucker & Gunn, 1998). Other Web-based efforts have used the Internet as a vehicle to deliver professional development content focused on developments in a particular teaching field, such as subject area standards (Shotsberger, 1999). Shotsberger suggests that one advantage of the Internet as a delivery system for providing in-service education is that teachers do not need to travel to a higher education institution in order to participate. They can participate during the academic year when they can immediately apply what they are learning to their teaching.

Impact of the Internet on Teachers' Practices

Research has indicated that access to the Internet encourages teachers to use more cooperative learning techniques, and that Internet-using teachers already have an approach to teaching that involves students as active learners before they incorporate the Internet (Roblyer, 1997). Teachers have reported that the Internet's resources changed the emphasis in the content they teach, helped them incorporate more diversity and the outside world into their lessons, and helped them teach in a more facilitative, investigative, inquiry-oriented, student-centered way, as opposed to a teacher-directed way (Rogan, 1996). Teachers have used the Internet to support their service-learning projects (Harwood & Chang, 1999).

Some teachers use constructivist educational theory as a basis for designing approaches to incorporate the Internet in their teaching. This is not surprising, since constructivist theory supports the student-directed, project-oriented, and collaborative learning designs that the Internet is reported by teachers to facilitate. Heflich (1996) found that teachers who had more access to on-line computer technology tended more toward using constructivist educational practices than those with little access to this technology.

Research has also suggested that use of the Internet may not dramatically change teachers' practices in fundamental ways. Based on their case studies of teachers, McDonald, Garties, Hanson, Slygh, and Schroeder (1996) concluded that while the Internet itself has not inspired a revolution in pedagogy, it has allowed creative teachers to experiment with new pedagogical styles.

Impact of the Internet on Students' Learning

Research on educational technology in general has not necessarily supported the frequent assumption that incorporation of technology in education has a powerful impact on learning (Clark, 1983, 1994). There is widespread agreement that unless technology is embedded in theory-grounded educational designs that guide exploitation of the technology to serve learning, learning outcomes are unlikely to be enhanced (Blanton et al., 1998; Mergendoller, 1996; Owston, 1997; Roschelle & Pea, 1999; Roschelle et al., 2000; Windschitl, 1998). Consistent with this view, Glennan (1998) has asserted that the use of technology in a school is not a "magic bullet" that will improve student learning without other accompanying reforms.

In 1998, Glennan testified to a federal Budget Committee Education Task Force that although the uses of technology in schools were too varied and situation-specific to allow a general answer to the question of whether technology improves students' educational performance, the Internet can serve a number of useful purposes. A federal commission report released 2 years later came to a similar conclusion (Web-Based Education Commission, 2000). Reports of the impact of the Internet on students' learning processes indicate that the Internet motivates students, that students enjoy using it, and that they take more responsibility for their learning as independent explorers and problem solvers doing real science (Glennan, 1998;

Rogan, 1996). Kupperman and Wallace (1998) found that developing and using a complex system for assessing students' writing processes, as well as their writing products, provided a more adequate picture of the interaction between the Internet and students' learning about writing. A review of research on telecommunications exchange projects in schools suggests that the impact of these projects on students' writing skills, multicultural awareness, and job preparation is mixed (Fabos & Young, 1999). Consistent with the view that the Internet is an important aspect of schooling, whether or not its use improves learning in traditional school curricular areas, schools have identified the Internet and other dimensions of technology as a learning-target rather than a learning-vehicle. Some states have initiated statewide required testing of students' computer-related skills, including telecommunications. One state reported disparities in performance among subgroups of students based on race, exceptionality, and English proficiency (North Carolina Department of Public Instruction, 1998).

Impact of Context on Teachers' Internet Use

The school represents the most immediate context of school-based Internet use. The school district, community, state, and society reflect other layers of context with the potential to influence Internet use in schools. At the school level, Ravitz (1998) found that teachers reported more availability of technical support than curricular support for Internet integration. The presence of a long-range plan for Internet development and use, a substantial budget allocation for Internet development and use, and the recognition of Internet use as a priority in existing school improvement plans were predictive of teachers' Internet use, as were the proportion of teachers in the school perceived by teachers to be Internet users and the number of teachers who discussed the Internet (Ravitz). Heflich (1996) found that social relationships in the school influenced the use of on-line computer technology, and that schools in which a culture of professional growth prevailed and in which administrative and collegial support for the use of this technology was present had higher access to it. Other studies have found that school leadership that encourages and models technology use aids teachers' use of the Internet (Gibson and Oberg, 1997; Ravitz, 1998; Schofield & Davidson, 1997). Physical features of the school can constrain the placement of Internet connections and computers, and affect the ease or difficulty (and expense) of installing the wiring and other infrastructure needed for Internet access (Schofield & Davidson, 1997). Electrical capacity may also be inadequate to accommodate the added load that an influx of Internet-capable computers may create.

Regarding the context beyond the school, parental support for Internet integration has been reported to aid teachers' use of the Internet (Gibson & Oberg, 1997), and is associated with higher access to on-line computer technology in the school (Heflich, 1996). The parental support reported by Gibson and Oberg was related to socioeconomic status. Ravitz (1998) found that high-Internet-using teachers reported support from school district personnel; higher education; local community members; vendors of computer hardware, software, and telecommunications equipment; and local businesses. Jensen's (1998) case study of technology integration in a rural school district reflected a significant role for higher education, the community, and the state in the technology integration the school was able to accomplish.

Schofield and Davidson (1997) point to several aspects of the culture of teaching that their study implicated as inhibiting Internet use by teachers, including the idea that teachers know more than students, and that in a well-run classroom, students sit quietly and listen to the teacher. These researchers found that in any given classroom, some students are likely to know more about computer technology and the Internet than the teacher, which can be threatening to some teachers. In addition, using computers in the classroom leads to more movement and student-student interaction. Finally, the isolation and privacy of the classroom were seen as deterrents to teachers' sharing computer equipment with each other.

Research Objectives

The advent of the Internet has added new dimensions to issues surrounding educational technology. The Internet's requirements go beyond the basic computers and software programs that characterized schools' systems in the 1980s—to additional software, more sophisticated computers, telecommunications services and equipment, and infrastructure. All of these are expensive. The Internet expands concerns about student abuse of computers and software, to include possible plagiarism by students who turn in documents available on the Web as their own, and access to Web sites deemed inappropriate for minors. Sifting through the resources the Internet provides is a very time-consuming task for teachers who want to incorporate the Internet in their teaching. Likewise, students are challenged to become efficient searchers, or waste considerable amounts of time in unsuccessful exploration. At this nascent point in the integration of the Internet in K–12 education, we simply need to know and understand more in order to guide Internet integration efforts and determine their worthiness. Research is needed to assist schools in strategically allocating limited resources to Internet-related efforts in ways that contribute the most to significant student learning (Windschitl, 1998).

Previous research on use of the Internet in K–12 schools has focused largely on pioneering efforts, reflecting the uneven distribution of Internet access in U.S. schools during the last decade. Because the distribution of Internet access has very recently encompassed nearly all K–12 schools and most high school classrooms, high schools now have the possibility of achieving school-wide implementation and integration of the Internet. Research that examines the implementation and integration of the Internet on a school-wide scale is needed in order to understand its patterns, what affects it, and its consequences. Data are needed on multiple levels regarding the implementation of the Internet in schools: Data at the classroom level can aid understanding of teachers' practices, teaching and learning processes, and student learning; school-level data can aid understanding of what is entailed in school-wide Internet implementation, what patterns emerge as schools move to this level of implementation, and the forces and conditions that support and impede it. Research on school culture has been suggested as an area of future research in educational technology that is likely to be productive (Woodward & Rieth, 1997). Both classroom and school-level data can illuminate how educators and schools mediate Internet access and use by students. Data on how Internet participation affects and is affected by learning systems and social systems in schools can add valuable insight into the transition process (Blanton et al. 1998). Data on teachers' use of the Internet for professional development and other purposes can also contribute to this understanding (Woodward & Rieth). Data concerning the context of the school can add to our understanding of forces and conditions that affect a school's Internet implementation efforts but are beyond the school's jurisdiction.

The school-level study reported here was initiated in early 2000 to address these needs for deeper understanding of school-wide Internet implementation. Supported by the National Research Center for Career and Technical Education, the study focused on high schools, which have the highest concentration of Internet connections among K–12 classrooms and the most career and technical education programs. It is anticipated that deeper understanding of Internet implementation in high schools will provide useful insight into the context for Internet implementation in career and technical education programs and other high school programs

The purpose of the study was to address the questions listed earlier and the research needs outlined above by conducting in-depth case studies of schools engaged in school-wide use of Internet-based technologies. The objectives were to identify the following:

1. Internet-based learning opportunities potentially available to and perceived as useful to professional educators and students;

2. Patterns of participation by professional staff and students in Internet-based learning opportunities, including the kinds of opportunities used and the characteristics of professional staff and students who use them to varying extents or not at all;

3. Reasons of professional staff and students for using the Internet, and specific factors that facilitate and hinder their participation in Internet-based learning opportunities;

4. The impact of participating in Internet-based learning opportunities on student and professional staff learning, motivation for and engagement in learning, and the teaching-learning system within schools;

5. The impact of the school teaching-learning system and its contexts on participation by professional staff and students in Internet-based learning opportunities;

6. Theoretical models that contribute to interpreting and explaining findings regarding the preceding five objectives.

Research Methods and Procedures

A case-study approach was used. Five public high schools from across the United States were chosen for in-depth study based on the following criteria:

1. *A mix of urban, suburban, and rural schools*. A mix of urban, suburban, and rural high schools was sought in order to investigate how school size and context relate to the opportunities for staff and students to use the Internet, and to factors identified as affecting staff and student Internet use.

2. *A range of student demographic characteristics*. Schools with a variety of student demographic characteristics, including schools with high concentrations of minority students and schools with high concentrations of students from poor families, were sought because of the well-publicized *digital divide*, which refers to the more restricted

access to computers of minority and poor students compared to their white and more affluent counterparts, and the evidence that has been reported that even when minority and poor students do have access to computers, they are asked to do different tasks than those their white and more affluent peers are assigned.

3. *Internet use for at least 2 years*. Schools in which the Internet had been used for at least 2 years prior to the study were preferred in order to allow for the time presumed necessary for learning and curricular integration to occur.

4. *Internet use integrated across the curriculum*. Some schools were nominated for inclusion in the study on the basis of Internet usage by one teacher or in one classroom, one program, or one grade level. This more isolated usage is more likely the result of the interest and motivation of specific personnel than of a system-wide effort to integrate Internet use throughout the curriculum. The latter situation is rarer and more difficult, but also more important to understand given the focus of prior studies on smaller scale, pioneering Internet integration efforts in schools. School-wide Internet implementation refers to a stage of change beyond experiment and tryout, when a school expands an innovation that has been tried in parts of the school to use throughout the school.

5. *A comprehensive curriculum, including career and technical education programs, as well as academic and general education*. Some alternative schools, regional centers, and other nontraditional schools were nominated and would have been interesting to study. It was decided, however, that because the vast majority of U.S. high schools are comprehensive high schools, understanding Internet implementation in such schools, varying in demographic and contextual situations, would be especially valuable.

6. *Geographic distribution across the United States*. Because states differ in policies and programs in ways likely to affect schools' ability to acquire the computers and infrastructure necessary for Internet access and to provide or in some way make accessible teacher training and other supports, varied geographic representation was viewed as important.

7. *Accessibility within program resources*. Geography was the primary variable used in meeting this criterion. Some schools in remote locations that required complicated and time-consuming travel could be included, but it was not possible to include several such schools.

Schools were selected based on a multifaceted search process. Areas of the United States with high minority populations were identified. Web 66 (http://web66.coled.umn.edu), a site created by the College of Education at the University of Minnesota that registers Web sites of schools across the United States and the world, was then explored for school districts in these geographic areas. Schools whose Web sites reflected Internet-based projects and activity to a considerable degree were noted. In addition, National Research Center for Career and Technical Education site directors were invited to nominate schools that reflected Internet integration. A consultant familiar with educational technology development on a national level was also asked to recommend sites. Finally, key informants involved in state- and national-level efforts regarding technology in schools were consulted.

The list of schools identified through this process was narrowed down to six schools that as a group met the criteria. The six schools were contacted and invited to participate in the study, and five of the six consented to be involved. Since these five schools covered the criteria, it was decided to include only five schools in the study and to provide a small honorarium to each participating school instead of involving a sixth school. The five participating schools were located in four states and included two inner-city schools, one suburban school, one school in a community on the outskirts of a large metropolitan area, and one rural school.

Data Collection

Data were collected at each site in two phases. In Phase 1, a survey questionnaire was provided to the entire professional staff and student body. The basic questionnaire covered where respondents gained access to the Internet, how long they had been using the Internet, how frequently they used the Internet, the kinds of Internet technologies they used, the training and/or support they received, the purposes for which they used Internet technologies, their comfort with and valuing of the Internet, and demographic information. In addition, the teacher questionnaire asked about the classes in which they used the Internet; the principal questionnaire included questions about the school; and the technology/media staff questionnaire asked about these staff members' roles and responsibilities regarding technology. Copies of the questionnaires that contain the basic questions asked of all staff plus these additional questions are included in Appendix A. The student questionnaire asked the basic questions and, in addition, asked about the impact of the Internet on the students' interest in classes and on grades. A copy of the student questionnaire is included in Appendix B. Staff and student consent forms and survey questionnaires were mailed to the staff member assigned by each school to coordinate the study. On-line questionnaires were considered, but since responses were desired from both users and nonusers of the Internet, it was decided that it was necessary to use paper questionnaires.

As soon as they were completed, staff questionnaires were returned by mail to the researchers for review, in preparation for the on-site visit to each school. The survey questionnaire data provided an initial picture of Internet use at each site that served as the basis for planning Phase 2—on-site data collection. Phase 2 was viewed as an important aspect of the study design, given the limitations that prior research on teachers and the Internet has revealed regarding questionnaires.

Dates for the visits to each school were arranged. Interviews were requested with all staff, where possible. Where school staffs were too large to interview all professional staff, interviews were requested with staff members who represented a range of Internet usage, as reflected on the staff questionnaires. Classrooms reported on the staff survey questionnaires as ones in which Internet use was frequent were identified for videotaping. Taping times were scheduled with the teachers of these classes, and consent forms were forwarded to these teachers for distribution to students and their parents. The study coordinator in each school was asked to select and schedule a few students for two or three focus-group interviews. Since project resources were not sufficient for gathering extensive student data beyond the Phase 1 questionnaires, it was only possible to include a few student voices in the interview process, rather than represent the range of the student body with respect to Internet use.

On-site visits to the schools took place between late April and early June of 2000. A four-member research team spent 3 to 4 days in each school interviewing staff members, conducting focus group interviews with students, videotaping classrooms in which the Internet was being used, observing the schools' computer facilities, and obtaining documents relevant to Internet capacity and use in each school (e.g., technology plans, Internet use policies). The completed student survey questionnaires were obtained during the on-site visits.

Individual 30- to 45-minute interviews were conducted with most staff who returned questionnaires. Questions focused on clarifying information the staff member had provided on the survey questionnaire, the uses made of the Internet, reasons for using the Internet, factors facilitating and inhibiting use of the Internet, the impact of Internet use on teaching practices and on student and staff-member learning, where help in using the Internet was obtained, and what would be helpful in the future in using the Internet. Appendix C contains the staff interview protocol. In a few cases, schedules necessitated interviewing more than one staff member at the same time. In schools where it was not possible to interview all staff members who had returned a questionnaire, interviews were conducted with staff whose use of the Internet varied in frequency and type. All interviews except one were audiotaped; one staff member requested the interview not be taped, and notes were taken instead.

Survey data were collected from 322 teachers (75% of the possible 430), 19 administrators (which included the principal and all of the assistant principals in each school, and, in some schools, coordinators of special programs), 18 counselors (which included all of the counselors in each of the schools), 13 technology coordinators (which included the director(s) of technology in all of the schools, as well as other technology staff that were employed in some of the schools), and 10 media staff/librarians (which included all professional-level media/library staff in four of the schools). In addition, 224 interviews were conducted with more than half of the teachers, administrators, counselors, media specialists and librarians, and technology staff in the five schools. Of the 322 teachers who completed and returned a survey questionnaire, 176 (55%) were interviewed. Of the 19 administrators who completed and returned a survey questionnaire, 17 (89%) were interviewed. Of the 18 counselors who completed and returned a survey questionnaire, 14 (78%) were interviewed. Of the 13 technology staff who completed and returned a survey questionnaire, 8 (62%) were interviewed. Of the 10 professional-level media staff who completed and returned a survey questionnaire, 9 (90%) were interviewed.

Of the 7,664 students in the five schools, 3,822 (50%) completed the survey questionnaire. Thirteen focus groups of students ranging in size from 15 to 2 were interviewed—a total of about 60 students. Questions posed were similar to those asked of professional staff. Appendix C contains the student focus-group interview protocol.

<u>Data Analysis</u>

The teacher and student survey data for each school were analyzed as categorical data using frequencies and percentages. The chi-square statistic was used to test relationships among variables. The audio-recorded interviews were transcribed, and those for teachers and students were coded for the first five research objectives by two researchers. The two researchers met frequently to cross-check codes for consistency. A third researcher then identified themes within the coded material. Responses with the same code were read in their entirety twice, key phrases were underlined, and the responses reflecting each key phrase were listed. These listings were then reviewed to confirm their reflection of the key phrase. This resulted in retaining some key phrases (themes), in identifying additional ones, in combining some, in moving some responses from one theme to another, and in the identification of sub-groups of responses reflecting sub-themes.

Interviews with and survey data from other school staff were analyzed for background information concerning the schools' Internet capacity, implementation processes, history, context, and curriculum. The interview, observation, and survey data were incorporated in a written case for each site that detailed the patterns revealed with respect to the first five study objectives. The survey data were also analyzed across schools using frequencies and percentages; the chi-square statistic was used to test relationships. The final step was to examine the data in terms of educational change theories, in order to develop a deeper understanding of the patterns that were revealed and to consider possible explanations for and implications of these patterns.

Findings

Findings are reported in Chapters 2–9, in relation to the research objectives. Tables contain survey questionnaire data. Excerpts from the interviews are reported in relation to the themes they reflect. Chapter 2 describes each school and the demographic characteristics of the teacher and student survey-questionnaire respondents. Chapter 3 details the Internet-based learning opportunities potentially available to and perceived as useful to the teachers in these schools, and the patterns of participation by teachers and students in these Internet-based learning opportunities (research objectives 1 and 2). Chapter 4 explores the reasons teachers and students use the Internet (research objective 3). Chapter 5 outlines the factors reported by teachers and students as facilitating and hindering their participation in Internet-based learning opportunities (research objective 3). The impact of participation in Internet-based learning opportunities on teachers' learning and development, and on student learning, motivation for learning, and engagement in learning is addressed in Chapter 6 (research objective 4). Chapter 7 covers findings from teacher and student interviews regarding the impact of Internet use on the schools' teaching-learning systems (research objective 4). Chapter 8 reports findings from teacher and other staff interviews regarding the impact of the schools' teaching-learning systems and their contexts on Internet implementation and technology integration (research objective 5). Finally, Chapter 9 presents interpretations of the study findings in terms of educational change theories (research objective 6). In addition to this report, which emphasizes findings across the schools, the case study reports that focus on each of the five schools are also available (Thomas, R., Adams, M., Meghani, N., & Smith, M., 2002a, 2002b, 2002c, 2002d, 2002e). A brief document that lists specific Web sites that teachers and other school staff identified as helpful has also been prepared (Thomas & Smith, 2002).

Limitations

It should be noted that the conclusions, implications, and recommendations noted at the end of Chapters 3–9 are based on the data from the five case-study schools. Consequently, generalizations that are made apply to those schools, and should be extended to a wider scope of schools with caution. It should also be noted that response rates from students varied considerably across the schools. In addition, in the two schools with large immigrant student populations, many of whom were English Language Learners, the student data exclude many in this group because of language facility barriers. These schools and a third school had diverse student populations overall, however, and this diversity is represented in the student data.

CHAPTER 2: STUDY PARTICIPANTS

The five schools included in the study varied considerably in ways relevant to the Internet, but were also similar in other ways. Each school is described in this chapter based on school documents, school and other (e.g., school district, state) Web sites, and questionnaires from and interviews with administrators, technology coordinators, media specialists, and counselors. These descriptions are followed by a description of the demographic profiles of the teachers and students who responded to the survey questionnaires. The general pattern of data presentation throughout the report is that data presented in tables are from survey questionnaires, and data from interviews are marked by italicized type.

The five schools were located across the United States. They were all comprehensive high schools serving students in grades 9 through 12. All offered academic and career and technical education programs. All had been involved in Internet use since the mid-1990s, and some had used the Internet since its early days—when Gopher, Telnet, and Mosaic were the means available for using it. Internet use in all of the schools was distributed across the curriculum. The student bodies in most of the schools reflected diverse racial and ethnic patterns, but were especially diverse in two schools. In most cases, the schools had developed clear strategies and goals for developing their technology capacities.

Despite these similarities, the schools also differed on many dimensions. Four of the five were large urban schools; one was a consolidated rural school. Two of the four urban schools were inner-city schools, one was a suburban school, and one was located in a community outside a large urban area. Two schools focused heavily on academic programs, and in two schools, career-oriented programs were leading aspects of the curriculum. In some cases, the state provided important support for obtaining Internet-capable computers and the infrastructure needed for school-wide Internet access; in other cases, the state played a minor role. In some cases, the school district was an important source of support and stimulation for the school's technology development, and in other cases, the district was viewed as an obstacle to Internet implementation. In two schools, substantial proportions of the student body were English Language Learners; most of these students came from families who were new immigrants to the United States. Three of the schools enrolled high proportions of students eligible for free and reduced-price lunch; the other two schools served students from mostly middle- to upper-middle-class families.

The Five Schools

In the discussion that follows and throughout the report, the terms *technology integration*, *Internet integration*, and *Internet implementation* are used. *Technology integration* encompasses incorporation of the Internet and other computer-based technologies and video technology in teaching and curriculum. *Internet integration* refers to incorporation of the Internet in teaching and curriculum. *Internet implementation* refers to the move by a school from incorporating the Internet in isolated parts of the school curriculum to its use across the entire school curriculum.

Midwest Inner City

Midwest Inner City, built to be a high-tech career academy high school, was in its 4th year of operation at the time of the study. It had been designed for goal-focused students interested in technology and the career-focused curriculum it offered, but had come to serve a more general inner city student population instead. Located in the largest metropolitan area and in one of the largest school districts in its state, Midwest Inner City was one of seven high schools in its district. It drew students from across its school district and also served students in its own inner-city geographic area. The school's neighborhood, which was located close to the downtown area, was racially diverse, but less so than the school's student body, which reflected a "concentration of diversity."

Widespread availability of computers and other technology was a feature of this school. The design of the school also featured smaller groupings of students and teachers within a large school. The career academy and *New Designs for the Comprehensive High School* (Copa & Pease, 1992) were models that had guided the design of the school. Smaller learning communities comprised of groups of students and teams of teachers was the approach for emphasizing transition and basic skills needs in grades 9 and 10, and focus or thematic areas was the approach adopted to emphasize career pathways and interests in grades 11 and 12. A cross-disciplinary team of teachers was assigned to each group of about 150 freshman and sophomore students. This teacher team shared an office in the area of the building assigned to their group of students. Classrooms were located in that area of the building so that the same teachers and students remained there for much of the day. The 11th- and 12th-grade career-oriented focus areas housed classrooms, relevant laboratories, and the focus area faculty's office. At the time the study was conducted, the school's teaching staff numbered 81. The school used block scheduling.

The challenges of starting up as a new school had occupied staff. The school's first 4 years had focused on creating and refining the curriculum, implementing the state's new graduation standards, raising students' basic skill levels, and going through its first accreditation process. Amidst these priorities, this comprehensive high school was determining how to formulate and reach a vision of technology integration throughout the curriculum.

Students. The school's diverse student body, which numbered 1,400 students, was reported by school staff to be 40% African American, 31% Asian, 22% Caucasian, 7% Hispanic, and 1% Native American. Students speaking a home language other than English constituted 44% of the student body; most of these students came from families who were new or recent immigrants to the United States. Students receiving free and reduced-price lunch comprised 65% of the student body. The rate of student turnover in the school (the proportion of students who left or entered the school during the academic year as a result of residential moves or other circumstances that caused students to change schools) was almost 38%. In 1998–1999, 13% of the school's students received special education services. The school's 1999–2000 student dropout rate was 9.4%. Home access to the Internet for many students was seen by staff as limited. Staff were concerned about the differences among students in access to opportunities outside school to gain experience with the Internet. Staff observed that the technology skills of students whose families did not have the means to have a computer at home were not as developed as those of their peers who had access to technology at home. The less skilled students were reluctant to use technology in front of their more expert peers, which limited their skills even more. Staff reported that although students' technology skills were very diverse when they entered the school, by the time those who stayed at the school were juniors and seniors, most had learned to operate computers and the Internet.

Computer configuration. Computer labs of varying size were distributed throughout the building. The largest were three media-center computer labs containing about 136 computers, and intended for use by the entire school. Other smaller computer labs and study-area computer clusters intended for use by specific 9th- and 10th-grade student groups and by specific career-oriented 11th- and 12th-grade focus areas were located throughout the building. The number of computers in these area labs and clusters ranged from 39 to 3. Each classroom had one computer. In addition, each teacher had a computer—either a laptop purchased at the time the school opened or a desktop model on their desk in their office. Almost all the computers in the school were Internet-connected Macintosh models from 1996 or later, and a number of them had been or were being upgraded with G3 processors. PC computers were also located in some labs and minilabs. The school was reported to use 10 BASE-T lines, which were reported to provide slow access when a large number of computers were logged onto the Internet at the same time. The connection outside the school was reported to be broadband cable. Computers were connected to a building information network that provided access to the school's Intranet, which contained instruction-oriented and reference material.

Technology plan and policies. When the school opened, a number of policies were implemented that not only encouraged, but required, staff to use computers. One requirement was to use e-mail and to check it daily. A second requirement for teachers was to use the electronic student-data-management program employed by the district for attendance and grading. Other policies were intended to ensure compatibility of electronic files across users in the building. The school used ClarisWorks for anything that was communicated within the building; this was also the program on which students learned word processing, spreadsheets, and databases, and developed presentations. It was chosen primarily because of its relatively low cost. It was believed that later, in their work and educational contexts, students would be able to transfer their learning to other programs having similar functions. Although the school was internally compatible in its use of this software, file compatibility was sometimes an issue with other schools in the district and the district office.

A security program was used to prevent unauthorized access to computers. Students and teachers all had individual account numbers, which they typed in during the log-on process. The log-on process also asked the user to indicate agreement with the school's acceptable-use policy. The school chose this way to implement its acceptable-use policy, instead of a parental permission process. The school also used a monitoring program that allowed a staff member to freeze a computer if a student gained access to an inappropriate site, but did not block out any sites. School personnel felt that the monitoring approach was preferable to a filter, which would inevitably block legitimate sites in addition to inappropriate ones. School staff saw these approaches as helping students learn to take responsibility for their own behavior, which staff saw as important in preparing students for the world of work.

The library/media center was open for 3 or 4 hours every day after school, which gave students opportunities to use its computers beyond the school day. The school did not provide students with e-mail accounts or permit students to access Hotmail accounts in school. Teachers were allowed to schedule the school-wide computer labs in the library for half a period only. With the school's block-scheduled, four-period day, this gave teachers about 45 minutes for their class to be in the lab. Teachers were not allowed to sign up for these labs more than 2 weeks in advance—a policy intended to maximize the labs' accessibility to everyone.

A limited technology budget necessitated a strategy of computer refurbishing, rather than replacement. Staff found it difficult to have a systematic technology plan regarding computer replacement and other technology development when little budget could be expected—at least within school-district funding streams. Because other schools in the district had less technology than Midwest Inner City, district technology funding priorities focused on equipping other schools. Nevertheless, some staff indicated a need for an overall consistent direction for technology planning for the school. Some teachers had pursued grant monies to obtain computer equipment they saw as needed in their area.

The technology committee had developed strategy to allocate computer power where it was needed and most used. Consequently, teachers who used their laptop or desktop computer only for word processing, e-mail, and attendance continued to use their old computer, perhaps with upgraded memory. In a few instances where a staff member's work required a more powerful computer, one had been purchased.

Technology-related personnel. At the time the study was conducted, technology personnel included one computer technician and two assistants. In addition, one of the librarians and three teachers maintained computer labs in their own areas. The librarian supervised the building network, ran the security program, and maintained and supervised the library computers and media-center computer labs. All of these personnel were involved to some extent in providing technology support to staff and students. The minicomputer labs and study-area computer-cluster labs were supervised by teachers located in adjacent offices and classrooms.

A technology committee was responsible for coordinating technology planning in the school. During the 1999–2000 academic year, a group of these committee members had formulated a policy for making computer skills part of new teachers' evaluation. Some of the school's possibilities and intentions for using technology when the school opened had not been realized, according to some staff members. Some staff saw these problems as stemming from multiple, rather than unified, directions within the school's technology streams. Technical support and maintenance were being provided by several individuals who had different supervisors and different approaches.

Curriculum. Because students and teachers were organized into small, self-contained groups and focus areas, the school did not have traditional subject-area departments. Nevertheless, staff occasionally referred to "the science department" or "the English department" during their interviews. The only teachers who were physically arranged in subject-area-based departments were in the three elective areas: art, family and consumer sciences, and technology education. Because teachers did not necessarily see other teachers in their subject at other grade levels, or even at their same grade level, during their teaching day, the curriculum coordinator scheduled subject-area department meetings in order to facilitate subject-area curriculum coordination throughout the school. The school offered Advanced Placement courses in some areas.

Midwest Inner City did not require students to take a computer skills course, although it offered such a course as an elective. Some staff members reported that this course was a requirement for all students the year the school opened, but that scheduling curriculum time for it and staff to teach it were seen as challenges. The school did offer courses leading to Cisco certification and Microsoft A+ certification. The school's Intranet provided an on-line tutorial written by one of the school's librarians/media specialists on how to use the Internet, and provided other curricular resources for students. The school ran a summer school in which it was reported that any student in or outside the district could enroll free of charge. The summer school curriculum included technology courses (e.g., digital imaging), some of which were Internet-focused (e.g., Web design).

The school was implementing graduation standards consistent with the state's standards. This agenda and raising the test scores of its students on basic skills were the school's priorities at the time of the interviews. As a result, the school's original interdisciplinary and technology-oriented curriculum visions had received less attention. Because the Internet was used to compile performance data regarding the graduation standards, teachers had to be able to use it. In addition, staff had to be able to use the Internet to track student progress on basic skills tests because these data were available on line.

Professional development. Midwest Inner City teachers' technology skills were perceived by staff to vary widely. Several staff mentioned that the Internet was not being widely integrated into teaching by teachers, and that teachers had not had much instruction for doing such integration. A number of faculty had come to the school because of its high-tech environment. These individuals already were skilled in using the Internet and other technology. Teachers new to the school were required to participate in basic training on the school's technology systems and were paid for the time they spent in this required after-school training session. In addition, implementation of the state's graduation standards necessitated teacher training in using the required on-line processes, and the state's curriculum repository related to these standards was seen as providing resources helpful for staff development concerning curriculum. Staff training beyond this was voluntary for everyone. On-line opportunities were available as well as classes, both at the school and at the district, but participation in these had been low, even though the faculty had been surveyed for areas of interest, and training targeted to areas of highest interest had been offered. The voluntary nature of teacher training was being questioned, and plans for developing a more systematic approach to staff development regarding the Internet and other technology were being formulated. Primary providers of training for teachers included the school's technical and library/media specialist staff.

Technology integration strategies. Midwest Inner City had been consumed with start-up processes, including curriculum development, staff and student-body formation, basic skills testing and achievement, and implementation of the state's graduation standards. As a result, technology integration had not received continued attention. The technology committee was working on a plan for a more systematic approach to teacher training and for making technology skills and use part of new teachers' evaluation process.

West Coast Inner City

West Coast Inner City was an inner-city school, with a diverse population, whose technology developments had recently surged. One of 16 high schools in its district, West Coast Inner City was located 6 miles from the downtown area, and was part of one of the largest school districts in the United States. The school was built in the 1950s. At the time the study was conducted, its teaching staff numbered 92. The school alternated block and regular scheduling every other day.

Although its school-wide technology developments were tied to a very recent state grant for equipment and infrastructure acquisition, West Coast Inner City had been involved in internationally recognized technology efforts in the 1980s, and had been linked to the Internet since the early 1990s. In the 1980s, the school ran a computer-based program designed to help students develop basic skills, and had been equipped with 250 computers. In 1992, the district had adopted a 5-year educational technology plan that emphasized integration of technology into the curriculum and staff development. At about the same time, some of West Coast Inner City's teaching staff became involved in a National Science Foundation initiative designed to familiarize high school science, math, and technology teachers with the capacities of supercomputers. With the help of nearby higher education institutions, these teachers helped their colleagues in the school learn what they were learning, which included early Internet structures and telecommunications, Gopher and telnet, as well as basic computer skills. A few phone lines were installed to give some teachers and the media center a modem connection to the Internet. In 1994, with the help of a grant, the media center acquired several computers and linked them in a small network. Then, using its technology-magnet program funds, the school acquired several computers for the science department, and teachers networked them for Internet access. The school hired a technology coordinator in 1995.

In 1997, the school became involved in a federal Technology Innovation Challenge Grant that its school district had received in 1995. This federal program, in effect from 1995 through 1999, was funded under the Elementary and Secondary Education Act of 1965 as amended, Title III, Part A, Subpart 2, Sections 3136–3137 (20 U.S.C. 6346–6847). It was administered by the U.S. Department of Education's Office of Educational Research and Improvement (U.S. Department of Education, 1999). The program awarded 5-year grants to a local education agency on behalf of a consortium for the purposes of improving and expanding new applications of technology in order to strengthen school reform, improve student learning, and provide sustained professional development of teachers, administrators, and school-library media personnel (U.S. Department of Education, 2001). The program supported and encouraged partnerships between school districts and businesses, community organizations, and educational researchers in implementing, evaluating, and documenting innovative applications of computer technologies (U.S. Department of Education, 1999). As a participant in the activities supported by its school district's Technology Innovation Challenge grant, West Coast Inner City received technology-focused training for several of its teachers, and some computer equipment and infrastructure. Shortly thereafter, the state initiated a state version of the federal Technology Innovation Challenge Grant program as a result of receiving a U.S. Technology Literacy grant. The federal

Technology Literacy funds awarded grants to states for teacher training, modern computers, connection to the information superhighway, and integration of software and on-line resources into curriculum (U.S. Department of Education, 1996). With the help of this second grant, the district extended the work of the first grant to include additional teachers and schools, and provided PowerBooks, computer projectors, and a SMART Board to West Coast Inner City. (A SMART Board allows computer icons and commands projected on it from the computer screen to be manipulated from its surface.) By the 1999–2000 school year, with additional help from a local referendum that provided infrastructure and a very recent state grant to West Coast Inner City that provided computers, every classroom at West Coast Inner City was connected to the Internet through the school district's Wide Area Network.

Students. The school's 1,600 students were divided almost equally among Hispanic (28.1%), African American (21%), Indochinese (20.7%), and White (20.4%) groups, with the remaining 10% made up of Asian (3.2%), Filipino (4.8%), Native American (1%), and Pacific Islander (0.8%) students. The families of many members of the diverse student body were part of the rapidly growing communities of new immigrants in the city. Approximately 30% of the students were designated as English Language Learners, and some of the new immigrants who came to the high school reportedly had never been to school before. About three quarters (74%) of the students qualified for free or reduced-price lunch. The student turnover rate (the proportion of students who change schools during the year) was reported to be 10–15%. About 8% of the school's students received special education services. Between 1993 and 1997, the school was reported to have reduced its student dropout rate from 11–12% to 3–4%. About 400–500 students were enrolled in the technology magnet program that the school provided within the district.

Computer configuration. All of the school's classrooms and instructional areas were Internet-connected—some as recently as a month or two before the interviews for the study took place. Teachers had at least one computer in their classrooms. Some teachers who had been involved in the district's grant projects had two or more (as many as eight) computers in their classrooms, all or most of which were Internet-connected, and some had a laptop computer for their own use, as well. Teachers who had not been involved in the earlier projects typically had only one computer in their classroom that had been provided by the very recent state grant. In addition, a scanner and a laser printer had been purchased for each classroom. A dozen computers were also available for teachers' use in a teacher workroom off the media center.

Students had access to the Internet on the computer(s) in their classrooms and in two central spaces—the media center, with 10 computers available to students, and a school-wide computer lab containing 30 computers. These two central facilities were typically open before school, during lunch, and after school for students' use. At the time of the study, however, the computer lab was not staffed, so it was unavailable to students unaccompanied by a teacher. The school also had a mobile cart containing 10 wireless Macintosh iBooks that teachers could schedule to bring into their classrooms for student use. Some classrooms had a significant number of computers for student use. The business education and technology education departments had had 30 or more computers in some classrooms for several years because software was central to their curriculum. In some of these classrooms, the computers were Internet-connected.

Macintosh computers predominated throughout the school, but PCs had been obtained for some spaces.

Technology plan and policies. The recent state grant application process required both a technology plan and a plan for evaluation that specified the increase in students' learning performance to be achieved. Getting all classrooms equipped with at least one Internet-connected, multimedia-capable computer, a laser printer, and a scanner was a goal, along with increasing the number of computers available to students in the media center. The school planned to purchase two additional carts containing 10 iBooks each, reflecting the priority they had come to place on these portable machines rather than desktop models, based on their experience with the one cart. The flexibility of the moving cart, the convenience of the wireless computers, and their durability, which reduced the need for repair, were all factors cited as prompting this plan.

Getting all teachers trained to operate the computer, use the Internet, and develop WebQuests (a model for Internet-integrated curriculum) was another goal. Beyond these major pieces, the plan included other equipment items that the school or specific programs needed. Some of these were computer-related, and some were video-related. Staff reported that teachers who used the technology that had been provided were given priority when further opportunities to acquire equipment and training arose. Subject-area priorities for integrating technology into instruction were reflected in the school's technology plan: English and science in year 1, social science and math in year 2, and all other subjects in year 3. Despite these priorities, individual teachers, more than subject matter, seemed to determine how quickly technology integration happened in their classes.

The school district had incorporated technology in its systems and work procedures to a point that required administrative staff to use it. This required use had built administrators' skills and comfort in using the Internet. The school district's student network-responsibility contract was signed by both students and their parents. Students did not have e-mail accounts, but district policy allowed them. The district maintained a filtering system to block students from inappropriate sites. The school technology staff had the ability to monitor students' locations on the Internet and take students off sites deemed inappropriate. The school's staff handbook clearly stated that students guilty of plagiarism, including the copying of computer accessed documents, would receive a zero grade on the assignment with no makeup allowed.

Technology-related personnel. Until 1995, teachers functioned as technology staff with no formal designation as such. Sometimes they were given a teaching assistant, but none of their own time was designated for the role. The technology coordinator hired by the school in 1995 provided technical support to both students and faculty, did the troubleshooting and installation on computer equipment related to grant projects, and had teacher training responsibilities. Before spring semester 2000, a college student-worker had supervised the school-wide computer lab and helped process students' acceptable-use policy forms, but had not been replaced after leaving the position. A steering committee composed primarily of teachers who had participated in the district grant projects helped the technology coordinator oversee the recent state grant project. This group also provided informal peer assistance to other teachers and responded to requests that came across the technology coordinator's desk. The district's technology personnel could be called on to deal with problems that could not be solved on site and to assist teachers with technology integration questions and problems. E-mail administration was also provided at the district level.

Curriculum. The school district required every student to take a computer literacy course in the middle school, so the high school did not require such a course. The school did provide such a course that met this graduation requirement, however, for students who came from other school districts. Since the computer literacy requirement had been instituted in the middle school, students coming to West Coast Inner City had more developed technology skills than in the past.

West Coast Inner City's approach to technology integration had a strong curricular orientation. The preferred approach to helping students develop computer skills was to make technology integral to instruction in all areas. Students were to be assigned content-driven projects that required them to use technology to create a product (e.g., Web page, multimedia presentation, video production). All seniors were required to do an exhibition of their work, preferably incorporating technology in the presentation or in the project itself. The roots of the school's curriculum-focused orientation toward use of the Internet seemed to be in the district's federal technology project, which reflected the belief that students should not be left to wander on the Internet on their own, but should receive specific guidance about where to go, what to do when they got there, and why it was worth doing. This project had produced a database of lessons in a range of subject areas that required students to use technology. Many of the lessons were interdisciplinary. This lesson repository was available to teachers for use in their teaching, and also provided examples to teachers interested in developing their own Web-based lessons. The lessons were designed according to a model aimed at ensuring a consistent level of quality and standards-based lessons.

The school's curriculum reflected the district's system of magnet programs and the state's provision for occupational training in high schools. These programs, part of the School-to-Career (vocational) program, received federal Carl Perkins money to support some aspects. Academic and technical subjects were integrated through team teaching and infusing English, math, and science into technical courses. Students in these vocational programs were encouraged to use e-mail to communicate with high-tech companies in the city that the school had partnerships with and to visit these companies. An exploratory magnet was offered for 9th-grade students. Advanced students developed occupational skills leading toward employment through both classroom and job experience. Full-time magnet students were able to meet graduation requirements and enter community college, university, and technical programs related to their magnet program focus area. Another occupational education program overlapped curricularly with the magnet program, but served students ages 16 to adult. The school's student handbook encouraged both students who were college-bound and those who were work-bound after high school to consider the courses offered through this state-funded program.

Professional development. Teachers' computer and Internet knowledge and skills varied widely. School technology staff had learned that it was not easy to accurately determine teachers' level of knowledge and skill through surveys because teachers' responses on such surveys did not reflect their true skill levels. Those with greater skill underestimated their capacities, and those with less skill overrated their abilities.

Beginning in 1997, the school's participation in the district's federal Technology Innovation Challenge Grant project provided the opportunity for 20% of West Coast Inner City's teachers to be trained in summer and school-year workshops by a university faculty member to develop Web-based curriculum modules according to a specific process and set of standards. These workshops were held at the university where the faculty member worked. Teachers were paid for summer training time, and received computer equipment to allow them to use what they had learned and created in their teaching. In this training, teachers learned how to make a good Web-based lesson in terms of instructional design, while also making it user-friendly. The teachers were exposed to Web-based curriculum modules developed by teachers in all disciplines, which inspired some teachers to collaborate in designing interdisciplinary modules. The curriculum modules that teachers were required to develop during this training were shared with all workshop participants and also placed on the school district's Web site as examples for other teachers to use and learn from. Some West Coast Inner City teachers participated in additional mentor training that was also offered through the federal project, which prepared them to help other teachers learn the Web-based curriculum module development process. With or without the mentor training, the pool of teachers trained through the federal project became a core faculty at West Coast Inner City for training other teachers.

The school's recent state grant required that all West Coast Inner City teachers be trained. The teacher training model used in the district's federal project was adopted as the basis for this training. With the help of its state grant, the school released all of its professional staff who had instruction-related roles from their responsibilities for 6 full days of the 1999–2000 school year in which 36 hours of computer, Internet, and technology-integration curriculum training was provided on a staggered schedule involving one sixth of the staff at a time. The training was provided by the technology coordinator, assisted by the teachers who had participated in the earlier federal project. A school district facility and a nearby college facility were used for this training. Staff were given about 2 weeks between training days to have time to process and experiment with what they had learned. The grant required that teachers, and ultimately students, learn six basic computer skills, including word processing, e-mail, Internet research and retrieval, using courseware, using spreadsheets, and electronic publishing. Part of the 36 hours of training was spent in having teachers from different departments work together to create interdisciplinary approaches to teaching and technology integration. The training materials from all six training sessions were posted on the school's Web site, as well as included in a notebook given to teachers. The curriculum modules that teachers developed were also placed on the school's Web site as examples from which other teachers could learn.

In addition to the grant-sponsored teacher training, the school district offered educational technology workshops and classes for teachers. Educational technology was also a component of the district's School to Career training, which sought to help all teachers think in terms of connections between their subjects and careers. This training involved teachers from all subject areas, not just vocational education teachers. The school district had also begun to institute a system of satellite transmission of professional development offerings to schools. West Coast Inner City was equipped with two-way technology and could receive these satellite transmissions, and teachers could interact directly with the instructors of these sessions or e-mail questions.

Sending its core of mentor teachers to instructional technology conferences was a goal of the school. Additional summer programs and institutes supported by private funds and the county education office helped teachers in West Coast Inner City's geographic region develop their technology understanding and skills. One of these required each teacher who participated to make a commitment to teach what they learned to 10 other teachers back at their school.

Technology integration strategies. As already discussed, this school's efforts to integrate technology were clearly curriculum-focused. The school combined the opportunities and resources it had available with new ones it was able to generate.

> *We've used several resources. We used funding sources of Title I funds. We are a magnet school. We used our magnet funds. We also used our general allocation funds. We combined those, and that provided us a lot of the support that we needed. The grants were the other major source of the funds that we needed.*

The state's willingness to use its surplus revenues in the late 1990s for upgrading and adding technology in the schools was an important benefit for West Coast Inner City. The school's faculty and technology staff also used resources made available by higher education institutions, including the Supercomputer Program, a university professor's model for Web-based curriculum development, and use of university and community-college computer facilities.

Another strategy was combining opportunities in a cumulative way so that one project and one staff-training effort built on another. The federal project had allowed technology staff to learn about what it takes for teachers to develop Web-based lessons—how much time, what kind of support—and how to plan workshops for teachers. This learning was then used with the state grant to expand and elaborate on what had been accomplished in the earlier federal project. West Coast Inner City's approach to technology integration was comprehensive. All staff with any instructional responsibilities were trained. Staff used technology as an avenue to broader educational reform, such as integration of curriculum in interdisciplinary approaches and changing ways of teaching toward more active learning on the part of students. Another strategy was "encourage, don't force." The federal project invited and encouraged participation by teachers. The state grant project provided substitutes, in effect requiring teachers to attend the training, but once there, teachers were encouraged, rather than required, to try things.

> *It took a lot of writing notes, and encouraging, and saying it's okay, and not forcing. That's the big thing, not saying, "You will go to this and you will do that," but just, "Well, why don't you try it?"*

Making training an opportunity to build colleagueship was a sixth strategy. The school-wide teacher training required by the state grant, as well as the federal project-sponsored training, allowed teachers from different curricular areas to get to know each other, to work together, to develop familiarity, and to discover common interests. By grouping together people who didn't know each other, and by having teachers spend significant parts of each training session working with members of other departments, the training laid groundwork for subsequent collaboration among staff. Helping staff change mind-sets and see new possibilities was a strategy in constant use. This process went on over time. It was embedded in the day-to-day decisions that were made and the conversations about them. Over time and with experience in facing challenges, new insights emerged:

> *You kind of have to break them out of that and then they find new ways to do things and start thinking a different way. . . . just the little things that they feel they have to do, and they can't do, and they have to find another solution. Then they realize, "Well, maybe I don't have to have this printed, and so if I don't have to have it printed, maybe I don't have to have them write a paper. Maybe they can do a poster; maybe they can do a Web page."*

A strategy that was used to get teachers involved in the federal project was to focus on teachers' interest in curriculum development and training, not on hardware. Teachers' commitments to participate in the training were obtained before it was revealed that they would be able to have a computer, as well. This helped to assure that teachers were interested in what they were going to be able to learn, not just in having a new piece of hardware. Finally, providing teachers with 6 full days of training for which a substitute was provided and the schedule of interspersing 2 weeks between training days allowed time for staff to learn, to experiment with and practice new learning, to begin to integrate it into their practice, and to generate questions regarding it.

Midwest Rural

This consolidated pre-K–12 school district was located near a small rural village in a midwestern agricultural area. The school district was formed in 1989 during a crisis that included a threat by the state to close the village's newly constructed school due to low student achievement. A new superintendent oversaw the consolidation and brought the belief that technology integration could spur effective teaching and student achievement. A profitable company located in the district generated resources that aided the development of this technology-infused school. After starting with some Radio Shack and Apple II computers, the school district got its first network in the early 1990s, and has had access to the Internet since about 1993. Acquisition in the mid-'90s of newer equipment and wiring to accommodate higher speed data transmission encouraged some teachers to create Web pages and Web-based instruction beginning in 1996. By 1997, the school had access to a T1 line for Internet and compressed video classrooms, and a student-to-computer ratio of 2:1—the lowest student-to-computer ratio of all the schools studied. Midwest Rural was one of six school districts in the state involved in a consortium that in 1997 received a federal Title III Technology Innovation Challenge Grant. As technology-based economic opportunities for students rose and exceeded the number of students who could fill them, community members took notice, and community attitudes were reported to have evolved from the view that the children's futures were to remain at home and care for family members, to support for education that might lead children away from home. As student achievement improved over the years, the crisis between the school and the state abated.

Students. The high school student body in grades 9–12 numbered approximately 100 students—47% Native American and 53% Caucasian. Half of the high school students (49%) were eligible for free or reduced-price lunch. The graduating class each year numbered between 20 and 25 students. Between 1989 and 1999, the proportion of graduating seniors who enrolled in post-high-school education grew from 33% to 95%, perhaps reflecting the changed attitudes toward children's futures mentioned above.

Computer configuration. The school district's goal was to implement a distributed-computer-configuration model throughout the school building, with several Internet-connected computers located in each classroom, grades pre–K through 12. Consequently, teachers and students had access to the Internet on four or five computers located in each classroom. One computer per classroom was the teacher's.

A 100-megabit switched environment with superservers was in place at the time of the study, in the spring of 2000. The school was exploring the possibility of an arrangement with a nearby community college that could provide wireless access to the Internet. That college was one of 42 hub sites in a statewide telecommunications and information network system providing high-speed communications to public schools, postsecondary education institutions, public libraries, government and court systems, the health care system, and research programs. This network, which used fiber optics and wireless technologies to transmit video, voice, and data, was the result of a partnership between the state and private telecommunications companies, and allowed negotiation of reduced rates and use of established, private communications networks.

Two building additions included computer lab space to supplement the distribution of computers in each classroom. One computer lab contained 16 iMacs; another contained 25 Gateway PCs. Another classroom, in which computer applications was taught, had 20 Gateway computers. To address the issue of students' lack of home access to a computer and the Internet, the school board decided to purchase iBook laptops for the freshman class during the 1999–2000 school year. These laptop computers were assigned individually to students for the academic year with the intention that the students would take them home and bring them to school each day. Based on this experience, iBooks were purchased for all high school students in the 2000–2001 academic year. This was a major step in the school's plan to move toward a wireless environment. A few teachers also were assigned an iBook laptop, and for other teachers, the school had laptops that could be checked out during the year and for the summer.

Because several computers were available to students in each classroom and in computer labs, the school library had no more computers than the classrooms, and was not used as a facility for providing computer access to large groups of students. The library was reported to have reduced its collection of books and other print materials for high school students as students' use of the Internet for obtaining information had increased. The library's holdings were maintained on a file server and networked to all computers in the school. A separate media center housed a radio broadcast studio, several video cameras, and video editing and production equipment that students and teachers used for video work related to Web-page and Web-site development.

Technology plan and policies. It was reported that since 1990, Midwest Rural had earmarked an average of $200,000 per year in the school district budget for technology. The school had benefited from the federal E-rate monies made available to schools (based on a school's level of eligibility in the federal free and reduced-price lunch program) and libraries by the Telecommunications Act of 1996, to help ease the cost of telecommunications services and equipment (Puma, Chaplin, & Pape, 2000). Through this program, Midwest Rural was eligible for a discount of 80% on Internet access and other telecommunications services. Since the school's telecommunications network was already developed before the E-rate opportunity became available, the school was able to use its E-rate money to upgrade, replace, and further develop components of its network.

Participation in the E-rate discount program required participating schools to have a technology plan, including a vision of technology integration into the curriculum, a mission in which technology played a role, an inventory of technology resources, descriptions of how the school would use technology to support student learning and how staff development would be supported to enable staff to use technology effectively, and a plan to assess the impact of using technology. In Midwest Rural's plans and policies, staff described the school's approach to technology as student-need-driven, which translated into software- and application-driven. The school's decision-making process was described as choosing curriculum and software first, and then choosing hardware.

High school students were provided with e-mail accounts. Students' messages were monitored, which school staff believed was necessary. Technology staff also used a monitoring system to check the computer screens of users and close down a user's computer if an inappropriate site was discovered. In addition to the monitoring system, the school had recently installed a filtering system to prevent students from accessing inappropriate sites in response to a case of inappropriate use by a student.

Midwest Rural's computers were cleaned, and some were upgraded, each summer. Old computers that lacked the capacity needed for the school's uses were sold at auction every 2 or 3 years. The school made the Internet accessible to the community by allowing community members to establish dial-up access accounts that enabled them to dial in to the school's servers 24 hours a day, 7 days a week. Community members, as well as students and staff, could use the library's computer workstations.

Technology-related personnel. Two full-time technology coordinators provided technical and curricular support, network maintenance, and teacher training. One, an information systems director with a background in computer-related businesses, had primary responsibility for the network and related systems. The other, a director of technology, provided the bulk of curriculum-related assistance to teachers and students. This individual was a former teacher whose interest and skill development in computer technologies led to a career-role change. In addition to assisting teachers and students, these individuals also helped community members experiencing computer problems. The technology coordinators were housed in the media center and supervised this facility. They did all the computer cleaning, repair, and upgrading, with the help of several students who had received training in the needed procedures. The two technology coordinator positions in relation to the number of students and teachers gave Midwest Rural the highest ratio of technology staff to teachers and students of the five schools studied.

A school committee made software purchase recommendations. The school board had recently formed an Internet Committee comprised of community members, as a result of the incident of inappropriate use mentioned above.

Curriculum. Midwest Rural's 4-year high school curriculum included agriculture, art, business, computer applications, English, family living and home economics, foreign language, math, media production, music, physical education and health, science, social studies, and technology education. A district-wide gifted program was provided, as was a special education program. During high school, students had to take a minimum of 14 required units, one of which was computers. Students took the basic computer applications class that met this requirement during their freshman or sophomore year. Those with sufficient skills could take a more advanced course instead. At the time of the interviews, a networking certification program was being considered as a possible future offering. Offering such a program to community members through community education was also seen as a potential direction for the school.

The school had technology goals for students at all grade levels and for staff. The goals focused on integrating technology learning throughout students' curricula and using technology in learning course content. Midwest Rural assessed its students' computer literacy through observing their ability to meet these classroom requirements, and through surveys and tests. Science curriculum was placed on students' iBook laptops, and had replaced the use of textbooks in some science subjects. Students were expected to submit assignments via computer transfer in a number of their classes. Students in several classes posted their work on the Web, and students were involved in creating Web sites for the school's student clubs.

The school's successful grant writing had expanded curriculum opportunities for students. A careers grant provided staff who worked with students in career and high school and post-high-school education planning. Other grants had provided special technology-focused opportunities for gifted and talented students, including a computer lab for use by these students. The Technology Innovation Challenge Grant that the school and its consortium of partners received provided an opportunity to create technology-based curriculum to help students develop skills included in the state's academic standards.

The school's long-term technology emphasis affected student responses on state standardized tests. It was reported that most of the school's students did poorly in one language arts section of a test that contained questions on the card catalog in the library. Midwest Rural students had been accustomed to doing on-line library searches, and many had not used a card catalog. This led the school to set up a traditional card catalog in the library to help familiarize students with what they were being held accountable for knowing on the standardized test.

The school had an interactive television classroom, which gave it the potential to expand curriculum available to students by bringing in courses from other schools. The school also used this classroom to allow students from other schools to take classes taught by Midwest Rural teachers, and to bring college courses to community members and Midwest Rural students who were eligible to enroll. Adult community education classes were offered that used the school's computer facilities to instruct community members in basic computer operation and software package use. These classes were typically taught by school staff members.

Professional development. For almost a decade, Midwest Rural sent students home at noon on Fridays so that every Friday afternoon could be devoted to teacher training, which mostly focused on the use of technology. Special permission had been requested from the state for this release of classes. The school's provision of teacher training every Friday afternoon came about as a result of inquiries by administrators into why teachers were not using the technology the school made available to them. Teachers responded that their teaching role left them little time for learning to use the new technologies, and that they would need more than "learning on their own" opportunities. The technology coordinators conducted much of the training, but teachers who had developed expertise in using various technologies also provided teacher training during these sessions. In addition, a considerable amount of teacher training was done on a one-to-one basis, and the school made books, magazines, software program manuals, and training videotapes available for teachers to use on their own. The school also encouraged teachers to use the technology training and information available at several Web sites.

The school had identified a detailed listing of six levels of teacher technology competency goals and, at the time of the interviews, plans were being implemented for including technology competencies into the criteria for teacher evaluation. The technology competency criteria were framed in terms of what teachers should be able to do and help their students learn to do, and included use of software programs, the Internet, video and computer-related equipment, electronic grading and attendance systems, and incorporation of Web-based resources and processes in teaching. Midwest Rural staff members self-evaluated their technology skills at the beginning of the school year and had the opportunity to develop those they felt were lacking during the Friday training sessions.

The school also provided technology training for staff in other schools, who also often came to observe Midwest Rural's use of technology. The school's interactive television classroom also enabled Midwest Rural teachers and those from surrounding schools to enroll in college classes for continuing education, or to pursue a graduate degree. Colleges sometimes brought their staff and student teachers to observe the use of technology at Midwest Rural:

> *I don't know what college it was but all* [the] *instructors came in and they pulled* [up] *in a Greyhound bus. And then the state university brings all their student teachers up here during the year. They'll pop in and observe us.*

Technology integration strategies. The school staff was deliberate and strategic in its approach to accomplishing technology integration. The general strategy was described as (a) making sure that teachers have equipment, (b) giving them a reason and a need to use it, (c) providing training so they know how to use it, and (d) recognizing and rewarding their efforts.

The school district had obtained grant-writing services through a county-based organization in order to seek additional resources for implementing its technology vision and these strategies. It had been successful in obtaining both state and federal grants totaling about $5 million.

Computerizing the attendance and grading systems—systems that teachers must use every day in doing their work—gave teachers reasons to use computers. Requiring teachers to check their e-mail three times a day and use it for communication purposes provided more reasons. Putting school policies and the school calendar on line necessitated use of the school's network. Since teachers needed to know how to use computers in order to use these systems and find information they needed, they attended training. Making training part of the school day assured teachers' participation, and gave them time to integrate their learning into their teaching and curriculum. Adding technology use to the teacher-evaluation system was also seen as encouraging teachers' technology use and participation in training. To recognize and reward teachers' efforts, teachers were encouraged to present their technology integration work at state and national conferences. The school provided substitutes, paid teachers' travel and conference expenses, and paid teachers a stipend of $200 for a state presentation and $300 for a national presentation, in recognition of the time and effort these activities required. Students, too, were recognized for their technology accomplishments; they were invited to demonstrate their work for groups touring the school, at technology conferences, and at state legislative hearings on technology in the schools, some of which were televised.

Other strategies the school pursued included hiring teachers who were open to learning to use technology, and connecting them with a technology-using veteran teacher as a mentor. As teachers developed their technological expertise, some taught courses at nearby colleges and some moved into technology-oriented jobs in higher education. The school leadership took a positive view of this pattern and focused on the good service these teachers had given during their years at Midwest Rural, where they had received the training that prepared them for such opportunities.

Furthermore, Midwest Rural sought to foster a technology-friendly environment in the region and the state. The school's efforts to inform the community about technology, provide access to technology for community members, and train community members to use computer technology were strategies that addressed this goal. In addition, whenever possible, the school provided training to other school districts that requested it and hosted tours for regional, collegiate, state, national, and even international groups. Hosting statewide conferences that involved school personnel from across the state, state-level education personnel, and legislators, and establishing a statewide technology administrators group were other strategies that supported this goal. Finally, school staff participated in national policy efforts designed to influence technology integration in the schools and maintain its funding.

West Coast Community

This high school facility, built in 1966, was the only comprehensive high school in its school district. Located in a midsize college town, but close enough to one of the largest population centers in the United States to almost be considered a suburb, the community was characterized by a degree of diversity in its population and above-average per-capita income. More than three quarters of community members 25 years and older had completed at least some college. The school enjoyed the community's respect for education and contributions of energy, time, and funds. The community was perceived as technologically astute and interested, and as having the means for getting involved in technology. The school district owned and operated a private broadband data network using infrastructure donated by a local television station, which saved more than $13,000 in recurring telecommunications costs per year. In return, the school provided the television station with a national test bed for broadband cable technologies. The school maintained Web pages for various community and school-related groups and functions. School staff made their expertise in areas such as network design and Web page development available to parents and community groups, and high school faculty members also taught a computer skills course for adults in the community. The school provided consulting services and advice to surrounding school districts, and maintained guest network access accounts for their faculties.

The school had been recognized for excellence at both state and federal levels. The school ranked 9th in the state's system of high school rankings based on academic criteria. It had received an Excellence in Education Award from the U.S. Office of Education as a National Exemplary School, and had received the Blue Ribbon School designation from the U.S. Department of Education (Office of Educational Research and Improvement, 2000). It had also been given a high ranking in *Newsweek* magazine's Advanced Placement poll.

The school's governance structure was site-based management. A school site council worked with school staff to develop a school plan (which specified how the school intended to meet student needs), update it annually, make decisions about school improvement, and coordinate the work of other governance groups. The school site council also approved departments' curriculum integration plans (which indicated how technology would be integrated into the curriculum). This coordinated governance structure incorporated technology decisions into the overall decision making of the school and brought specific attention to technology issues, plans, and initiatives. The council, composed of staff, students, and parents, had supported using a considerable portion of the school's state funds for technology. The district's technology staff had created further opportunities for the school to develop its technology through grant writing. The school's current administrators included individuals well-versed in computers; one had been using computers since 1982, and another had worked for IBM.

The school's involvement in computer education had more than a 20-year history. Its first computer efforts were "assemble your own" computers constructed from kits by faculty and students in science classes in the 1970s. These early computers were used to teach computer science and programming. Computer education soon moved beyond the science department, when learning computer skills was made a requirement for all students at the school. Even with 25 or 30 computers at the school, this graduation requirement for 400 seniors was a challenge to implement. In the mid-1980s, a state-sponsored occupational program enabled the school to acquire more computers and expand its curriculum in computer science. By this time, the school had also added more faculty who were knowledgeable about computers from experience in business and industry, or who were curious and self-taught. These faculty taught science, math, and English. A few years later, the original computer lab with the computers built by students and faculty was replaced by a Macintosh lab, and in 1989, the English department received funding to put in a computer lab for teaching writing courses.

As time went on, the school placed the computer course required for graduation earlier in the high school curriculum, and finally the district moved it to the intermediate school. In the early 1990s, West Coast Community became involved with the National Science Foundation's Supercomputer Project for Educators. This led to a cooperative arrangement with the community's colleges for Internet access. A new teacher workroom created in 1992 made networked computers available for teachers' use and exploration. During the same year, the school received a state grant that allowed science classrooms to be equipped with computers and networked. As a result of these efforts, other instructional departments became interested in obtaining equipment and network connectivity. The school used state funds to respond to these requests. The site council, who reviewed, approved, and coordinated plans for expenditure of these funds, helped to coordinate the school's technology acquisitions. Departments were encouraged to develop long-range, comprehensive, multiyear projects and to write proposals for use of these funds.

In 1993, the school provided dial-up access to its network from home for students and faculty. The school initiated a Web server in 1994, which was reported to have been the first K–12 education Web server in the state, and the fourth such server in the United States. In subsequent years, the network was expanded to every classroom, three computer labs, and the library/media center with the school's state funds, state-sponsored occupational program funds, and Carl Perkins funds. Foundations also contributed some funds for computers and related purchases, and parents and local businesses donated money and computers they were discarding. The school had staff with the technological skill to upgrade or rebuild donated computers. This expertise had helped the school to get maximum benefit from its technology investments and the donations it received. Equipment and infrastructure had been pieced together so that older equipment and wiring remained useful beyond its average life.

By 1997, the school had connected all of its rooms to the network, and most classrooms contained at least one computer. More than 200 computers in the school provided access to the Internet. Both T1 lines and broadband connections were being used. West Coast Community was the district's server resources center, and functioned as the gateway to network connectivity for the other schools in the district.

A state grant awarded in 1998 gave the school the opportunity to move from its refurbished computers to state-of-the-art computer and Internet technology. This 4-year state grant program provided funds for technology infrastructure, equipment, curriculum resources, and teacher training to one fourth of the state's schools each year, and ongoing funding in subsequent years for technology support, continuing staff training, and maintenance and upgrading of systems.

Students. Four major groups were represented in the school's student body: 57% White, 17% Hispanic, 12% Asian, and 10% African American. English Language Learners constituted approximately 7% of the student population. About 14% of the student body was eligible for free or reduced-price lunch. A dropout rate of 0.4% was reported for 1998–99. More than 500 (a little more than one fifth) of West Coast Community's 2,213 students participated in vocationally centered course work, which led to careers or post-high-school education at colleges or technical schools. Approximately 85% of its students attended 2- or 4-year colleges upon graduation. Students' academic performance was described as above average, with SAT scores ranging from 19 to 48 points above state and national averages.

From teachers' perspectives, students' technology skills had become increasingly varied as the computer skills graduation requirement had been moved out of the high school and into earlier grades in the district's curriculum. Students at the school had access to the Internet in some of their classrooms on one or more computers, and in the library/media center. Depending on the courses in which they were enrolled, they might also have access in three other computer labs—one in business education, one used by the yearbook and school newspaper staffs, and one used in occupational program courses.

Computer configuration. The 1998 state grant provided the school with an opportunity to refurbish its technology. By the spring of 2000, the infrastructure had been upgraded throughout much of the school, including replacing the old underground wiring that had been in place since the early days of the school's network. A Local Area Network composed of gigabit fiber-optic connections to dedicated, switched 10/100 megabit Ethernet service had been installed in every room at the school. The school's broadband connection made Internet connectivity fast in areas where it had been installed and that had newer computers. Access was slow in areas that still did not have broadband and that had older equipment.

The student-to-computer ratio at the school was reported to be about five- or six-to-one. All classrooms were reported to have computer access and Internet connectivity. Some classrooms had more than one computer. These multicomputer classrooms ranged from rooms with 2 computers to 15 or so, and were located in various departments. Not all of the computers in multicomputer classrooms were necessarily Internet-capable or connected to the Internet, although more than 350 computers on campus were reported to be directly connected to the Internet. Computer purchases and Internet connectivity of instructional spaces were ongoing during the 1999–2000 academic year and were scheduled to continue during the 2000–2001 academic year. Several laptop computers were available for teachers to sign out. The school had a SMART Board and two projectors that teachers could check out from the library/media center.

The 1998 state grant had been used to equip a school-wide computer lab in the library/media center with 25 new networked iMacs. These new computers were placed in a special space so that classes in which all students needed to use a computer station could be scheduled in the space. The library/media center was open before school, at lunchtime, and after school to allow student and teacher access on an individual basis. A second computer lab with 33 Macintosh computers had been created 2 years earlier with computers described as "cast-offs." This lab was used intensively by students working on the yearbook and the school's on-line student newspaper. A third computer lab, the business education lab, was also about 2 years old, and was equipped with about 35 PCs. The school's fourth computer lab was provided by the state-sponsored occupational program, which offered computer technician and applications courses during the day to high school students and adults. Only the library/media center lab was available for use by programs throughout the school.

Technology plan and policies. The school district had an educational technology master plan for 1996–2001 on file. Provisions of the district's master plan were evident throughout West Coast Community's own technology plans, technology committee structure, and technology personnel structure.

The school's 1998 state grant application stated that an objective of the school was to *"change the tone of our institutional culture from being tentative in its regard of technology to one where technology is integral."* To achieve this goal, the school was using the grant money in three major areas. First, updating and expanding infrastructure to make a high-speed network available to every classroom, office, and public space was a priority. A *"fiber optic backbone with multiple, switched Ethernet for data drops, combined with cable television and closed-circuit video capacity for every classroom and public space on campus"* was planned. Second, staff development was a primary goal. The project plan was to provide training to all faculty and staff in both the use of technology and its integration in the classroom and day-to-day work. The third focus was providing equipment where it was still needed—in some classrooms and for student workstation clusters in a few classrooms. School staff believed that these developments, along with what the school had already been doing for students in its technology efforts and other areas, would continue to give its students a competitive edge in their future pursuits.

All faculty and students were provided with free dial-up access to the Internet from home, a free e-mail account, and server space to establish Web pages if they wanted them. Students and faculty had on-line access to the library that served the local colleges. Students were required to obtain parental permission to use the Internet at school. Policies for student use of the Internet outlined two principles that governed inappropriate use: (a) deliberate damage or modification of hardware or software on the school district network or the Internet or the operations of either, and (b) sending threatening, defamatory, or inappropriate messages on the Internet or the network. The school maintained a filter system, which blocked entry to certain sites. Students and faculty who used the school's dial-up access from home encountered the filter when they attempted to go to Web sites that it blocked. It was reported that this discouraged some students from using a school dial-up account. In addition, some parents did not want their children to have Internet access at home. It was also reported that many students had not elected to have a school e-mail account because they already had their own account through the Internet service their family had purchased at home.

Technology-related personnel. The school district's philosophy was to make teachers self-sufficient in dealing with computer problems that arose in their work. Consequently, no full-time technology staff were employed at the school level. District-level technology staff included a technology director who managed the district's professional development programs and resources, and a systems administrator/network manager, who was located at West Coast

Community where the district's servers were housed. The district had discontinued its repair technician staff several years earlier, when budgets became especially tight and it was learned that these resources were not always used efficiently. Since then, each school had been given a repair budget for hiring computer technicians outside the district to do repairs and solve problems that could not be handled by the school's technology coordinator. This strategy was intended to avoid having to pay unnecessarily for simple problems that could easily be resolved by someone with a little computer knowledge and good troubleshooting skills. But perhaps more important than these practical considerations was the view that school staff could learn, and that they would be better off and more likely to integrate technology if they could handle their own problems.

Each school had a technology coordinator—typically a teacher who was not given release time nor compensated monetarily. The high school, West Coast Community, where the 1998 state grant paid a partial salary and stipends for the teachers who shared this role, was an exception. The grant provided funds for a teacher to be a part-time technology staff development coordinator, and for a teacher in each department to be a technology integration leader (TIL). As already mentioned, the district's full-time systems administrator/network manager (a former teacher) was located at the high school. The role of technology coordinator at the high school was shared to some extent by all of these individuals, although the TILs were the first-line personnel. Responsibilities of the 10 TILs were to work in a mentoring capacity with teachers in their departments in developing curriculum integration projects, maintain and update faculty technology proficiency data for their departments, maintain computer hardware, do technical troubleshooting, and provide technical support and teacher training. The TILs also served on the high school's educational technology committee and met regularly as a group with the technology staff development coordinator. Instead of release time from teaching, TILs were paid a stipend. The TILs had found that teachers called on them to provide basic computer troubleshooting and informal computer, Internet, and software skills instruction. The faculty had come to depend on them to fix hardware and software problems and do tasks that the TILs wanted faculty to assume for themselves, so that the curriculum projects they had hoped to encourage received less attention. The development of student technology leaders was just beginning in the spring of 2000.

The school librarian and 3.5 full-time-equivalent assistants also helped faculty and students in using computers and the Internet. One of the assistants provided computer technician functions in the library/media center. An educational technology committee reviewed departmental curriculum-integration project plans and the design and implementation of staff training, and coordinated acquisition, placement, and repair of equipment. Faculty and staff had to submit a proposal for how an item of equipment would be used when they made equipment requests. The technology committee made recommendations to the site council regarding these proposals.

Curriculum. West Coast Community's curriculum reflected its college orientation. Graduation requirements included earning 220 credits (in the school's crediting system, the equivalent of 8 semesters of work) over 4 years in English, social science, mathematics, science, physical education, visual and performing arts and/or foreign language, public health and safety, and computer education. In addition, students were required to pass the school district's proficiency examination in reading comprehension, writing, and computation skills. Students identified as college preparatory were expected to earn 240 credits. The school offered honors courses and advanced placement courses.

The school had a plan to offer students the opportunity to "major" in an area of study to a depth helpful in their postsecondary educational pursuits and career endeavors. Students who completed such a major would receive a certificate of mastery. The first major to be offered was planned for fall of 2000, and was to focus on fine arts (the school indicated that its theater program was one of the best in the state). Future majors being considered included technology, technical studies, and business and marketing. The technical and applied studies department offered a career exploration summer course for freshmen and sophomores that focused on six career pathways. An enrichment-oriented summer school enrolled 1,600 students and employed 30 teachers.

The school's learning goals included technology-focused expectations for students. The school offered a course that met the computer-education graduation requirement, but students could also satisfy the requirement by completing an examination of their computer-related skills and understanding. This course and one other—a computer applications/operations/desktop publishing course—were available to all West Coast Community students. Other department-based, computer-focused courses were also available. A computer mathematics course was offered by the mathematics department. The science department offered several computer-related courses, including computer modeling and simulations, programming, electronics, and two computer science courses. A community college that served the West Coast Community geographic area offered a computer science course and a programming course at the high school, as well. The visual and performing arts department offered a computer graphics course and an animation course. The technical and applied studies department, which offered business education, consumer and family studies, industrial and technology education, and a work-experience program, offered a keyboarding course. Computer technology was also addressed in the industrial and technology education core courses. A computer applications course was also offered within the state-sponsored occupational program that served students over 16 years of age and adults. This program offered several other courses focused on computers at other locations, including computer graphics printing, computer technician, two networking courses offered in a cooperative arrangement with Cisco, and office technology/word processing/desktop publishing. These Cisco Academy courses were applicable toward networking certification.

Professional development. The school had surveyed faculty in each department to determine each department's profile of technology skill levels in seven areas identified in the 1998 state grant application as essential for students, teachers, administrators, and support staff to gain proficiency:

1. Information literacy, including the Internet as a curricular resource

2. Word processing, including writing and publishing tools

3. Spreadsheets, including grade-keeping applications

4. Video skills, including camcorders, editing fundamentals, and closed-circuit television
5. Presentation software and hardware
6. Multimedia skills, including authoring systems and CD-archived portfolios
7. Telecommunications skills, including e-mail, public file-posting, and home-office communications skills

The department skill-profiles were used as a basis for planning professional development opportunities. A rating system identified skill levels as none, emerging, proficient, and expert. Staff were described as being at all levels. In 1998, when the state grant application was submitted, one fifth of the faculty were rated as having no technology skills, almost half as emerging, one fifth as proficient, and less than one seventh as expert. A menu of staff development workshops was provided by the school that included different levels of training to accommodate the variation in skill levels of staff. Teachers signed up for what they wanted to learn within their proficiency level and were required to participate. The workshops were offered during the 2 hours made available by a scheduled delay in the start time of the school day. Anticipated staff development days had not materialized because of a policy change at the state level regarding school schedules that reduced the time available for staff development. Because of this change, the school provided only three or four of the late-class-start days (a total of 6–8 hours of training) during the 1999–2000 academic year. The workshops were taught primarily by the TILs. Beyond the school's efforts, the district also offered technology-based training for teachers. These workshops were optional, and were available after school and on Saturdays.

Technology staff had noticed that staff levels on the technology skills survey had declined by one point since the school had been involved in the 1998 state grant project. As other schools also noted, self-reporting technology skills surveys seemed to yield distorted data because staff with minimal knowledge tended to overrate their knowledge, and those with considerable knowledge underrated their knowledge. As staff learned about technology, they may have been able to assess their level of knowledge more accurately, and thus the drop in scores may have reflected more accurate self-assessment rather than a decline in knowledge.

The TILs received training as part of the 1998 state grant to prepare them for their role. Some of the training was done at the high school, and some was off-campus, including attendance at conferences and workshops. These teachers also drew on informal help for learning. They mentioned having taught themselves with the help of colleagues at the school or elsewhere, and with on-line resources and books.

Technology integration strategies. Not all teachers were using the Internet, or even computer technology in general. Technology staff employed a number of strategies to lead teachers toward technology integration. These included providing access to technology, encouraging rather than mandating technology use, supplying a vision of possibilities, requiring teachers to submit proposals for curriculum projects in order to get new equipment, developing teachers' self-sufficiency, and exposing teachers to a limited number of resources at a time. The strategy of making computers and the Internet available to teachers was reflected in the school's continual efforts to acquire computer equipment and provide network connectivity with school funds, donations, and grant writing. Once teachers had access, however, they needed to be encouraged to use the technology available to them. Technology staff indicated that they felt it was important to obtain teacher "buy-in" to technology integration in the curriculum—that encouragement was the only reasonable strategy for getting faculty to begin to use computers and integrate technology in their classrooms. Making e-mail and a grading program available had been important inducements, as had pointing out how teachers could do what they wanted to do better with the Internet or other computer technologies. One staff member maintained a bare-bones Web site as a way of showing that a Web site doesn't have to be elaborate or complicated.

Technology staff did not see teachers' integration of the Internet happening very easily, however, without providing better ways of getting teachers involved. Incentives, compensation, and other rewards were perceived as critical to encouraging teacher involvement, as was time and space in teachers' schedules. The 1998 state grant had funds built in to reward teachers who moved to a higher technology proficiency level, including software and small hardware devices like Zip drives and computer speakers. The staff's frustration with the reality of adding more to their already-full plates of responsibilities was evident. Creating space for teachers to do the learning and lesson development that technology integration requires was identified as a need that was, as yet, unfulfilled at West Coast Community, and its absence was a serious barrier to technology integration.

Southeast Suburban

This school was situated in a suburban community in a rapidly growing southeastern U.S. metropolitan area. Southeast Suburban was one of 15 high schools in one of the largest school districts in the United States. Built in 1973, the school was surrounded by shopping areas and business-lined roads. A major renovation of the school building was being initiated at the time of the interviews.

Earlier in the school district's history, parents had been concerned that it was not performing as they expected. In 1989, with a new administrative team in place, the school addressed these quality issues in several ways. The school moved to site-based management, in which decision-making was shared among administrators and staff through a committee structure. It also began to examine its performance data in more detail so that areas in need of attention could be identified. More emphasis was placed on evaluation and teacher development. These and other changes made a difference. In 1994, 98% of the school's students passed a new state high-school-exit exam, and the school received state recognition as a School of Excellence and national recognition as a Blue Ribbon School of Excellence (Office of Educational Research and Improvement, 2000). In 1998, the school was identified within the state as an exemplary school. Students' average SAT scores had risen 21 points in 7 years.

Over the years, the school was reported to have been involved in pilot projects the school district and others wanted to try out, reflecting the staff's willingness to try new approaches. This stance was seen as contributing to the school's ability to develop partnerships in the community, which were reported to be influencing the school's curriculum:

> *We are actually responding to employers' requests for the kinds of students they want to see coming out of our schools. . . . We collaborate with businesses. . . . We have banks, consulting firms, and environmental firms that are our partners in education. We have students on a work program, we have students who are in an apprenticeship program, and we have an ongoing dialogue with employers who say these are the skills, these are the employability skills that we want. So we listen to what employers want in the skills of students leaving high school and entering the job market, and we're trying to respond to those employability skills.*

This desire among the staff striving to keep up with, and be knowledgeable about, new developments drove the school's technology integration efforts. A grant received in 1996 paid for installing the school's first Internet line (the first in the school district) and Internet computer lab. This was a gifted-program Internet lab obtained with state lottery money funneled through the state's gifted student program. Internet classes were first taught to gifted students in this lab in 1996, and this lab was also where the school's teachers received their first Internet-related training. Because interest in technology was reflected by the community, parents, and the school district, however, much of the money used to purchase the school's computer equipment since then came from community taxpayers:

> *This community expects technology. They expect innovation. It's expected of us, because that's what they're getting at home. That's what they're getting in the middle and elementary schools. Unless we can keep up with that, we're going to have a very upset community.*

Support also came from the PTA, which had purchased needed equipment for the high school in exchange for services it needed that school staff and students' technology skills could provide. The school was also occasionally offered donations of equipment being discarded by individuals and organizations in the community; while the gestures were appreciated, these offers were problematic if the equipment was not usable.

School staff spoke of the effect they felt that their initiatives in technology and other areas had on changing the community's perception of the school. Staff viewed the school as moving from being *"a school that didn't always enjoy such a favorable reputation"* to one that was recognized for its accomplishments. The school was in its 2nd year of offering classes to senior citizens on computer technologies, taught by students with technological expertise:

> *We bring in groups of no more than 12. They come for 4-week sessions and stay about an hour and a half. And they learn Internet research. We teach them how to produce letters with Publisher, and little flyers and cards, and they really enjoy it. Most of the students have enjoyed it a lot. . . . It's an opportunity for our kids. . . . It doesn't cost the seniors anything to do it; it doesn't cost us anything to provide it. . . . It's been a wonderful venue for intergenerational communication.*

This connection had familiarized senior citizens with the school, and had stimulated their interest in other aspects of the school.

The state also provided special funds for technology in schools. It had allocated a portion of its lottery proceeds to a fund earmarked for technology in the state's schools. It had created on-line networks of learning resources that were available to schools, and made technology training a requirement for recertification of teachers. With the help of Federal Universal Services Fund E-rate monies (Puma et al., 2000), the state had established a two-way interactive video distance delivery network of state resources. Southeast Suburban had a network lab that was capable of receiving distance courses. Several school staff members mentioned that these state initiatives had made it easier for the school to acquire needed computers and infrastructure.

In addition to school district and state funds, Southeast Suburban's faculty and staff had pursued additional opportunities to enhance technology integration at the school by successfully applying for a federal Technology Innovation Challenge Grant with other schools, through participating in a grant under this program received by the school district, and by using products resulting from such grants received by other schools across the country (U.S. Department of Education, 1999, 2001). This school's and its consortium partners' $6.5 million Technology Innovation Challenge Grant, in progress at the time of the interviews in May 2000, involved Southeast Suburban teachers and teachers from schools in four other states in developing and distributing on-line educational resources aligned with state and national standards. The school district's Technology Innovation Challenge Grant also involved Southeast Suburban teachers in developing technology-based curriculum. The two Technology Innovation Challenge Grant products that Southeast Suburban was using included the Virtual High School and Generation WHY. The Virtual High School provides on-line distance courses to high school students across the United States for the purposes of curricular enrichment and access (Hudson Public Schools & Concord Consortium, 1999). Generation WHY involves training students to be technology mentors to teachers (Generation YES, Inc., 2000; Olympia School District, n.d). In addition, Southeast Suburban had been awarded a Vocational Technology Innovation grant in 1998.

The school's technology integration efforts were noticed. In 1996, Southeast Suburban was one of 29 schools nationwide to receive special recognition from the Blue Ribbon Schools Committee for its integration of technology into the curriculum. In 1999–2000, the school was named one of the top 10 schools in the nation for technology integration by *Business Week*. During that same year, the school received recognition from the U.S. Department of Education's National Awards Program for Model Professional Development for its efforts to support teachers' professional development in using technology in their classes.

Turnover among the school's 150-member faculty was reported to have been under 2% for several years. The district's teacher salary schedule was reported to be at the state's high end, but perhaps also significant was the school's philosophy of "growing your own." Teachers did not have to move elsewhere to find interesting things to do and satisfying growth areas:

> *When a teacher has an idea for a grant, it's "I think this would be cool. Go for it. Here's some support. Here's some help." Just providing resources to encourage teachers to branch out. People ask, "How do you get so many grants?" Well, because we write them, because we go after them, because the environment here encourages it and supports it. And it's a snowball. Once you start doing it, you build on those previous successes.*

Directions staff members talked about for the future included developing an Intranet, providing an Internet skills course for students, having students submit their assignments electronically, and putting student progress reports, which were generated every 3 weeks, on the Internet. School staff's visions for the future clearly extended beyond school walls. Southeast Suburban's positive experience with the senior citizens led the staff to consider the idea of becoming more of a community school, where citizens in the community could learn about new technologies and gain experience with them. The school was also considering possibilities for pursuing its state's interest in a state virtual high school that would offer advanced courses in math, science, and other areas to schools whose enrollments did not make these offerings possible. Another possibility being contemplated was a virtual high school model through which Southeast Suburban's technology-using teachers could help other teachers around the country develop technology skills and understanding. The school's Technology Innovation Challenge Grant project was another avenue through which Southeast Suburban saw itself, along with its consortium members, achieving a statewide and national presence that would provide teachers across the curriculum with Internet-based resources for curriculum and staff development:

> *We want to impact the nation's teachers. . . . We also provide Web sources, so that teachers get used to effectively going in and garnering the best of the Web. . . . They have a place to go that says, "Listen, these Web sites have been reviewed by master teachers. And they're appropriate for use in your classrooms. And not only are they appropriate, but here's a good lesson plan that goes with it."*

Students. Southeast Suburban's student body of 2,350 students in grades 9–12 was described as 79.49% White, 10.66% African American, 5.33% Asian, 3.07% Hispanic, 0.10% American Indian, and 1.34% multiracial. Reflecting the community's middle- to upper-middle- class population, only 2–3% of Southeast Suburban's students were eligible for free or reduced-priced lunch. Just 1% of its students were reported to be English Language Learners. More than 400 students, almost one fifth of the student body, were in the gifted program. Eighty five percent of the school's seniors were reported to enter colleges and universities following high school graduation, 6% were reported to enter vocational training, and the remaining 9% were reported to enter the military, employment, or other endeavors.

Computer configuration. Since the installation of its first Internet computer lab in the gifted program in 1996, school staff had been working to expand computer and Internet access through several means. A fiber optic network had been extended throughout the school, making the connection of all classrooms to the Internet possible. Despite this infrastructure, the number of computers at the school and their usage rates, along with usage loads on the district's network, meant that staff and students often experienced slow data transfer and processing speeds, and occasional electrical circuit failure.

Staff described the school's computer configuration as both computer labs and at least one computer in each classroom, although several classrooms had two or three computers, or as many as seven or eight Internet-connected computers. One department kept their allotment of Internet-capable computers on carts that could be dispersed one per classroom or grouped in various configurations in the department's classrooms. This arrangement had the advantage of flexibility, but the disadvantage of inconvenience. Rounding up the computers, getting them hooked up in a classroom, and then disassembling the connections and redistributing the computers after use was reported to take about 2 hours of a teacher's time.

Several departments had computer labs. Internet-connected computers had been available in one or more of these labs since the mid-1990s, and some of the labs had just been equipped in the 1999–2000 school year. These computer labs included an English writing lab, a foreign language lab, a special education lab, three business education labs, a vocational technology computer lab, a drafting lab, a law enforcement lab, a graphic arts lab, and the gifted program's Internet lab mentioned earlier. Some of the labs contained PC platform computers, others had Macintosh computers, and some had a mixture of both. When teachers in a department wanted to use the Internet, they scheduled their department's lab ahead of time. Occasionally, when teachers in one department were not able to schedule their own department's lab, they could try to schedule another department's lab. The labs were reported to be heavily scheduled for within-department classes, however, and teachers' chances were likely to be better in the two school-wide computer facilities. These included one lab acquired with Technology Innovation Challenge Grant funds and the media center's computer lab. The media center lab was available to students before school, during lunch, and after school, and to teachers at these times and during their preparation period, and could be scheduled by teachers for their classes. The media center also had three SMART Boards that teachers could check out. In addition, a digital camera was available, and teachers could sign out a laptop computer when needed.

In addition to the departmental and school-wide labs, several minilabs had a few Internet-connected computers. For example, a career center used by the guidance department had eight computers (reported to be acquired with the help of federal Carl Perkins monies in 1998), and seven classrooms housed such minilabs.

Technology plan and policies. The school's goals regarding technology had evolved over time. Initially, priority was placed on getting updated servers, more lines, and more computers in the media center, where they were accessible to everybody, and getting one computer in each classroom. After teachers had experienced the one-computer classroom for a year or two, they wanted strategies for removing its limitations. Attention turned to ways of projecting the computer screen so that the whole class could see it. Televisions were placed in all classrooms to allow the use of an Aver Key (a small black box that hooks into a computer and a television, allowing the computer screen to be viewed on the television so that an entire class can see it). Because the resolution on the television screen was not as clear as that on a computer screen, teachers pushed for better quality—and they wanted a bigger picture. Computer projectors were then purchased for a number of classrooms and the school also acquired a few SMART Boards.

Although the school's accomplishments in developing its technology resources were acknowledged by staff, they knew that they would face challenges in the future when it came time to replace, update, and refurbish the equipment. To deal with these eventualities, and to guide the acquisition of equipment, the school had a 5-year technology plan, which was described as helpful, but limited:

Five years ago we wrote a 5-year technology plan. To be frankly honest, a 5-year technology plan is ridiculous. There's no way to predict what's going to happen in 5 years. But, you have to have it so you're pointing at something. And in 2 years, you come back and go, wow, we misjudged that, let's adjust it. . . . But the 5-year plan has provided a structure that guides us through our decision making. We tweak it, revise it every year. So it's a rolling 5 years, effectively.

The school's approach to developing its Internet-capable computer facilities had a departmental orientation, in which departments were given the opportunity to plan a configuration that they believed would meet their needs. Departments generated plans that identified learning goals for students, and based their technology requests on these plans. Finding space to house computers and computer labs was a challenge. The department labs approach, in which 10 or 15 computers were put in one classroom in a department, avoided giving up classrooms to house computers. The rooms remained classrooms assigned to a teacher, who typically had some hours released from teaching to provide technical and curricular support to others. Other teachers swapped their classroom for this one when they needed to use the computers for their classes.

Frequent users of technology, who spent many hours working on the computer and needed considerable hard-drive space for their projects, had been given laptop computers. Allocation of equipment was based to an extent on past use. This meant that non-users of technology and infrequent users were less likely to receive additional or updated equipment than were frequent users.

The school district had an acceptable-use policy regarding technology, and it operated a filter system that kept teachers and students in schools throughout the district from gaining access to Internet sites it blocked. Staff, but not students, were provided e-mail accounts through the school.

Technology-related personnel. Southeast Suburban gave decision-making responsibility and technical support functions to its faculty. As a result, many teachers were quite knowledgeable about technology and self-sufficient in dealing with it, and several staff were able to assume multiple roles with respect to both teaching and technology. Several teachers and the school's two media specialists shared responsibility for providing support to teachers and helping teachers with less technology-experience develop their Internet-related skills. The media specialists supervised the media center computer facility and administered the school's staff e-mail accounts. The five individuals described below each supervised one of the school's computer lab facilities, and they were released from some or all teaching responsibilities. In their supervisory capacity, they assisted students and teachers who encountered problems when using computers in the lab. Several of the five held or were working on master's or specialist degrees in instructional technology. All had pursued special training relevant to their role, including participating in training opportunities provided by the district, the state, and on line, and had spent many hours working to develop their skills through self-teaching and experience. Courses in Novell administration, Web-based publishing, technical troubleshooting, and Web-based teaching were among the kinds of preparation they reported. Several of them referred to a network of colleagues they could contact by e-mail if they ran into problems they couldn't solve.

One of the five technology-related staff members was the manager for the school's Technology Innovation Challenge Grant. This teacher on special assignment served as the school's full-time technology director. This staff person led workshops for teachers concerning the development of Web-based curriculum and handled technical support services that could not be addressed by other staff. A second technical support staff member was a teacher and department chair who was released from some teaching responsibilities, and provided workshops for teachers and taught a Virtual High School course. This individual also mentored teachers across the country who were preparing to become Virtual High School teachers. Both of these staff persons helped teachers across the country develop Web-based curriculum and deal with curricular and technical challenges of a Web-based educational context.

A third technical support staff member was a teacher who also taught a Virtual High School course and was providing training to other Virtual High School teachers nationally. A fourth technical support staff member was the school's Virtual High School site coordinator. This individual helped students at Southeast Suburban who were enrolled in Virtual High School courses stay focused on getting their assignments completed. This person also assisted teachers with Internet-related and other technology questions, led staff development workshops, helped new teachers become acquainted with the school's technology resources, and connected students with on-line resources regarding study and test-taking skills, career decision-making, homework, and time management. A fifth teacher who provided technical support at the school had teaching responsibilities, was developing a Virtual High School course for the 2000–2001 year, and was implementing the Generation WHY program mentioned earlier. This teacher worked with students to compile and develop Web-based resources by subject area to assist teachers in using the Web in their teaching. In addition to these staff, advanced students were involved in assisting with the school's Web site development.

Because the school had made an effort to help teachers learn to troubleshoot more routine problems themselves, each department had teachers who could answer many of the questions and solve many of the problems their departmental colleagues encountered regarding the Internet. Technical support personnel indicated that because teachers and departments could deal with more routine problems themselves, the problems referred to support staff were more serious ones. District technical support personnel were available, if needed, to help with these.

The school's technology committee was responsible for setting goals and making plans regarding the school's technology. This committee had its roots in the school's site-based management approach. Each department had a representative on this committee. Because departments had a voice in the decision making about technology acquisitions, the committee was able to understand unique needs and perspectives connected with subjects and personnel across the curriculum:

We put together a site-based management committee that represented every department in the building, and that included the media staff, the guidance office, clerical workers. . . . We followed the rigors of site-based management—to bring everybody in. And when you brought everybody in . . . you started to hear that what special education wanted was so different than what the media center wanted. It was so different from what social studies wanted. . . . You began to realize that, "I'm not the only person and what I want to buy really doesn't fit into the scheme of things, or if I compromise or postpone what I want, we can buy . . . the backbone . . . the main line."

Curriculum. Southeast Suburban characterized itself as an academically oriented school focused on preparing students for careers, not just jobs. A career orientation was evident in several areas of the required curriculum. For example, an English class had students hone their Internet search skills by finding a listing of fast-growing careers, locating self-assessment instruments on the World Wide Web that related to careers, and finding information on the Internet about specific careers and their educational requirements. A math class assigned students a paper in which they discussed careers that involved math. A course offered on the Internet by one of the school's teachers through the Virtual High School focused on helping students learn a process for finding career information and making career decisions. The school had been awarded a Drafting Industry Certification Initiative grant in 1999.

The state's high school diploma system was reported to offer college preparatory and career-focused options that students could choose when they entered high school. The requirements for all of these options included English, math, science, social studies, health and physical education, and one unit from among technology, fine arts, and career preparation. Technical education, business, art, drama, music, and physical education were the elective areas listed in the student handbook. The school offered 4 years of four foreign languages, including Latin. The school's vocational-trade and industrial department offered accelerated learning courses in technology and society, and video production, to gifted students. The school offered a work-study program, a gifted program, and a number of honors-level courses and advanced placement courses. Southeast Suburban was also a magnet school for special education. Postsecondary-options courses were available to students in cooperation with postsecondary institutions in the area.

Many students came to the school with computer ability they had already developed at home. Although a computer skills course was not required, keyboarding skills were expected of all high school students, and a keyboarding course was offered. Given the school's distributed model of technology integration across its curriculum, students in all curricula appeared to have Internet exposure, but at different levels. The gifted program instructed students in computer programming, production, and research. The computer applications course offered in the business area covered basic computer operation and standard software programs. Some staff implied that this course was taken mainly by students interested in business, and that they thought a course like it should also be offered for students whose interests were in other curricular areas, because they found themselves having to teach more basic computer skills than their subject-area time could afford. Students were reported to learn computer and Internet search skills in the context of projects they were working on in their classes. The media specialists in the media center taught such skills to groups of students, especially freshmen, who were brought to the media center by their teachers to spend a class hour working on project assignments for class. Presentation skills were expected of all high school students. These were taught and evaluated in each class. Presentations had to be done using PowerPoint and the SMART Board. Some teachers required students to meet additional criteria that included the Internet (e.g., importing resources from the Internet into presentations).

Because the Virtual High School allowed 20 students in a school to enroll in any of the courses offered by the Virtual High School when a teacher from that school teaches a Virtual High School course, Southeast Suburban students had this opportunity. Students enrolled in Virtual High School courses were able to get courses not otherwise available to them, to develop depth in an area of interest, to test the appeal of a potential college major (e.g., a pre-engineering class), to boost their grade point average or Carnegie Unit courses, to take the honors courses and advanced placement courses available through the Virtual High School, or simply to have a new adventure. Staff members observed that Virtual High School courses also allowed students who had missed school due to an extended illness to make up some classes, and that students with special problems that interfered with their ability to be part of a high school class socially were still able to complete academic work through the Virtual High School. Three Southeast Suburban teachers were becoming involved in teaching Virtual High School courses, which meant that 60 Southeast Suburban students could enroll in Virtual High School courses in the future. The state was reported to have recognized only four Virtual High School courses as meeting state core academic requirements, however, so most Virtual High School courses did not replace curricular requirements at Southeast Suburban.

The school also followed a practice of pairing regular students and special education students at the computer to support the learning of both students. In addition, a grant-supported project allowed high school students to connect with kindergarten students by teaching them technology skills.

As teachers had developed Web-based curriculum, used Web resources in their teaching, and overseen students' Web-based work, copyright questions and issues had arisen:

> *There's so many copyright issues. . . . Some of us are literally copyright police in the sense that it's a whole new train of thought that you have to convey, not only to the students, but to the teachers. . . . The Department of Ed financed one of the Challenge Grants an extra $300,000 just to investigate video footage, because a lot of us are creating products. A lot of the lessons that we're creating reference another Web site, relying in that way on someone else's work. We're using this Web site inside the lesson plan. Now mind you, we're not selling any of our product, so we reference it and give credit to it. Everyone's doing that. . . . It's one of the integration strategies. But, there was just a recent court case on deep linking. That's linking to someone else's site deep in yours, so effectively their site becomes an integral part of your site. How legal is that? And how much deep linking are you allowed to do?*

Professional development. As noted earlier, Southeast Suburban had received recognition from the U.S. Department of Education's National Awards Program for Model Professional Development for their efforts to support teachers' professional development in using technology in their classes. This awards program recognized comprehensive efforts to improve teacher effectiveness and student achievement consistent with research-based principles for, and exemplary practices in, professional development.

Because a number of Southeast Suburban teachers had pursued degrees and certificates in educational technology, a considerable amount of informal assistance was requested and provided among teachers themselves. Teachers were reported to get together during lunch, before and after school, and on weekends to help each other with technology areas that one wanted to learn and another was able to teach. Teachers also reported using the Internet to keep up to date on information in their field and from their professional organizations.

An only slightly more formal pattern was used for *department-focused* teacher training. One of the teachers in a department or the department head identified an area or skill that everyone in the department needed to learn, and a department staff member spent a little time teaching the skill to small groups of department faculty. Afterwards, a concerted effort might be launched to use the skill department-wide in ways that enabled everyone to practice the new skill. In addition to these efforts, the school's media specialists provided informal training for staff, as needed, and assistance in finding useful Web-based resources. A department-focused form of the latter included moving some of the media center's computers into a back room for a day. The school paid for substitute teachers in a department so that the teachers could spend the day, with the help of the media specialists, finding Web sites potentially useful for the courses taught in the department.

More formally arranged interdepartmental training was done during a school-wide technology in-service day each year in the fall. Teachers were required to participate in this training, in which staff members taught other staff members different areas of educational technology:

> *The technology experts in the building kind of step up to the plate and say, "I know how to build a Web page. Let me show these guys how I use it in my classroom." So the guy teaching next door to you shows you how to build a Web page and how he's using it.*

The administration was reported to have supported the development of these technology experts by providing them with needed equipment (e.g., a laptop computer) and supporting their attendance (by paying for a substitute teacher) at short-term technology-related workshops. A few of these teachers had taught college courses or professional development courses to teachers beyond the school and school district.

In addition to the technology day training, a five-session after-school class was made available to teachers school-wide over a 5-week period in the fall and again in the spring. This class, which focused on Web publishing, Internet skills, or Microsoft® Word, for example, was taught by the technology coordinator or another staff member. Other offerings were also reported to be scheduled during the school day. Teachers commented on the value of these experiences for building a collaborative spirit among teachers at the same time as technology skills were learned:

> *There have been days when everyone who is developing on-line lesson plans has been able to get together. We were able to get together for a full day and work with the technology of it, which is mostly just learning how to sign on and save your work. But the idea of what's going on in other areas was fostered there. . . . I think all that's fostered a team approach.*

The school's grants sponsored some of these opportunities and gave teachers opportunities to collaborate with teachers at other schools; to participate in state, regional, and national meetings that provided exposure to new ideas and possibilities; and to present their work at various meetings in their state and around the country.

A nearby state university was mentioned as providing helpful educational technology courses, workshops, and consultation at no or very low cost to individuals or staff teams. This university was one of the state's technology training centers that offered educational technology courses and programs. It provided in-service staff development for teams of teachers in formats accessible to Southeast Suburban's teachers, including intense summer classes and on-line classes. An outside person might occasionally be brought in to Southeast Suburban to do initial training, but once a group of teachers was trained in an area of educational technology, arrangements were made for that group to train others. This approach saved money, and teachers were viewed as having an easier time learning from someone whom they knew and who could be available at a time when they were free.

The school also sent teams of teachers to take part in a state training program focused on using technology in a student-centered classroom. In this program, teams of five teachers from schools in the state attended a technology-focused course at a participating college or university. Administrators from the teachers' schools had to agree to provide substitutes for the teachers and to attend 2 days of training designed to prepare them to evaluate technology-trained teachers. Administrator involvement was required because it was assumed that new modes of teaching would be observed among these teachers. Administrators also were required to provide a multimedia computer station for each participating teacher and to allow these teachers to check out equipment on weekends, during school vacations, and over the summer. Several teams of Southeast Suburban teachers had participated in this 50-hour, 7-day experience since it had become available in 1998. One teacher who had taken part described learning how to develop PowerPoint presentations, how to help students develop presentations, how to find good Web sites, and how to create courses that reflected state standards. Once a team had met all the requirements of implementation within their own classrooms, its members were eligible to return for further training that prepared them to train other teachers. A teacher participant on one of these teams indicated that this program had facilitated a team approach to technology integration in the school and the sharing of Internet-related resources among teachers at Southeast Suburban. Statewide, 11,000 teachers had been trained through this program, which the state had approved as meeting its teacher-recertification computer-competency requirements.

Technology integration strategies. School staff described the introduction of computers into teachers' practice as a gradual evolution. Requiring teachers to use certain technologies in order to press teachers to learn them was one approach that was used. It started with a grading program introduced around 1989 in which teachers had to enter grades for students. Regular progress reports for each student were then required. Training on the software that fulfilled these functions was provided annually. In the mid- to late-'90s, when monies were available to bring more computer equipment into the building, training became a priority. Teacher training started with word processing, but then moved to Internet-based technologies. Bringing in-service training into the school, employing a colleague to teach it, and tying training to teachers' subject areas encouraged teachers to participate:

> *We offered it here on campus. . . . They finished their seventh period class, they packed up, they brought a Coke, and they moved to the lab. . . . Number two, the teacher was somebody they knew. That . . . was a bigger incentive than I would have thought. . . . In those days, they were still very computer-phobic. They did not want to admit that they didn't understand. . . . To have it taught by somebody who knew them took a lot of the anxiety out of it. Number three, we made* [the training] *very relevant to their subject area. We were not doing generic things. We said, "Bring something that you want to develop for your classroom."*

Other strategies that school staff used to encourage faculty development and involvement in technology integration included identifying key leaders, requesting department-level planning for technology integration, and supporting teachers' requests to attend staff development conferences:

> *As we got key people in our building who felt comfortable and could show that it made a difference in their classrooms, we would embrace that and brag about it, and then pull that person out and say, "Share your expertise. Why don't you share it within your department? Why don't you share it in the broader school community?" And that's how it all started. You had a few catalysts, a few key people who did some good things, and then you spread the word, so it becomes contagious.*

> *Most of our department chairs embraced it, and that really helped. . . . We asked the departments to think about their goals. What were they currently doing in instruction, and how could they enhance it by using the new methodologies that are out there in technology?*

> *We never deny any opportunity for professional growth for any of our faculty members, any conferences they want to go to, any extra staff development. We don't deny anyone this opportunity.*

Discontinuing the school's printed newsletter that contained information important to teachers and providing it only on e-mail, and sending notices of meetings only on e-mail was another strategy used to necessitate teachers' use of technology. School staff indicated that teacher candidates' technology skills were a factor seriously considered when new teachers were hired. Teacher evaluation criteria did not include specific technology skills, but such a component was being considered.

The school administration had facilitated the offering of courses required for an educational specialist program in instructional technology through the state's two-way interactive-video distance-delivery network so that Southeast Suburban teachers could take these courses after school in the school's network lab:

> *One of the biggest pluses is the administrative support. . . . We had a cadre of teachers getting their specialist degree . . . and their master's degree, and the administration arranged classes to be taken here . . . . They arranged it with the university so that it facilitated a lot of us getting our specialist and master's degrees.*

The state's rules for teacher certification renewal required teachers to demonstrate satisfactory proficiency on a professional standards commission-approved test of computer competence. Those who did not pass the test were required to take commission-approved training or an equivalent course.

Southeast Suburban's Technology Innovation Challenge Grant project encouraged integration of the Internet in teachers' instruction in several ways: (a) by training teachers, (b) through the production of an on-line repository of standards-based lessons and units across the school curriculum that incorporated Internet resources, and (c) by making a virtual community of scholars, technical experts, and Web publishing guidance available on line to teachers. Teachers involved in the grant project received training in basic computer operation, using the Internet, and on-line lesson plan development. They produced lessons and units according to a specified lesson/unit development process. These lessons, when reviewed by content experts, revised, and approved, became part of an on-line lesson repository. Teachers were paid for their involvement.

Teachers' use of and familiarity with the Internet ranged widely. Some teachers held education specialist and master's degrees and certificates that focused on educational technology, while others did not embrace the Internet or respond to the technology-based approaches they were encouraged to integrate into their teaching. One staff member commented on this phenomenon and how it was handled:

> *There are still those who are resistant to technology. And you're never going to get away from that. So you don't waste time on people who don't agree with you. Let's agree to disagree, and I'm going to go work with these other folks that do agree. If you want help, just say the word and we'll be there and we'll help you and we'll do anything we can to get you to come along. But, we're not going to slow down.*

Discussion

As mentioned earlier, the schools involved in the study have both similarities and differences. The similarities are emphasized in Chapters 3 through 7, where the common themes that emerged in interviews with teachers and students across the schools are reported. But similarities are also evident in the background descriptions reported here. First, all the schools had several years of experience with computer technology. At one school, this experience stretched as far back as the 1970s. Two schools had 10 years of experience with networks and Internet-based technologies, one had 5 or 6 years of Internet experience, and the newest school had opened with Internet access 4 years before. The value of these early experiences is demonstrated by the learning that the staff had done and the commitment they had developed to expanding technology access in their schools.

Another shared characteristic among the schools is the importance that staff attached to technology. In each school, individuals were evident who had promoted the development of technology integration in the school over time, and who, in four of the five schools, had spearheaded grant proposal development and other ways of acquiring the resources needed to provide computers and infrastructure in the school. In each school, individuals who understood curriculum as well as technology had provided leadership for technology integration. In all cases, school personnel saw their school as being ahead of other schools in their district and state in integrating technology. The science department was the most consistent early user of Internet technology across the schools. One staff person suggested that this was because funding had been focused there in earlier years. Four of the schools had been or were currently involved in federal technology initiatives, the Technology Innovation Challenge Grants (three schools) and the National Science Foundation Supercomputer Project (two schools).

Beyond these similarities, however, many differences were evident among the schools. Two had incorporated technology integration in the wake of academic crises and dissatisfaction, and one of these had embraced technology integration as a means of resolving these problems. A third school started with a full array of technology and was experiencing serious academic problems. Communities varied in their support of technology integration. Three schools were in communities that clearly supported the schools' efforts to integrate technology, while two were in communities that had little experience with or knowledge of computer technology prior to the exposure that the school brought to students and community members. Economic resources available to the schools for acquiring technology also varied widely. Three schools were in states that were providing considerable financial assistance to schools for acquiring computers and infrastructure and for training staff. A fourth school had a unique financial base that allowed it to create a technology-rich environment. The fifth school received no special funds. Special grants (federal, state, private) were relied on extensively by one school, and moderately by three schools, as sources of funding to support technology integration efforts. Higher education institutions played an important supportive role for technology integration in three of the schools.

Students

Students at the five schools varied considerably. Student populations in the two inner-city schools reflected a high degree of diversity in race and ethnicity and in languages spoken. Both of these schools had rather extensive English Language Learner programs. A high proportion of students at these schools and at Midwest Rural were from families with limited economic resources, and substantial percentages were eligible for free or reduced-price lunch. Midwest Rural, while less diverse than the inner city schools, enrolled a high proportion of minority students. Students at Southeast Suburban and West Coast Community reflected less (although some) diversity, and had fewer English Language Learners and students eligible for free or reduced-price lunch. Table 1 provides a profile of the student bodies in the schools, along with some of these dimensions.

In three of the schools, many students did not have access to a computer and the Internet at home. One of these schools (the smallest) solved this problem by providing students with laptops they used in school and could take home. Even in the two schools in which most students did have home access to the Internet, some parents did not want their children to use the Internet at home or at school.

Table 1

Profile of Case Study High Schools' Student Bodies in 2000

School	9–12 Enrollment	Largest racial group (%)	Free or reduced-price lunch eligibility (%)	English Language Learners (%)
Midwest Inner City	1,400	40	65	44
West Coast Inner City	1,600	28	74	30
Midwest Rural	100	52	49	0
West Coast Community	2,213	57	14	7
Southeast Suburban	2,350	80	2–3	1

Computer Configuration

Three schools reflected a highly distributed model of computer placement. Midwest Rural, Southeast Suburban, and Midwest Inner City all had classroom computers, computer minilabs, and large, school-wide labs. To some extent, and especially at Midwest Rural, classrooms were minilabs. Departmental variations were evident in the computer configurations at four of the schools (all except Midwest Rural), although these schools also had many single-computer classrooms and each had at least one school-wide lab. The patterns reflect a variety of complex computer configurations.

Macintosh platforms predominated in three of the schools, but all five schools had some PCs and some Macintosh computers. Students at two of the schools used laptop computers; Midwest Rural assigned iBooks to students, and West Coast Inner City moved a mobile cart with 10 iBooks between classrooms. In all schools, some teachers had access to a laptop computer, but most used a desktop model in their classroom or office. The schools varied in the degree to which they depended on computer projectors and SMART Boards.

Technology Plans and Policies

The schools or their districts had technology plans with one exception—Midwest Inner City. This school faced the most severe need for upgrading equipment, largely because its equipment was all the same age (new when the school had opened). Equipment in the other four schools was a mix of new and old, which afforded the schools the possibility of gradual replacement. Only one school, Midwest Rural, had a well-established replacement plan and schedule, perhaps because it had the longest history of school-wide technology integration and was in the best position financially to systematically upgrade its technology.

All the schools used either a monitoring system or a filter, or both. All had procedures for obtaining agreement from students and staff regarding acceptable-use policies, and four schools used parental permission procedures. All of the schools provided e-mail accounts for staff, and two provided them for students.

In providing computer equipment to teachers, once schools had distributed the basic equipment allotment to classrooms, priority for further equipment was given to teachers who had a track record of using what they had been provided in the past. One school required teachers to submit proposals for equipment; another required proposals on a departmental basis. These procedures were intended to emphasize the curricular goals that were to be served by the equipment.

Technology-Related Personnel

The profile of technology personnel in the schools varied widely in both amount and background. Two schools had technical specialists; in the others, teachers and media personnel performed technology personnel functions. The schools varied considerably in the centrality of the role media specialists played as technology personnel. In some of the schools, media specialists were central technical and curricular support persons, whereas in others they seemed to have almost no support role related to technology. Where teachers were used as technology personnel, they worked full-time in that capacity in some schools and part-time in others. Teachers were either assigned technology responsibilities as part or all of their job assignment or were paid a stipend over and above their full-time teaching salary if no release time was provided. In some schools, technology personnel were centrally located, and in others they were department-based with the intention of facilitating technology-based curriculum projects. Each school had a technology committee or core group of teachers who, along with technology personnel and sometimes an administrator, spearheaded technology planning and coordination and made (or at least approved) decisions about equipment acquisitions and allocations.

Curriculum

The schools varied in the kind of curriculum they offered and the emphasis placed on various curricular aspects. Midwest Inner City and West Coast Inner City emphasized career- oriented programs. Southeast Suburban and West Coast Community emphasized college prep programs and offered a wide array of Advanced Placement courses and honors courses. Midwest Rural offered a comprehensive curriculum that included both career-oriented and academic-oriented courses. All of the schools reflected a degree of career orientation in their academic programs and the use of the Internet to support this focus.

Two schools had magnet programs—one in industrial technology (West Coast Inner City), and one in special education (Southeast Suburban). Midwest Inner City was planned to function as a technology magnet school. Southeast Suburban had an extensive gifted program. Midwest Inner City had a nontraditional curricular organization in which academic programs were integrated within career-oriented focus areas; the other schools had the traditional subject-area curricular organization.

All but one of the school districts required students to take a computer literacy course in high school or earlier. Some of the schools offered extensive computer technology curriculum, most notably West Coast Community and Midwest Inner City, but all offered several courses through which students could develop intermediate-to-advanced technology skills and understanding, and all sought to develop students' technology capacities through technology-based project assignments in all subjects. In three of the schools—West Coast Inner City, Southeast Suburban, and Midwest Rural—federal Technology Innovation Challenge Grants had contributed to curricular developments.

Professional Development

All of the schools provided some teacher training, but professional development opportunities made available to teachers varied enormously among the schools. Midwest Rural had released classes every Friday afternoon during the school year for several years in order to provide required technology training for teachers. West Coast Inner City, with the help of its state grant, provided substitute teachers in order to give its instruction-related staff 36 required hours of technology-focused training in 2000. Southeast Suburban had provided after-school technology classes, brought in courses required for advanced degrees in instructional technology (which embedded technology learning within a larger purpose), and sent teams of teachers to 50-hour technology courses for several years. In contrast, West Coast Community and Midwest Inner City, whose staff development days had been eroded by changes in state and school district policies, provided 8 or fewer hours of technology training they required teachers to take during the 1999–2000 academic year. At Midwest Inner City, technology training was provided and required only for teachers new to the school. Some schools sent teachers to technology conferences, and Midwest Rural paid teachers to present their technology-based work at professional meetings. Training offered by the schools was provided by technology coordinators, media specialists, and technology-knowledgeable teachers, on both an informal and a more formal basis.

States differed in the support they provided for technology training. One state required teachers to either pass a technology skills test to be recertified or take an approved technology course. This state also provided technology training centers around the state where teachers could receive training, as well as consultation concerning instructional technology. Another state provided grants to schools that included provisions and requirements for training teachers.

All of the schools had outlined areas of competence they expected teachers to develop, and West Coast Community had outlined a series of levels within these areas that were used to track teachers' progress. In all of the schools, teachers' technology skills differed widely, leading some of the schools to adopt a menu approach to training. Getting an accurate sense of teachers' skills was also a problem for schools, because many teachers either overestimated or underestimated their capacities on skills surveys.

Technology Integration Strategies

The schools differed in the degree to which they encouraged, versus required, teachers to use technology. West Coast Community and West Coast Inner City were the most committed to an encouragement strategy. The other schools all required teachers to use technology to some extent, ranging from providing announcements and information that teachers needed only on line, and not on paper, to requiring teachers to check their e-mail 3 times a day. Most of the schools used electronic grading and attendance systems, which required teachers to be able to operate a computer. Two schools reported selecting new teachers with already developed technology skills or interests.

Some schools had followed a highly strategic and deliberate approach to achieving technology integration, whereas others had not gone beyond requiring use of e-mail and grading and attendance systems. The most strategic approach was seen at Midwest Rural, where the steps of (a) providing access to technology, (b) providing reasons to use it, (c) providing training, and (d) rewarding technology integration were clearly articulated. Southeast Suburban also had a strategic approach that involved providing teachers with access to technology, training, and opportunities to fulfill technology leadership roles.

Some schools had established subject-area priorities for equipment acquisition and allocation. Typically, these priorities focused on academic subjects first, and career and technical education and other elective subjects second. The great range of teacher commitment to and use of technology in all subject areas, however, induced most schools to apply teacher-use criteria when allocating equipment, so that the subject-area priorities were not rigidly applied.

Several schools were considering making technology competence a criterion for teacher evaluation, but only Midwest Rural had moved to the point of implementing such a policy. -Staff in three of the schools saw themselves as influencing other teachers and schools: West Coast Inner City was focused on providing Web-based teaching resources for others, Southeast Suburban on providing technology-focused teacher education for others, and Midwest Rural on developing state and national policy that was friendly to and supported technology integration in the schools.

Teacher and Student Study Participants

The next chapters report the questionnaire and interview data obtained from teachers and students at the five schools. Profiles of teacher and student respondents to the survey questionnaires are summarized in Tables 2 and 3. More female than male teachers and students responded. The age distribution for teachers is fairly even across categories, although 50 or more years old was the most frequent age category reported. Although there were teacher respondents in all professional experience categories, more than half had more than 10 years of teaching experience. The experience of teacher respondents at the study schools followed a bimodal distribution: Almost 30% had taught at the study school more than 10 years, and more than half had been at the study school 4 or fewer years.

Students were distributed fairly evenly over the predominant age categories of 15–17. Fewer students were 14, and 18 or older. Students were also distributed across grades 9–12, but the higher the grade, the fewer the student respondents. In the smallest school, 8th- and 9th-grade students were combined in many of the classes in which the Internet was heavily used, so the 8th-graders from that school were included in the study. Less than half of the student respondents were White. African American and Asian students were equally represented, and together make up 30% of the respondents. One tenth of the student respondents were Hispanic.

Table 2

Teacher-Respondents' Demographic Profile

Characteristic	Number	%
Gender		
Male	136	42
Female	186	58
Total	322	100
Age		
≥ 50 years	102	32
42–49 years	72	22
34–41 years	55	17
26–33 years	71	22
≤ 25 years	18	6
No response	4	1
Total	322	100
Total teaching experience		
> 10 years	173	54
9–10 years	17	5
7–8 years	19	6
5–6 years	23	7
3–4 years	35	11
1–2 years	32	10
6–12 months	15	5
< 6 months	4	1
No response	4	1
Total	322	100
Teaching experience at this high school		
> 10 years	92	29
9–10 years	19	6
7–8 years	10	3
5–6 years	19	6
3–4 years	65	20
1–2 years	58	18
6–12 months	41	13
< 6 months	13	4
No response	5	2
Total	322	101*

*Reflects rounding.

Table 3

Student-Respondents' Demographic Profile

Characteristic	Number	%
Gender		
Male	1,796	47
Female	1,996	52
No response	30	1
Total	3,822	100
Age		
≤ 14	365	10
15	1,051	27
16	1,026	27
17	794	21
≥ 18	479	13
No response	107	3
Total	3,822	101*
Grade		
Eight	25	1
Nine	1,214	32
Ten	1,133	30
Eleven	820	21
Twelve	622	16
No response	8	-
Total	3,822	100
Race/ethnicity		
African American	568	15
Alaska Native	12	-
Asian	561	15
Filipino	50	1
Hispanic, Chicano, Latino	370	10
Native American/American Indian	70	2
Pacific Islander	27	1
White/Caucasian	1,641	43
Multiracial	239	6
Other	218	6
No response	66	2
Total	3,822	101*

*Totals exceeding 100% are due to rounding.

CHAPTER 3: INTERNET-BASED LEARNING OPPORTUNITIES AND PATTERNS OF INTERNET USE

This and the next five chapters report the findings that emerged from the teacher and student interviews and questionnaires regarding the first five study objectives. After the data are presented in each chapter, the findings are summarized and discussed. Each chapter finishes with conclusions, implications, and recommendations drawn from the findings. The final chapter of the report, which addresses the sixth research objective, analyzes the findings in light of relevant theories of educational change and presents conclusions, implications, and recommendations based on that analysis.

This chapter covers the Internet-based learning opportunities that teachers and students reported they were aware of and used in their teaching and learning. It also reports the patterns of Internet use, including the proportions of teachers and students who reported using various Internet-based technologies, their length of experience using the Internet, the frequency of their Internet use, and the purposes for which they reported using the Internet. Web sites used by teachers with their students and the kinds of students with whom teachers reported using Internet-based learning opportunities are also discussed.

Internet-Based Learning Opportunities

In the interviews, teachers identified a wide variety of Internet-based learning opportunities as potentially available to them and as useful or likely to be useful. These opportunities included on-line lesson repositories, two federal Technology Innovation Challenge Grant project products (the Virtual High School and Generation WHY), school and other Web sites that provide links to resources, listservs, and other teachers' Web sites, virtual communities of professionals and experts, on-line courses and programs, search engines, and Web sites focused on technology and other topics relevant to teaching. All of these represented opportunities for teachers to learn to use the Internet in teaching and to obtain resources for teaching and for updating their own knowledge.

On-Line Lesson Repositories

On-line lesson repositories were typically large collections of lesson plans created by teachers. Teachers in two of the study schools were involved in creating lessons that became part of such repositories as a result of their schools' involvement in federal Technology Innovation Challenge Grant projects. Both of these projects provided training across subject areas to teachers who then developed Internet-based lessons. In one of the projects, teachers from schools in five states developed and distributed educational resources aligned with state and national standards. The standards that were considered in lesson development included the Secretary's Commission on Achieving Necessary Skills (SCANS), and content, industry, and technology standards. The lesson plans and units were reviewed by content experts, revised, and approved before becoming part of the project's on-line lesson repository. In the second project, teachers developed lessons following a specific model for on-line lessons. These lessons became part of the school district's Web-site project. In both projects, the lessons were accessible on line to all teachers in the school, the district, and anywhere in the world. Another on-line lesson repository that was perceived as useful for standards-based curriculum development was maintained by the state in which one of the study schools was located. This state was in the process of implementing new graduation standards for high school students, and the repository focused on lessons that addressed these standards. It contained approved courses and assessments from school districts across the state for each standard.

Virtual High School

The Virtual High School (VHS) mentioned in interviews with teachers was also the result of a Technology Innovation Challenge Grant. This Internet-based learning opportunity was being used on a limited basis by one of the five schools, and was being considered by that school's state as a model for a state-based virtual high school. The Virtual High School Project was initiated as a 1996 Technology Innovation Challenge Grant to the Hudson, Massachusetts, school district and its partners, the Concord Consortium (Hudson Public Schools & Concord Consortium, 1999). When a teacher in any school in the nation offers a VHS course, 20 students at that teacher's school can enroll in any of the VHS courses. Schools agree to allocate 20% of a teacher's assignment to teaching a VHS course. During the initial year of a course, its developers receive on-line VHS training:

> *The way Concord* [Massachusetts] *is doing it, it's being done very well. The teachers are being brought along through a learning course. . . . It prepares the teachers to be on-line instructors, instead of just saying "let's develop a course and let's teach on line." We don't know how to teach an on-line course. I need some help, and Concord has done that. . . . They've provided that help, that guidance, on how do you create a good on-line course.*

One of the VHS teachers commented that teaching in the VHS was satisfying because students who enrolled wanted to be there. That teacher's school required students to fill out an application its staff had developed, obtain references from their teachers, and be interviewed by school staff before they were allowed to enroll in a VHS course. A student's grades, discipline history, and understanding of the desired VHS course were reviewed before an application was approved. The VHS required the school to designate a site coordinator to work with students to ensure that VHS course assignments were completed. Teachers of VHS courses contacted the site coordinator if problems arose with a student's performance or ability to meet course deadlines. VHS courses were entered on students' transcripts as Virtual High School distance learning.

> *I'm a big proponent of* [Virtual High School] *if it's used correctly. This is something that is done in addition to the school day. It is not to replace the school day. . . . I think this is a great supplement. . . . to make it possible for the kids to get all ranges of education.*

Generation WHY

Generation WHY was initiated as a Technology Innovation Challenge Grant awarded in 1996 to the Olympia, Washington, School District and its collegiate, community, and business partners to expand to other schools a model for technology integration it had found successful (Olympia School District, n.d.). Generation WHY involves students as technology leaders in secondary schools. Students build and maintain networks, support teachers in the use of technology in the classroom, and develop contacts and collaborate with people outside their schools. Students take a class that teaches them technology, collaboration, and project development skills and builds their ability to mentor a teacher during the school day in integrating technology in the curriculum (Generation YES, Inc., 2000). The Generation WHY program was described in the school that was implementing it as follows:

> *It is supposed to be kids who have some technological ability or interest who are trained to be mentors to teachers. Teachers who are a little bit nervous about trying some of the things have a student* [available] *if they are working with equipment and something goes wrong.*

In 2000, the Generation WHY program was one of two programs recognized as exemplary by the U.S. Department of Education from among 134 educational technology programs submitted to a panel of educational technology experts (Office of Educational Research and Improvement, September 9, 2000).

School and Other Web Sites That Provide Links to Resources

Teachers mentioned that their school Web site was a helpful resource. All of the schools' Web sites provided links to curriculum repositories, reference tools, encyclopedia sites, library sites, and state and school district sites that provided additional links to compilations of resources. These links were often organized by subject area. The advantage of links compiled by the school (often by the media specialist and sometimes by the technology coordinator) or a subject-area group was that these links were tailored to teachers' needs. Teachers also located Web sites produced by other secondary schools, by universities, and by professional organizations that contained useful material for their subject:

> *Lots of math Web sites are out there now that are gathering information and giving a nice entry point into the Web from their site . . . helps you kind of localize your searches.*

Listservs and Other Teachers' Web Sites

Teachers mentioned listservs they belonged to as providing them with useful information about Web sites and other learning resources potentially useful to their teaching area and role:

> *I'm on listservs for a number of different math organizations that are on line. They tell me when new things* [are] *added.*

> *I actually use listservs quite a bit to find the good* [Web] *pages to go to. . . . like for biology, it's Access. Excellent! You go there and then they have all the places you want to go to from that, depending on what your topic is.*

> *One of the biggest aspects of my professional life that has helped is I'm involved in two foreign language* [listservs] *and one German teacher's listserv. So sharing of ideas and sharing resources is very, very helpful. The listserv involves people from all over the world who are teaching German as a second language, so it gives me a perspective of people on other continents, not just my colleagues in this country.*

Some of the listservs teachers mentioned were news services that allowed teachers to keep up with news, in general, or in a particular area:

> *With my current-events classes, I'm on the e-mail* [listserv]. *They have highlights of news and breaking news that I have e-mailed to me.*

Teachers also found other teachers' Web sites potentially useful because these sites often contained teaching ideas and lesson materials for the subject area they taught. Teacher Web sites of interest included those of both high school teachers and college faculty:

> *I use the Internet to use ideas from other teachers that are postings of lesson plans on their Web sites. To go in and just get ideas from them, what they are doing in the classroom for, like, beginning keyboarding classes. It's been really helpful. Very useful in that respect.*

> *So if you do get on a good listserv or if you do find a teacher who either loves the computer or just has a lot of time, or is just very committed, and who puts their curriculum or this great activity on the* [Internet] . . . *you suddenly have access to it, and it's access that's instantaneous instead of waiting for it to show up in the mail.*

<u>Virtual Communities of Professionals and Experts</u>

Some teachers mentioned that they knew of communities of professionals on line that could answer questions or give them ideas and suggestions. Some of these communities were listserv-based, some were contacted by sending an individual an e-mail, and some were contacted through chat rooms:

> *I guess it feels like a support group of IMP* [Interactive Math Program] *teachers throughout the country. So I was in their group, getting all the information and lesson plans and curriculum guides.*

> *News groups, chat rooms, all those kinds of things. You get on line and there are people out there like you adopting the technologies and giving comments on, "This ISP is a good one," or "we've had major problems with that ISP," or "this software here has a bug, and here's a way to solve it," or "here's a hot link to this site." So you can go get* help. . . . you can always go on line.

A science teacher mentioned an advanced placement listserv that not only allowed her to get Web sites and teaching ideas from other teachers of advanced placement courses, but also included a question answering service provided by a university:

> *There was a question-and-answer thing through the University. . . . professors or Ph.D. students. We'd get on and they would answer. . . . I could get on and just ask, and within 10 minutes there'd be an answer. Within 24* [hours] *there'd be an answer.*

An earth-science teacher described a Web bulletin board that provided a question answering service as well as other helpful resources:

> *A volcano Web site . . . run by the American Geological Institute (AGI), and the coordinator for the Midwest is out of the U of Wisconsin at Milwaukee. I attended a workshop there last summer. The way that we communicate is through the Web board that they set up if we have questions* [and for them to do] *general updates. Then the people from AGI in Virginia monitor that Web board, so if they see problems coming up, they correct it. If they find something that needs to get out to everybody, they put it there. It's their way of keeping* [people informed].

On-Line Classes and Programs

Teachers reported being aware of classes and programs that were available to them partially or completely on line. Some of these classes were part of a graduate program:

> *I took a course . . . that was a combination of going to class and prescribed chat room times and regular contributions to the bulletin boards. . . . that would be a time to interact . . . around the state, and the teacher would serve as moderator of the chat room discussion. That kind of thing happens a lot for me in graduate school.*

> *In a graduate program, a lot of it is distance learning. Several of my classes have been on-line classes, or partially on line.*

Search Engines

When teachers didn't know specific Web sites to go to for a certain kind of information, they used a search engine to find them. Teachers also indicated that knowing how to use a search engine was key to avoiding a search that yielded too many resources to sort through:

> *It's a matter of just knowing how to use the search engines and everything. If you know how to use the search engines, you can get around pretty well and find what you need.*

Web Sites Focused on Technology and Other Topics Relevant to Teaching

Teachers who were familiar with the Internet knew of specific Web sites that provided instructions for creating Web pages and sites and on-line lessons, and for using the Internet in teaching:

> *I'm familiar enough with the Internet and trying to find my own sources of information. You can find a lot of information on the Web about how to incorporate the Web in your classroom. So things like that I can do on my own.*

> *The other good teacher resource is now lodged with Discovery Web page, and it's Kathy Schrock and her Web page for teachers.*

Teachers also described Web sites focused on other topics relevant to their teaching:

What I do is go to certain Web sites and look at grading information, as far as different techniques and different things.

Patterns of Internet Use by Teachers and Students

This section reports findings from the survey questionnaires regarding teachers' and students' experience with the Internet, the degree to which they used various Internet-based technologies, and how frequently they used the Internet. Findings from the survey questionnaires and interviews with teachers and students regarding the purposes for which they used the Internet are also reported. Finally, data from teacher interviews regarding categories of Web sites they used with their students and the kinds of students with whom they used the Internet are also reported.

Experience in Using the Internet

Teachers were asked on the survey questionnaire to indicate how long they had been using the Internet. These data are reported in Table 4. Most of the teacher respondents (76%) reported having used the Internet between 1 and 6 years. Teachers were also asked to report the Internet-based technologies they had used within the past year. These data are shown in Table 5. Almost all of the 322 teacher respondents reported using e-mail and the World Wide Web. The variation across schools was very slight. In contrast, less than one third of the teacher respondents reported using any of the other Internet-based technologies that were listed on the questionnaire.

Table 4

Teacher-Respondents' Internet Experience

Length of Internet experience	Number	%
> 10 years	4	1
9–10 years	6	2
7–8 years	27	8
5–6 years	67	21
3–4 years	104	32
1–2 years	75	23
6 months–1 year	15	5
< 6 months	24	7
Total	322	99*

*Reflects rounding.

Table 5

Teacher-Respondents' Use of Internet-Based Technologies Within the Past Year

Internet-based technology	Number	%
E-mail	310	96
World Wide Web	303	94
Downloading music and/or videos	100	31
Remote access to computers or files	88	27
Listservs/news groups	81	25
Telnet/File Transfer Protocol (FTP)	65	20
Chat rooms	53	16
Audio conferencing/telephony	20	6
Videoconferencing	19	6

Students, too, were asked on their survey questionnaire about the length of their experience with the Internet and the Internet-based technologies they had used within the past year. Students' responses are reported in Tables 6 and 7. The majority of students reported between 1 and 4 years of experience with the Internet. The Internet-based technologies most frequently reported by students as used within the past year included the World Wide Web, e-mail, chat rooms, and downloading music and/or videos. In contrast, only 16% or fewer students reported using any of the other six Internet-based technologies listed. The proportion of teachers who reported using the World Wide Web and e-mail was higher than the proportion of students, although both groups reported these two technologies as the ones they had used most frequently within the past year (see Tables 5 and 7). Videoconferencing was the least-frequently reported technology by both groups.

Table 6

Student-Respondents' Internet Experience

Length of Internet experience	Number	%
> 10 years	54	1
7–10 years	46	1
5–7 years	200	5
4–5 years	441	12
3–4 years	663	17
2–3 years	883	23
1–2 years	766	20
6 months–1 year	417	11
> 6 months	325	9
No response	27	1
Total	3,822	100

Table 7

Student-Respondents' Use of Internet-Based Technologies Within the Past Year

Internet-based technology	Number	%
World Wide Web	3,088	81
E-mail	2,928	77
Chat rooms	2,324	61
Downloading music and/or videos	2,304	60
Remote access to computers or files	601	16
Audio conferencing/telephony	460	12
Telnet/File Transfer Protocol (FTP)	443	12
Other	417	11
Listservs/news groups	357	9
Videoconferencing	313	8

Frequency of Internet Use

Teachers' responses to questions on the survey questionnaire about how often they used the Internet for professional and personal purposes, how often they used it in their classrooms, and how often they had their students use it in their classrooms are shown in Table 8. Only one teacher reported never using the Internet. About half of the teachers reported using the Internet for professional and personal purposes daily, but only 15% of the teachers reported daily classroom use, and only 14% reported daily use in their classroom by students. Teachers' responses regarding their own and their students' use of the Internet in their classrooms were fairly evenly distributed over the less-frequent categories of 2–4 days per week, once per week, 1–3 days per month, less than once a month, and never, with responses in each category ranging from about one fifth to about two fifths of the teacher respondents.

Frequency of Internet use reported by students is shown in Table 9. Almost 60% of the students reported using the Internet either daily or 2–4 days per week. Only 2% indicated that they never used the Internet.

Table 8

Frequency of Internet Use Reported by Teacher-Respondents

Frequency	For personal and professional purposes	In classrooms by teachers	In classrooms by students
Never			
Number of respondents	1	51	67
%	–	16	21
< once/month			
Number of respondents	22	67	71
%	7	21	22
1–3 days a month			
Number of respondents	31	57	53
%	10	18	16
Once/week			
Number of respondents	33	35	46
%	10	11	14
2–4 days a week			
Number of respondents	78	53	27
%	24	16	8
Daily			
Number of respondents	155	48	46
%	48	15	14
No response			
Number of respondents	2	11	12
%	1	3	4
Total			
Number of respondents	322	322	322
%	100	100	99*

*Reflects rounding.

Table 9

Frequency of Internet Use Reported by Student-Respondents

Frequency	Number of Respondents	%
Never	86	2
< once/month	345	9
1–3 days a month	581	15
Once/week	575	15
2–4 days a week	939	25
Daily	1,248	33
No response	48	1
Total	3,822	100

Purposes for Which Teachers and Students Used Internet-Based Learning Opportunities

Tables 10 and 11 report data from the survey questionnaires that concerned the purposes for which teachers and students used the Internet. Table 10 indicates that resource/information acquisition was a frequently reported purpose for Internet use by teachers, with two thirds indicating use of the Internet for this purpose at least once per week. Individual projects or work, and seeking expertise on aspects of work or projects, were two other purposes frequently reported by teachers. In contrast, less than one third of the teacher respondents reported using the Internet to publish their work or for developing and maintaining Web pages. Communication with other teachers was the most frequently reported communication purpose.

Table 11 shows that obtaining information was a frequent purpose for students' use of the Internet, as was working on individual projects. Communication with other students was the most frequently reported communication purpose among students. A slightly higher percentage of students than teachers reported using the Internet to publish work and to develop and maintain Web pages, but these purposes were relatively infrequently reported by both groups.

Table 10

Purposes for Which Teacher-Respondents Reported Using the Internet

	Frequency of use															
	Never		Less than once/ month		1–3 days a month		Once a week		2–4 days a week		Daily		No response		Total	
Purpose	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%*
Resource/information acquisition	6	2	41	13	64	20	73	23	83	26	54	17	1	-	322	101
Sharing files/documents with others	91	28	84	26	65	20	40	12	28	9	12	4	2	1	322	100
Collaborative projects/work with others	124	38	86	27	61	19	24	7	11	3	6	2	10	3	322	99
Individual projects/work	35	11	78	24	73	23	44	14	51	16	39	12	2	1	322	101
Seeking expertise on aspects of work/projects	42	13	101	31	74	23	50	16	36	11	17	5	2	1	322	101
On-line publishing of work	239	74	50	16	11	3	7	2	8	2	5	2	2	1	322	100
Web page development and maintenance	202	63	69	21	26	8	11	3	7	2	4	1	3	1	322	99
Communication with administrative staff	124	39	64	20	39	12	30	9	30	9	33	10	2	1	322	100
Communication with other teachers	80	25	59	18	46	14	38	12	49	15	48	15	2	1	322	100
Communication with students	180	56	61	19	30	9	29	9	11	3	10	3	1	1	322	100
Communication with parents	174	54	65	20	43	13	23	7	8	2	3	1	6	2	322	99
Other	0	-	0	-	6	2	6	2	11	3	10	3	289	90	322	100

*Totals not adding to 100% are due to rounding.

Table 11

Purposes for Which Student-Respondents Reported Using the Internet

	Frequency of use															
	Never		Less than once/ month		1–3 days a month		Once/ week		2–4 days a week		Daily		No response		Total	
Purpose	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%*
To get information	160	4	541	14	1,004	26	779	20	649	17	524	14	165	4	3,822	99
Sharing files/ documents	1,400	37	724	19	499	13	418	11	323	8	290	8	168	4	3,822	100
My own individual projects	381	10	750	20	975	26	630	16	469	12	444	12	173	5	3,822	101
Projects I do with others	872	23	1,050	27	917	24	416	11	240	6	155	4	172	5	3,822	100
Finding experts on project topics	1,635	43	826	22	564	15	273	7	200	5	142	4	182	5	3,822	101
On-line publishing of work	2,497	65	473	12	270	7	171	4	110	3	124	3	177	5	3,822	99
Web page develop-ment/main-tenance	2,279	60	516	14	311	8	227	6	125	3	189	5	175	5	3,822	101
Commun-ication with other students	887	23	524	14	475	12	473	12	454	12	832	22	177	5	3,822	100
Communi-cation with teachers	2,769	72	350	9	189	5	136	4	80	2	115	3	183	5	3,822	100
Communi-cation with administra-tive staff	3,139	82	210	5	110	3	79	2	33	1	62	2	189	5	3,822	100
Other	559	15	85	2	111	3	98	3	170	4	329	9	2,470	65	3,822	101

*Totals not adding to 100% are due to rounding.

Interviews with teachers reflected the quantitative data in Table 10, revealing that teachers used Internet-based learning opportunities with their students, or assigned their students to use these opportunities, for a wide variety of purposes: to obtain information; illustrate lessons and student products; work on projects; produce reports, Web pages and sites, presentations, and other kinds of products; prepare for starting a new unit of study; prepare for exams by reviewing, pretesting, and practice testing; prepare for laboratory experiences; prepare for field trips; hold virtual discussions and dialogue; gain expert advice and guidance regarding projects and other work; conduct self-assessments; explore careers; create simulations; provide extra-credit opportunities for students; and provide on-line learning opportunities for others. Teachers also reported making use of the Internet accessible to students as a way of managing student behavior. Students reported in interviews that they used the Internet to obtain help with schoolwork from friends and experts, and to communicate with students in other countries.

Obtaining information. Teachers obtained information from the Internet in order to develop their background in their teaching areas or a topic they were interested in, and to keep up with news:

> *The other side of the coin that really got me going into the Internet was looking for information about school-to-career programs elsewhere, about vocational training elsewhere, and, in particular, statistics of success, student involvement, post-high-school employment. I first began to realize the power of the Internet by looking for that information.*

Almost all teachers interviewed indicated that they made frequent use of the Internet for the purpose of obtaining information, and they also frequently assigned students work on the Internet for this purpose.

Teachers' Internet-related assignments for students were most often reported to take three forms. The first was answering questions posed by the teacher:

> *Almost daily, in their assignments, I'll have at least one Web page that I want them to go to. And I give them some specific questions to answer about that Web page.*

> *We did a scavenger search for* pi*, so I gave each group a question and they had to find the fact about* pi.

The second was answering questions posed by students:

> *If a kid has a question in class that we don't have the answer to, like one day, the kids asked, "Why do cats purr?" So we went on the Internet and checked it out.*

The third was finding information on an assigned topic or one chosen by the student:

> *It used to be that the most boring thing I taught was livestock breed identification. That was done basically with pictures or slides. . . . there's even a videotape put out . . . a video of slides. So now this animal science* [Web site at the university], *they've got*

breeds that we'd only have in America, and [then] *there are worldwide breeds . . . the kids can actually now go, and right there at the site look at the breed, and it shows all the history.*

Right now in my composition II class, they are doing research papers where I ask them to choose . . . a person, an invention, a technological advancement, or event in the 20th century that had an important impact . . . and to come to the library and use the Internet to do research on whatever it is they've chosen.

The latter purpose was also seen in the project and product assignments described below.

Illustrating lessons and student products. Teachers used the Internet to find pictures, images, diagrams, and other visual material to make their lessons more real and more interesting for students and to aid students' understanding:

What I use the Internet for is when I teach world history. We were talking about South Africa and I wanted to actually get some pictures of South Africa. There was an overall view of it that was beautiful. . . . Basically, pictures to go with what I'm teaching to give the kids a visual picture, because my kids love visual pictures.

If I wanted to do a lot of research on different places to get pictures to put in a little slide show when we're lecturing about something, then I have been projecting it . . . and that's made a huge difference in my lectures. It's almost like, I don't have to just describe [it].

Teachers indicated that students, too, used the Internet to obtain illustrations for products they were creating, such as children's books, magazines, yearbooks, and kiosks:

We're doing a children's book, which has to have illustrations, and some of them can't draw, so they can go out and find all sorts of clip art and pictures, and they save it on their files. They print them. They color them. Every day they use it.

We do a whale kiosk, and they can download whale videos and whale sounds, and that kind of thing.

Working on projects. Teachers assigned projects for which students needed to use the Internet. Much of the time students spent on the Internet working on these projects was focused on obtaining information:

When they were doing structural engineering, designing their towers, they went out and just would do broad searches trying to find what information they could on what towers exist and how they were designed, find whatever pictures they could, whatever specifications they could that they then could adapt back down to the size and the specifications that they had on their tower.

We've been working on human rights lately. If you just punch in "human rights," . . . there's everything from children's rights, women's rights, men's rights, you name it, and from virtually every country in the globe. But we narrowed it down to Amnesty International. Well then, I can get all of the students working on the same project now within that Web site, literally from A to Z is every country that . . . has supposed violations. So now, within that framework, I give them some flexibility as to which topic. So we can kind of set a goal, but then within that goal they can wiggle a little bit.

Producing reports, Web pages and sites, presentations, and other kinds of products. Many uses of the Internet that teachers required of students involved developing a product of some kind:

We just finished studying the Holocaust. I've asked them to do a report [containing] *information about some other situations in the world today that mirror* [the] *Holocaust in terms of one group persecuting another based on race, religion, ethnicity, or culture.*

Although many student products were written reports for which the Internet was used primarily as a source of information, other student products involved creating something on the Internet itself, such as Web pages and sites:

The first 9 weeks, we spent time building a Web page, and they created their own Web pages. . . . anything they created for me went on that Web page.

Other teachers reported having students create their own Web page as a vehicle for displaying other assignments they completed. For example, in a forestry unit, an agriculture teacher had students place on a Web page their digitized photos of leaves they had collected and identified:

They're working on an on-line leaf collection. Instead of putting their leaves on a piece of cardboard, they have to digitize them and make just one Web page.

Teachers also had students incorporate material they obtained from the Internet in presentations the students made in class:

Right now my . . . students are creating a PowerPoint presentation. . . . And in order to do that, they had to pull up information off the Internet . . . as well as maps that they incorporated into their presentation.

Preparing for starting a new unit of study. Teachers found the Internet a helpful resource when they were introducing a new unit of study, because it captured students' interest in what lay ahead, and was a source of background information that set the stage for the learning that was to come:

A lot of times, what I've done with it is start a unit; what their questions are, we've gone out and researched them. And then they've given a little report on it. And it's a good way of sharing and good way of starting a unit. So that's one way I've used it quite a bit.

Especially at the beginning of a new unit, the students are a lot more apt to be excited about learning from a computer.

The Internet provided a way for teachers to develop the prerequisite knowledge and skills the students would need in a new unit.

We just finished To Kill a Mockingbird, *and at the beginning of it, I asked them to look up information on the Depression, the Scarsborough Trial, [and so on].*

Preparing for exams by reviewing, pretesting, and practice testing. Teachers reported using the Internet to help their students prepare for tests:

We would also use that for our Algebra II college-prep students to do review, as well as to prepare for exit exams and to prepare also for the exams that the students need to take for the graduation process.

In some cases, students worked on Web sites that guided them through reviews of chapters in a textbook they had studied:

They have a program that we use and we access it through the Internet. I basically use it after every chapter to review.

In other cases, on-line tests allowed students to check their understanding and identify areas in which they needed to do further preparation before an in-class test:

And they use pasoapaso.com (it's by [a companion to] *the book that we use) to review vocabulary. To take what we call self-tests. They use the Internet for reviewing purposes.*

By taking sample tests on line, students could also become familiar with what a real test they would take later would be like, and what it would demand of them:

For my advanced placement biology class . . . there's a Web site where students can get in through the College Board, which administers the test. They have on-line quizzes . . . that'll help them study better for that test, so they know what the test they have to take at the end of the year is like.

Preparing for laboratory experiences. Some teachers used virtual science laboratory sites on the Internet to prepare students for real laboratories. Teachers who used these sites this way felt that they helped students get more out of the real laboratory. One teacher taught an occupational class for high school students and adults who wanted to work as technicians in biotechnology laboratories. Some of the equipment was so expensive, the program was not able to purchase enough for students to get all the practice they needed. This teacher planned to use the virtual lab to build students' understanding, which would then shorten the practice time they needed in the real lab:

I just downloaded sites last week where the students can go on and use pipettes on the computer. Just click and point and it shows them how. . . . If some of them don't get it, they can click on it first and see if they're wrong or right. . . . I just found this, so I think next year when I do this class, I'm going to start them off with the computer virtual pipette. Then do the real thing.

<u>Preparing for field trips and other community-based experiences.</u> Teachers had students look at Web sites of places a class was going on a field trip so that students would have some information in advance.

And so we'll do Internet research to find out about the particular places we're going so they have some background knowledge beforehand.

Before they got there, I wanted them to know what type of facility it was. I had them look it up on the Web, and they had to tell me all the different departments. When they did the tour, they were very well aware.

Teachers also prepared themselves for class trips with the help of the Internet:

When we take our students on their senior trips, it is really convenient to be able to log on and find out all sorts of information about the places we are going to take the students and things that we are going to have to have.

<u>Holding virtual discussions and dialogues.</u> Teachers used chat rooms and instant messaging sites to give students opportunities to communicate with experts, groups, and other students with whom they would otherwise not have been able to interact. A typical example across schools was in foreign language classes where the Internet was used by the class to communicate with students in countries whose language they were studying:

They would just be in touch with things about that country fairly often. Or go into chat rooms and talk with German kids.

Virtual discussions and dialogue were used in other classes to enrich the variety of perspectives brought to bear on a topic of interest:

We did a book discussion internationally the first year that I was working with this [computer] *lab, and it was great. We had kids from Australia and Germany, and they were all communicating and talking with one of our classes.*

<u>Getting expert advice and guidance regarding projects and other work.</u> Teachers reported that they sought out Web sites at which experts gave advice and guidance in areas their classes were working:

This year, I used scholastic.com. There was a writer's workshop. They had several adolescent literature writers . . . so I incorporated a lot of what they talked about in their workshop into creative writing. We tried some of the different techniques they used, and I *said, "This is what the pros use, so let's see if it will work for us," and it really took you through every step.*

Some teachers had students go directly to these sites for guidance:

I'd give them an assignment like this . . . this excellent site from the University of Michigan on how to make science posters. And so I refer them to that site and have them spend a couple of days studying that site, and then we start making posters, and . . . we'll probably make four sets of posters. By the time they finish that, then they know the difference between a grade-school-appearing poster and a professional-appearing poster.

And they each are assigned a certain environmental problem like air pollution, water pollution, and they're doing it, a month-long research project that will entail using the Internet to find information. . . . And then, in some cases, they're using the e-mail through the Internet system. If they come across something, the professional who talks about his work in a certain area, they may e-mail him and correspond with him about the work in order to have a professional opinion in their paper.

Conducting self-assessments. Teachers indicated that they used the Internet as a way for students to develop self-awareness in a number of domains. Teachers sent students to Web sites that provided questionnaires, calculation formats, and other activities that helped students assess their own status, consider their own profile, identify their strengths, and so forth. The most typical self-assessment domains were career interests and possibilities, and health and fitness. What students learned about themselves from these experiences was then typically used in further work:

There are some sites we've been to for assessment tests for the occupations that I have found in their work program. . . . There is also a site that is like an "understanding yourself" type of program. Just health and wellness.

I took them to the media center and had . . . a sheet set up for them, and they went to different Web sites. I used a lot of interactive Web sites. It was easier because they didn't have to do the computations such as figuring up the body-fat percentage and body-mass index. Those were the types of sites we used. I used it on a nutrition project where we talked about fast food. They figured out a meal they like to eat and they looked up the calories and all the nutrition values in the foods they ate.

Exploring careers. Teachers used the Internet often as a resource for career information:

This is an example of a project that I do in all four of my classes. It's using the Bureau of Labor Statistics. The students will go into that site and then they will click on Occupational Outlook Handbook *. . . type in a career that they're interested in researching, and it comes out with about an 8- to 10-page printout on each career. . . . That's very useful. Then from those printouts, they answer the specific questions on the back.*

The prevalence of this use of the Internet across subject-matter areas was striking. For example, a chemistry teacher got students to think about careers in chemistry by having them explore a specific company and develop a realistic sense of the work and responsibilities behind the salaries they saw listed, and the kinds of preparation required to attain chemist positions:

> *I asked them to find out where . . .* [the company's] *stock was listed and how much it was and financial stuff. I asked what would it take to get a job with that company. . . . I asked how many in each . . . of the following categories they employ. Chemists. It told their starting salary and what general education you had to have to be a chemist at that company, and that dropped a few jaws. So they realized the effort that the companies were looking for from these people, and they looked at the pay that a chemist could get. I think that was helpful.*

One of the most thorough approaches to using the Internet for exploring careers was described by a teacher as follows:

> *We would go to the Kersey personality site, and they would do some character and personality testing and it would give them the results. It would give them a picture of the kind of people that were of that type and the kind of careers that they had . . . Then we would find out that maybe they were suited to, or had the desire to, pursue this particular thing and we would go back to the Internet and find programs that would offer this. . . . Then we would use the Internet to find life stories of people doing those types of things, and we would use the Internet to develop* [a resume]. *There was a resume site. We used it a lot. It was very good.*

Some teachers in academic areas suggested that this career focus was one way their program addressed the SCANS recommendations.

Creating simulations. Teachers used the Internet to help them create simulations. (This was not the same as using a simulation on the Internet; teachers also used simulations that the Internet provided, which is described in the next section.) Teachers incorporated various Web sites in their simulations to make the simulation possible or more realistic. These teacher-developed simulations were elaborate projects that spanned several weeks or months. For example, an English teacher who taught students in a program that led to a vocationally oriented diploma used the Internet in a new-business-development simulation:

> *This is a project for the vocational seniors, who will go on to either technical schools or, more likely, the workforce. They create a small business. A lot of the work requires computer use, and especially because we don't have phones, kids can use the Internet to get a lot of their data. Their use of the Internet is incredibly helpful with so many businesses having things on line. So the kids decide the theme of it. This year it is an automotive accessory store. They decide what groups they need to have in order to pull off the creation of this. So the main group that uses the Internet is the services group, who has to determine what we purchase, where we purchase it from, how much it's going to cost, how much we are going to charge. So they're getting all sorts of information from different companies on line, getting phone numbers that we can order sample catalogs*

from, which we've been able to do. They've also created a Web page to go along with their different things, and they even found a site where we could get 250 free business cards for just paying shipping and handling. So they created a nice little business card, on line, and had it sent to us. One of the staffing group members used the different computer resources, Internet and others, to find out general salaries for different employees, and what qualifications they needed to have.

A business education teacher created an international business simulation:

One of the projects that we did was an international business project, so I came up with some guidelines. I . . . simulated that they would be working with a company, and they would be on assignment to another country. They had to select a country, and they had to do some homework to get some information about the country before they actually went there. Some of the topics were to find out what the flag was, the music, the social customs, etiquette, just some information so when they went, they would be prepared. They did all of that on the Internet. They researched and found that they could download the flag of the country, they downloaded the music, and then at the end of it all they did a PowerPoint presentation, and they presented it to the class. I have a very culturally diverse group, so it was wonderful to see that many were able to go back to the countries that their parents had come from. . . . many of them even brought extra items in to share with the class.

Providing extra-credit opportunities for students. Several teachers said they assigned Internet-based work as extra credit. This was optional work that students could do if they were so inclined. Some teachers reported that many students did this extra-credit work:

On a smaller basis, I've done a few things where kids can get some extra-credit points by doing some [Internet-based] *research projects.*

Their homework, extra credit, for tonight is to find an [Internet] *article, read it, and briefly give me a paragraph summary of it. . . . I would say anywhere from 40 to 60%* [do it.]

[I encourage them to] *kind of hunt for the good stuff for me. Find a really cool Web site, and earn five points extra credit.*

In some cases, teachers said they assigned Internet-based work only as extra credit, because many of their students did not have Internet access at home, and they were reluctant to require use of the Internet. This finding supports what students said in interviews: that teachers did not tend to allocate class time to Internet use.

Providing on-line learning opportunities for others. Teachers had their students create material with the intention of posting it on line for others to use. The audience for these materials might be the local community, the school's students, or audiences farther afield:

> *In my other math classes, like my advanced math class, the focus is still on math-related topics, but I do stop at some point and time in the year, and we do a project that ties in, not only the Internet, but . . . other software packages. The end result is that we have a Web page out there that the kids created with a Web-producing software like Quicktime VR and some other things. The purpose is for them to create, but also to kind of have an intended user on the other end. A lot of people just create something that's just posted information. Not that ours gets lots of hits or anything. It's primarily local people that we tell* [about it], *but the idea is that it would be designed for somebody.*

Teachers themselves also created and published Internet-based material. The audiences teachers created material for were mostly students, and occasionally other teachers. For example, one teacher created Internet-based lessons called WebQuests that she intended to use in her classes with her own students:

> *I have put together four different WebQuests. One is called "China: Roots of Revolution," where I try to get kids to look at whether or not China has actually made significant changes as a result of the 1949 revolution, as opposed to how it was before. One is called "Global Challenges," which is about water scarcity and conflict in water-challenged regions. I did two this year. One for my advanced placement United States history class, called "From These Honored Dead," which is looking at the Civil War. The most recent one that is more complex is "Return of the Great Game," which looks at regional and ethnic conflict in central Asia, primarily looking at the weaker people of that central-Asian region, and the possible impact of the nuclear powers that surround that region.*

Managing student behavior. Several teachers mentioned their use of the Internet as a behavior management tool. They rewarded students for completing assignments by allowing them to use the Internet:

> *I let them use* [the Internet] *when they've got all their work done. That's kind of their reward for finishing their work.*

> *It has been a good tool to keep the kids on task because if they can get a certain amount of work done, then they can. In fact, today a couple of girls finished up an assignment. Then they ask if they can spend a couple of minutes before the bell rings on e-mail.*

Some teachers said that they had fewer discipline problems when students used the Internet, and that it was easier to monitor students when they were using the Internet:

I do find that when they're doing stuff like that, and they're having a good time creating something for the Internet or working on the Internet, I have a lot fewer discipline problems.

We can go to the lab and everyone sits down and I can help them individually and keep my eyes on all of them at the same time. No one's moving around and touching and hitting people.

It is easier to monitor students.

I can monitor more students at once.

Purposes reported by student interviewees. In the student focus group interviews, students indicated that they used the Internet for communication; doing research for school; getting college, scholarship, and internship information; entertainment; and pursuing personal interests. They reported that some of the Web-page and Web-publishing work they did was assigned by teachers. Students' comments regarding learning opportunities emphasized the communication aspects of the Internet. Some of the communication and research work that students did for school involved communicating with friends about homework and with experts about projects:

If you need homework help, you probably have many friends that you can go on there and talk to about it . . . and you can talk to people across the world about anything. I've got a psychology project, and I can get on and talk to a psych professor in California, or we're doing projects on South America and I can . . . talk to people in Brazil about what it's really like down there.

Students reported that their teachers involved them in communicating with students in other countries:

We sent e-mails to different people all over the world. We wrote to them and they wrote back telling us how their country was, how their school was, and we wrote back telling about ourselves. That was pretty fun.

Categories of Web Sites Teachers Used With Students

In addition to describing purposes for which they used Internet-based learning opportunities, teachers in the interviews discussed categories of Web sites they used with their students. These categories included tutorials, image manipulation sites, virtual science laboratories, simulations, on-line specimen collections, on-line databases, reference sites, Web sites coordinated with textbooks, news sites, and museum sites.

Tutorials. Teachers used tutorial Web sites to give their students opportunities to practice new learning, and to go back and recheck their learning, and relearn, if needed. Tutorials gave students a chance to have longer and repeated exposure to what they were learning in class. A graphic arts and communications teacher commented:

> *The tutorial would come along and it would have the voice, and the video would show you how it worked. It would actually show you using the PageMaker program, pulling it in: this is how you would wrap text. It's very helpful for the kids, because I can show them, and I do. I've got a projector and I hook it to my computer, and I'll show the kids. And you know, they don't remember. They can't possibly remember if they've seen it once, until they actually do it. And then they may need extra help* [which they can get] *by using the Web site.*

A math teacher used math tutorial Web sites to help students reinforce concepts and mathematical operations they were learning in class:

> *The other thing that I use it for is that there are a lot of good tutorials or places where there are Internet games or logic games that they can use. Those kinds of things I have the students do either as extra credit, or I say, "If you really need help with this and you don't have time to come in, you can do a tutorial on the computer."*

Image manipulation sites. Science and math teachers reported that they used Web sites that allowed them to track the movement of virtual phenomena, and to change the perspective of an image or drawing to allow students to see important features not visible in the laboratory or with other media:

> *I found a particular Web site that has what they call "physlets," but I think it's just a physics applet that they're calling physlets, but it's a little program that runs downloaded from the Web. . . . it allowed me to move things, and they can see real-time what happened. Like in the case of lenses and mirrors: if I move the object here, what does the image look like? It lets me slide things around. I would use one computer and our LCD projector so that all the kids could see at once what happens when you're at the focal point or beyond the focal point. Occasionally I'll stumble across things that allow me to demonstrate better than I could normally do with an overhead or a chalkboard.*
>
> *There is a site that shows an atom and the movement of the electrons around the electron shell.*
>
> *I did with my geometry class. I found a site that had perspective drawings and some real good perspectives and examples. You could see the vanishing points.*

Virtual science laboratories. Science teachers reported using Web sites at which students could experience a virtual science laboratory. Examples of such sites included a virtual earthquake, a virtual hurricane, a virtual pig dissection, a virtual fruit-fly genetics lab, and a virtual physics lab. Although teachers indicated that they did not think virtual laboratories could take the place of all real ones, they noted that virtual labs could be helpful when the students could not actually experience the real phenomenon (such as earthquakes and hurricanes) because of danger or inaccessibility, when they did not have enough equipment for an entire class, when the lab involved a material that was particularly difficult to control, and when students found dissections very distasteful:

> *We did a virtual earthquake lab. There was a virtual hurricane lab that we did off the Internet.*

> *If they don't like the dissecting, there are many interactive* [sites] *on the Internet, so they can see the same thing.*

Simulations. Teachers reported that simulations on the Internet were helpful in teaching. One of the values of the Internet in this regard was the modeling the simulation could provide in terms of showing the results of an action on some phenomena:

> *There is an earthquake simulation available through one of the universities in California.*

> *I have a couple of times done a simulation over the Internet. It is called Project Moonlink, in which students are simulating landing on the moon. Each person is controlling the spaceship with a separate control panel they have.*

Teachers also realized that students needed actual experiences, as well as the simulated kind the Internet could provide:

> *It is tempting to do simulation-type stuff where you push the button and see the results on a simulation, as opposed to actually doing it, and kids need both.*

On-line specimen collections. Science teachers reported finding Web sites that contained specimen sets that related to their curriculum. They reported that these sites were helpful to their students in acquiring and practicing skills in identifying and classifying specimens, and in developing their understanding of taxonomies and classes. A teacher who taught entomology used a specimen site to help his judging team prepare for competitions with teams from other schools:

> *There are even sites now that will let a small video scan around the bugs so you can see all different angles. So all that stuff is out there. . . . one site has 1,260 moth identification pictures, and it takes a while to boot that up, but it's a really nice, neat site.*

Teachers also used Web sites displaying rock specimens. One teacher reported having his students create such a site using the specimens they had collected and studied, and then use their site as a study tool:

> *In earth science the first semester, they did a huge project on rocks, on three different types of rocks, and they pulled information and pictures from the Internet.*

For the last weeks, they've been working on that rock collection. So it was a big chunk of their time. . . . all the stuff back there is on line . . . a lot of the neat ones are on there. Quicktime Virtual Reality where you can do 360 of them. The kids shot all that and put it on there [on the Internet].

On-line databases. Teachers used Web sites containing databases to give students experience in manipulating and analyzing data:

We can tap into almost any database we want, if you're working on climate, if we're working on animals . . .

Science teachers, in particular, reported that they used Web sites that allowed students to enter data, which was then graphed so that the students could see patterns in the data. Some of the sites that did such graphing were part of larger scale projects in which students around the world collected data and added it to the database at the site. Students thus gained experience in collecting, as well as analyzing, data:

We also have done a global water project. People from all over the U.S. and different countries go out and do all this water testing, and then everybody puts in data from where they were doing their data collections, their water sampling, and then you can compare.

I'm having the kids work with the cell sites, the Human Genome Project, and some research projects that are associated [with] *that. I'm trying at this point to get them to work on communicating with e-mail, and setting up with some of the data collection sites around the world. We have a high school data collection site.*

Other kinds of databases were used by social studies teachers to help students learn about other countries:

They use Discovering Nations and States, and they used SIRS government reporter. Each student was assigned a country, and they would look up [answers to] *questions that applied to the current day. Like what is the exchange rate? They had to look that up for money, and who is the current leader of the country. So these things were all obtained from Internet access on databases.*

Reference sites. Teachers reported having their students use on-line dictionaries and encyclopedias, as well as other reference sites related to the work students were doing:

When they are doing vocabulary, we use the Web for dictionary sources.

My yearbook kids use it. For example, they might be doing an article in there about the latest movies, and they'll mention an actor's name, Arnold Schwarzenegger for example, but we're not sure how to spell it. So I say, "go check Yahoo.com." I frankly don't know how people used to look up that kind of information before the Internet came around. So that's something I noticed in my first couple of years as a teacher, before we had Internet *access. Those are the kind of things that would come up all the time, the cultural references, where we don't know names or when a movie was released, and it used to be a lot harder to find that. Now it's so readily available that we can verify these things easily.*

Teachers mentioned that the encyclopedia sites on the Internet were especially helpful because of the multimedia presentations these sites offered:

I do use the on-line encyclopedias like Grolier and Americana. Those are nice, too, because you can access them and get more visual pictures and sounds and video. You get your multimedia presentation.

Web sites coordinated with textbooks. A number of teachers mentioned using Web sites provided by textbook publishers that contained activities coordinated with the textbook:

And the Spanish II text and materials that we use is Paso a Paso. *Scott-Foresman Publishing Company. They have a program that we use, and we access it through the Internet. I basically use it after every chapter to review. It's a different way to sit down and do a task. Students get immediate feedback, and then they have to go back and . . . the students enjoy that.*

Glencoe has a site that correlates with their book that we use, and they have a lot of interactive activities all lined up for me, so it's a time-saver. The kids can get into that one when they need to.

In addition, teachers reported that textbooks often recommended relevant Web sites that extended students' learning:

In computer science, it's a recent textbook, and all through the textbook are Web sites for both the AP and College Board, and for the author of the textbook. So . . . I'll have them go to the Web site and explore beyond what the textbook had, based on the references the textbook gives.

News sites. Teachers found news sites helpful for their own information:

It's also shown its effectiveness in allowing me to just check up on daily news.

Teachers of foreign languages used foreign news Web sites to expose students to everyday use of the language they were studying:

I use it to play around on the Web. Because I'm a French teacher, I like to look up the French newspaper. And then . . . I'll use articles from that for my students.

Foreign language teachers also found that their students' understanding of the culture of a country whose language they were studying and of U.S. culture was enhanced by having students read accounts of current events in the United States in on-line foreign newspapers:

When there was the Columbine massacre last year, the high school massacre, we looked up what the German daily press was saying about that, and that was very interesting to them.

Finally, language teachers found on-line newspapers and on-line radio news programs helpful in keeping their own language skills and understanding of the foreign culture they taught current:

I sometimes see daily news events in German newspapers. . . . Also, personally, probably two or three times a week for half an hour or so, I'll be working on something in my office, [and] *I will listen to a German news radio broadcast. And that's very nice because it's so hard to remember. You just get . . . the current issues and current language. It's hard to hear everyday language and that's been very nice.*

Museum sites. Teachers of history and art, in particular, mentioned museum sites as useful for exposing students to material that would be very difficult, if not impossible, to gain access to without the Internet:

I've found the New York Tenement Museum, which is a site that shows one house over a period of about 35 [or] *40 years. The museum is now lodged in this home, and you can access, room by room, the stories of the thousands of people who have lived in that one building over that period of time. Where else would you ever find that? So it has a uniqueness in a way that if I want to tell the immigration story, what better way!*

Museums are on line now. . . . For art, getting art images is really amazing because we can't go to the Louvre or the Prado, but we can . . . [through the Internet]. *You don't see the real thing, which could be better, but at least we can get the information and we can look at the pictures, and cheaply too. A lot of museums are putting up some pretty high-quality images now, which they weren't doing 5 years ago. That is amazing, as an art teacher, to have access to all of that.*

Kinds of Students With Whom Teachers Used Internet-Based Learning Opportunities

Teachers reported using the Internet in classes with all kinds of students—including those identified as gifted; advanced or honors students (e.g., students in advanced placement courses); English Language Learners; students needing special help developing their basic skills and study skills; and students with special learning needs. One math teacher who taught a wide range of students talked about using the Internet with all of them:

The honors geometry classes, which are the ones who use it the most probably, they've done a project on [the Internet]. *Then they're doing their end-of-year research project, and they're all using it. In my transition math class, we used it for a stock market project where they had to pick a company.*

<u>Gifted students.</u> Teachers in one of the schools with a particularly large gifted program reported that the Internet and other technologies were incorporated throughout their gifted curriculum, in all of the classes for gifted students. Students in this program created Web sites for use by teachers and students in other programs throughout the school:

> *We teach the kids to help develop projects, how to do Web pages. They can all write to code. They can also use a Web page editor. So we try to incorporate the lab* [the department's Internet-connected computer lab] *into every aspect of our curriculum. Any one of our classes involves some kind of technology. We've written it into all of our curricula, so that through the day the kids either go into our lab or, of course, all of them are on line at home. So they're able to develop things that they can use on their computers at home by accessing the Web pages we designed in Internet class.*

<u>Advanced students.</u> Most of the schools offered advanced placement courses, and some had honors sections of courses. Teachers of such courses frequently reported that their students were able to use the Internet to help themselves and their peers learn:

> *The Victorian Web has their interest. It has the information, and it presents it in a way that Brown University developed. Maybe not all high school students could appreciate it and enjoy it, but I'm working with some advanced students, and it is the trick.*

> *I have just a little tutorial page . . . I give it to my AP students. . . . if they really like working with the computer better than a book, there are some sites that are nice structural backups. One of the sites at University of Wisconsin. . . . Another one is the Fordham University.*

> *In terms of our honors algebra II students. . . . We had them do a research topic where the students looked up the use of algorithms and their applications in other forms of mathematics. We also had them look up trig functions, and we had them look at trig functions as compared to how you would use trig in other courses, such as analysis, calculus, and how they relate to other formulas. And we found that a lot of students were able to go in there* [to the Internet] *and pull together information and share that with other students and derive equations for it.*

<u>English Language Learners.</u> Teachers of English Language Learners (English as a Second Language [ESL] students) across schools reported using the Internet to help their students learn language, as well as school-subject content:

> *I think it's good because I've gotten a lot of information for ESL; for instance, using games in the classroom.*

> *I designed a project for my ESL . . . students. For this WebQuest, they had to plan a celebration in a different country, and I wanted them to be able to use the English that they know and take it from the Internet.*

> *They produced booklets. They got pictures through the Web, and then they got information from the Web, and then they wrote it in their own words, which was really difficult for intermediate* [ESL] *students. They came up with a two-page essay and included the sources.*

Students needing special help developing their basic skills, study skills, and test-taking skills. Teachers reported using the Internet to help their students who needed extra work in basic skills areas or who needed help with their study skills. Teachers who worked with students needing these kinds of assistance reported using drill and practice sites:

> *Math. There's a site in Sweden that has math flash cards. I have a lot of kids who are very poor in their basic skills, so I get them on there as a sponge activity to pull up that site. They get a hundred problems.*

> *It's KidClicks drawing, and it has a lot of animation on it. This is the other one that I plan on using for English. You put it on your G: drive, and kids can click it and then they can do it right then and there. They have great little reviews on grammar, and each week is themed. My kids have to work on spelling and punctuation. They just do not have the skills.*

Other teachers reported that they used the Internet to help students who needed to develop study skills and test-taking skills:

> *The students in study skills . . . They are on line and they can quiz themselves, so they use that in our classroom, in the study skills classroom.*

> *I also would take study skills information from a variety of college and university Web sites. Effective studying for tests or test-taking skills.*

Students with special needs. Teachers also used the Internet with students who had various kinds of special needs that affected learning:

> *It's using the Web for research. For example . . . my ELD students are doing a research project now about biography. And so they went to the library and learned how to use resources in the library like Electric Library and one or two other resources. And then we also have access to Encyclopedia Britannica* [on line].

> *We took the geography kids* [in special education] *to the computer lab, and we did a lesson on satellite photos, and I showed them the terra server. I don't know if you've ever been there, but it's pretty neat. It's Microsoft's terra server. It's actual shots of the earth, and I was able to show them what does a satellite photo of the earth look like. You've got these ideas of what it looks like from the movies. Well, let's go look at a real one. And we were able to go through and show them things like the Statue of Liberty, the arch in St. Louis, the old stadium before they plowed it down, with some of the archives photos.*

Discussion

Teachers identified a wide range of on-line learning opportunities they regarded as useful to them or for their students. Clearly, the Technology Innovation Challenge Grant Program was important in two of these schools—both in providing opportunities for teachers to develop on-line learning opportunities for themselves and other teachers, and in finding useful resources developed by others. It was surprising that school personnel did not know about Technology Innovation Challenge Grant projects beyond those they were directly involved in, since there is a Web site that lists and describes all of these projects. In some interviews, school staff mentioned that they foresaw or wished for a resource that they described as being much like the Virtual High School, but, when asked, said they were not aware of the Virtual High School. The one school that was involved in Technology Innovation Challenge Grant projects beyond their own was in a state that was reported to have encouraged schools to get involved in using these products. This suggests a need for wider dissemination of information about the Technology Innovation Challenge Grant project products to states, schools, and school districts in ways that will capture their attention.

Web pages that provide teachers with links to resources that have been screened for quality and relevance save teachers' time and make finding Internet-based resources convenient. Listservs also can perform this function. Virtual communities offer learning opportunities to teachers that they would not otherwise have, and do so with minimal cost, time, and effort on the teacher's part. On-line classes and programs make learning opportunities available to teachers where they are, enabling them to pursue learning in areas of interest to them without the inconvenience and cost of travel. Search engines are perceived by teachers as useful, particularly to teachers who are reasonably skilled in using them and thus able to find sites relevant to an interest or question without having to sort out too many irrelevant sites. Web sites that helped teachers learn to make Web pages and Web sites, and use other Internet-based technologies in their teaching, and sites that assisted teachers with other aspects of their teaching, were also perceived as useful.

One of the most striking things about the patterns of participation by teachers and students in Internet-based learning opportunities can be captured in one word: *variety*. Rates of participation in Internet-based technologies and frequencies of use varied considerably among both teachers and students. Teachers and students both used the Internet for a wide variety of purposes, ranging from simply obtaining information to creating something new. Exploration, preparation, self-assessment, and product creation were all purposes for which teachers had students use various kinds of Internet-based learning opportunities. In addition, both teachers and students used the Internet as a vehicle to share their creations with others and to communicate with others. Teachers also used Internet material in creating lessons, which, when taught, involved students in examining or using the Internet-based material. Finally, teachers used the Internet to manage student behavior, as a reward, or as a way to reduce the potential for discipline problems.

The categories of Web sites that teachers used with their students also reflected variety. Teachers used tutorial sites that helped students get acquainted with a new concept, operation, skill, or product. Image manipulation sites helped students understand concepts. Virtual science-laboratory sites provided laboratory experiences for students. Simulations gave students experiences they otherwise could not have. Database sites helped students learn to manipulate data, and some gave students opportunities to contribute data. Reference sites such as dictionaries and encyclopedias were used for reference, and on-line specimen collections were used to hone identification skills. Many textbooks provided Web sites coordinated with the book. News sites and museum sites extended teachers' and students' experiences beyond the classroom.

Teachers across the curriculum used Internet-based learning opportunities. Some purposes and learning opportunities were specific to certain subjects, while others were reported by teachers in many subject areas. For example, virtual science laboratories and image manipulation sites were used by science teachers, whereas databases and tutorials were used by teachers across subject areas. Foreign news sites were typically used by language teachers. Museum sites were most often used by social studies, history, and art teachers. Web sites coordinated with textbooks were used by teachers in a variety of subject areas to expand students' learning experiences beyond the textbook or to review textbook material. Preparation for laboratories was a purpose almost exclusively limited to science teachers. In contrast, career exploration was a purpose noted by teachers across the curriculum, as was obtaining information, creating products, providing on-line learning opportunities for others, and creating simulations. The pervasiveness of on-line career exploration across the curriculum may reflect the influence of the SCANS report and other documents that have urged all teachers to assume responsibility in this area.

Learning-focused uses of the Internet that students reported in the focus group interviews emphasized communication—with friends, with experts around the world, and with students in other schools and other countries. These learning opportunities were linked to a specific subject area to some extent. For example, students who reported communicating with students in other countries were taking foreign language classes.

Regarding the kinds of students with whom teachers used Internet-based learning opportunities, the pattern was, again, variety. Teachers used Internet-based learning opportunities with students who excelled at learning in school and did so easily, and with students who faced a variety of learning challenges. Teachers had found Internet-based learning opportunities that were appropriate and useful for a range of students.

Conclusions, Implications, and Recommendations

Conclusions

- E-mail and the World Wide Web are the Internet-based technologies used by the most teachers and students. Videoconferencing is used by the fewest teachers and students.

- Internet use by students and teachers is ubiquitous, although for some students and teachers it may be infrequent.

- Frequency of classroom use of the Internet by teachers and students varies widely. Teachers use the Internet for their own personal and professional use much more frequently than they use the Internet in the classroom or have their students do so.

- Internet resources used by teachers and students are highly varied and serve a broad range of subject-area and student needs and teacher and student purposes.

- The most frequent purposes for Internet use in school by both teachers and students are to obtain information, work on projects, seek expertise, and communicate with others.

- Teachers use the Internet to help them update their knowledge; create assignments; locate lesson ideas and plans; enhance their lessons with photos, graphics, and video; and manage student behavior. Teachers have students use the Internet for exploration, preparation, self-assessment, communication, and creation of products.

- Teachers in both academic and career-and-technical-education subjects are using the Internet to help students learn about careers.

- Students of all ability levels and with varying special learning needs use the Internet in school.

- Products resulting from the federal Technology Innovation Challenge Grant Program are useful to teachers and schools.

- Many of the on-line learning opportunities teachers perceive as useful are Web sites at which links to high-quality Web-based resources relevant to teachers' subject areas are compiled.

- The Internet extends expertise, courses, and programs to teachers where they are, overcoming or diminishing barriers of time, cost, and distance in accessing these resources.

- The search capacities of the Internet are useful to teachers if they are skilled in using them.

- Web sites focused on technology and other teaching-related topics help teachers who know how to reach them integrate the Internet into their teaching and increase their teaching expertise.

Implications

- Because of the variety of resources it provides, the Internet is likely to be in demand by teachers and students across the curriculum. To take advantage of these resources, departments throughout the school need access to the Internet. If these demands are to be met, adequate resources to supply schools with the computers and infrastructure required by the Internet will be needed.

- The Internet's potential for career exploration, assignments, and projects (e.g., the *Occupational Outlook Handbook* and the Strong Interest Inventory) is likely to be of interest not just to career and technical education programs, but to other programs as well.

Recommendations

- State education agencies should make efforts to inform school district personnel about Technology Innovation Challenge Grant products. Similarly, teacher education programs in colleges and universities should make preservice teachers and administrators aware of these resources.

- Those working to help teachers integrate the Internet in their teaching should connect teachers with listservs, news groups, and Web sites that provide links to Web-based resources relevant to teachers' work.

- Higher education institutions, professional groups, agencies, and businesses should work to find ways to make expertise, courses, and programs available to teachers on line.

- Efforts aimed at developing teachers' capacities to use the Internet should include opportunities for teachers to become familiar with specific Web sites relevant to their work, kinds of educational purposes the Internet might serve, the types of on-line learning opportunities available, Internet-based learning opportunities appropriate for students, and products useful to teachers and schools resulting from the Technology Innovation Challenge Grant Program.

CHAPTER 4: WHY TEACHERS AND STUDENTS USE THE INTERNET

Teachers and students were asked in interviews to share their reasons for using the Internet, particularly in their educational pursuits. Thirteen reasons emerged from the interviews and were highly consistent across the five schools.

Teachers spoke about their reasons for their own use of the Internet, their reasons for engaging their students in using the Internet, and reasons they had observed for their students' use of the Internet. Teachers' reasons for using the Internet typically had to do with the nature of the Internet, its perceived superiority on some dimension compared to alternatives, with the results that it produced, or with their sense of need to use it and to engage their students in using it. Teachers reported using the Internet because they viewed it as current, comprehensive, fast, convenient, efficient (saving time, effort, and money), reflective of the real world, and fun and rewarding to use. It provided material unavailable elsewhere, gave them an opportunity to share their original work with a broad audience, and facilitated their communication with each other, with their students, and with parents. They perceived it as broadening their own and their students' abilities and perspectives, and believed that it was becoming a part of the fabric of life and culture.

Students' reasons for using the Internet were similar to those of teachers. Students saw the Internet as comprehensive, convenient, and fast, and as a way to facilitate communication. Students felt dependent on the Internet and used it both out of personal interest and because they needed it to complete school assignments.

Perceived Advantages of Internet-Based Learning

Currency

Teachers viewed the Internet as having up-to-date material that was more current than books and libraries:

> *The Internet gives you . . . freshness, that "right now" immediacy that you don't get with the other things, even books. I mean, by the time you get a book, it's old.*

> *Some of the Internet sites obviously have more up-to-date information than what we have here in the library.*

> *The Internet is going to give immediate factual information on what the career or area is doing now.*

Students interviewed echoed these views:

> *Everything's more up to date than if you went to an encyclopedia or something.*

> *Books can be outdated. . . .* [On the Internet] *you can get stuff that was updated yesterday.*

Uniqueness

Teachers remarked that some material on the Internet was not available to students anywhere else:

> *Now they do use it because there's some stuff on the Internet that's not printed in any books.*

> *It has definitely given them new information and new perceptions that they wouldn't have had otherwise.*

> *If you look long enough, carefully enough, you really can find the enrichment and perhaps the depth, the rigor that you can find no place else.*

Comprehensiveness

One of the reasons teachers gave most often for using the Internet was its innumerable resources on a seemingly infinite number of topics. Teachers indicated that they saw the Internet as containing a wide range, as well as a large volume, of material:

> *It has such an abundance of information. It's the best resource I can think of on any subject matter that you would want to look up or get any information from.*

> *Just an immense amount of information. . . . You can print it out, you've got pictures, all kinds of things.*

> *There are multitudes of things to look up and to seek out and to find. . . . as a research tool, there's really no limit.*

Because of its comprehensiveness, the Internet was viewed by teachers as useful in filling gaps in their schools' resource centers:

> *It can expand the learning facility as far as the references we already have here at the school. For instance, especially in my area, perhaps the library doesn't have as good a selection on architecture or parenting as they do on some of the great works of English authors.*

Students, too, were impressed by the Internet's rich array of useful resources. Although many students said they used the Internet instead of books for this reason, some students reported using it to supplement books:

> *And also we have different options, not just one, not just one book or one page. We type in the topic and find all these Web pages where they can be related to what we are looking for.*

> *If you just click up the Web site, you've got all the information you need, because it has been gathered there by a bunch of people. You've got all the information you need instead of going through the library looking for books, and then you have to read the book to find the information you want.*

It makes researching a lot easier. . . . sure, the library is a great resource tool and I use it all the time, but the Internet is so broad that you can really touch and access stuff, and if you're looking for something that is different, it's hard to find that in a library because there are only so many books. But the Internet, it's large.

Resemblance to the Real World

Teachers used the Internet because they perceived it to pertain to the real world in ways beneficial to their students. Several contrasted the Internet with textbooks in this regard:

I frequently do use the Internet for getting access to information, not necessarily like that from our textbook, but from what I call real-world resources, not educational resources.

It was possible to go on the Internet and find out what was happening somewhere in the world at the moment. Teachers liked to use the Internet because it gave their students a glimpse of the real world beyond their classroom and helped them develop capacities for living in that world:

I think it just makes them much more capable in the real world. . . . I think it enhances their ability for life in the real world.

I think a lot of them discover that what we teach in the classroom is not something so obscure that you only find it in that room. They'll find references to it elsewhere all over the Internet, and so they begin to get a better idea of the worldliness of what we're teaching. The real world is generally kept out of the classroom, but the Internet allows us a glimpse.

Speed

Teachers frequently mentioned the ability of the Internet to provide information quickly as a reason for using it:

It gives them access to all kinds of information very quickly.

They also often favorably compared the speed of the Internet to that of other resources in accomplishing tasks:

It's faster because you can go direct to the source. . . . It is much faster than flipping the pages in a book. You're visually more able to cover more material faster than you are in a book.

It gives me time to do a lot more things because it doesn't take as much time to do the research.

Students made similar comments on the speed of the Internet:

You don't have to wait.

It's faster, and I can access information faster, instead of having to look for the right book and then look for the right part of the book. I just click in the question . . . and there are like 70 different answers that are all the same but they are in different styles.

Ease of Use and Convenience

Teachers observed that the Internet was easy to get to and use, and that they didn't need to go beyond their school or home in order to find information they needed:

I'm on it every day here at school during planning and lunch, usually. I mean, it's the easiest tool to use for research. It doesn't require going anywhere. The lab is right next door to my class. So it's out of convenience more than anything.

If you want information now, you don't even have to leave your home or the school.

Students had similar perspectives on the Internet's ease of use and convenience:

I think we all use the Internet because it's quick and it's easy and straightforward. . . . I think it's a lot easier than having to go back and forth to the library . . . It's easier when you don't have to go out.

A number of teachers mentioned the ease and convenience of the Internet in relation to traditional alternatives:

On the Internet you can search for what you want and . . . you don't have to dig through a bunch of books and everything. It's right there.

Students nowadays enjoy the process of research on the Net. It is easier. A certain tenacity was required to do research up until about 5 years ago. Now it's much easier to do. Now I like that tenacity, and I have it, and you probably have it too. Now it's a lot easier. You don't need as much tenacity.

What you retrieve is a lot better on the Internet than it would be through a book. You are able to categorize stuff, get your sources, print it out instead of having to go to the copy machine and copy and turn the pages and dig and skim. In our fast-paced society, it helps the children as they become more fast paced.

Students also pointed out that using the Internet was less complex than looking for information in books:

With the Internet, we see bullet notes that help us more than just reading the whole book and not knowing what we are reading. If we're on a Web page or Web site, we read and see the bullet notes, and if we like the link, we go to the different things they have. Reading the whole book and not knowing exactly what we are looking for [isn't as good as] *if we go to the Internet, pull up the topic we are looking for, and we find it right away.*

> *Everything is right there instead of having to go to the library and looking at all the different sections and then searching through the books.*

Several teachers also expressed appreciation for the fact that the Internet was available 24 hours a day to accommodate their own needs and patterns:

> *I go find stuff after hours. . . . I'm a night owl.*

> *I especially like it because if you get kind of an obsessive thought, you think about it, you're mulling over it, and you're wondering, and it's just gnawing at you. In the middle of the night, you can get up, get on the Internet, and start looking.*

> *You can just sit at home and* [use the Internet] *at 3 in the morning if you need to.*

Efficiency in Saving Time, Effort, and Money

Teachers used the Internet because its efficiency saved them time, effort, and money. It allowed them to avoid some steps otherwise needed. They found that using the Internet to get information took less time and energy for both students and teachers, and was less expensive than other resources.

Teachers said that the Internet saved them effort because they could use material they found there rather than developing their own, and because they and their students could find what they needed on the Internet instead of going to the library or making phone calls:

> *The different lesson plans are showing up on the computer, too, so that you can get those things and not have to do it yourself.*

> *You can just copy a certain part and not have to mess with the rest of it that you're not interested in.*

> *I think it's less time-consuming, perhaps, to use it for me personally, instead of going to the library and looking through a bunch of books and the catalogue and so forth.*

> *It's a wonderful resource of information at your fingertips. . . . I use it personally . . . for getting information . . . that normally you would have to make four phone calls for. I can go and type* [the Internet] *up in 5 minutes, and have it at home and print it out if I need it.*

In addition, teachers could send documents over the Internet, rather than transporting disks and converting files on disks:

> *I don't have to drive to her house or send a disk in the mail, so that is a huge convenience. In addition, I don't have to deal with a disk and converting all this stuff.*

The Internet also saved them and their school money, according to teachers, because it provided many things free of charge, some of which would cost a considerable amount if obtained elsewhere:

Handy access there, and a lot of the stuff is free.

I don't have to go out and buy a $75 art book to get information. It's a lot cheaper to get information and look at images on the Web than it is to go to the bookstore and buy a really expensive art book.

Being able to access the Internet's wealth of material from home avoided the cost of transportation and parking:

It makes it easier to access information . . . than having to drive down to the public library and trying to find a parking spot. And I get [parking] *tickets every time I go down there because there's no place to park.*

Students who borrowed books from the library and didn't return them on time saw the Internet as saving them from having to depend on library resources and paying overdue fines:

You don't have to have a library card and worry about overdue books ('cause I forget them sometimes), 'cause I don't like to pay fines.

Enjoyment

Teachers saw the Internet as a medium both they and their students enjoyed:

It's like being a kid in a candy store—not just the use of the Internet, but I get excited about all the little gidgits and gadgets that come along with it.

I think kids enjoy the assignments we give them that are Web-based.

I think they like it better because it's a little bit more fun . . . they will have a good time on the Internet.

I think that most kids . . . seem to enjoy the Internet projects versus being in a book or doing a project out of a book. I like it better too.

Broadening of Students' Awareness

Teachers felt that the Internet extended their students' horizons by exposing them to different perspectives and points of view, and a wide array of careers, resources, and places:

And the Internet, by far, opens up wide, vast arrays of knowledge.

"Go home and find something on this topic." It is not one site. You might have 25 sites that kids can go to. It just opens up the world to a lot of kids.

I think that because they can access information, more types of information, there is maybe a broader knowledge base that they can get to.

Using the Internet in school also helped students become aware of useful resources that they might otherwise not know or learn about:

There are some pages out there that they would never find. Like that ProQuest page. That really is a wonderful source. So that's important. And that's primarily the reason I use it is because it gets them to some sources that they . . . might otherwise have no access to.

One specific way in which the Internet broadened students' horizons was by removing geographical barriers that prevented students from being exposed to perspectives and places beyond their own community:

It is a socioeconomic factor too. I think that these kids aren't exposed to much beyond their neighborhoods. A couple of weeks ago, I did a travel [unit]. *They had to choose a country and learn about* [it]*, and the Internet is great for that. . . . You can learn everything you want about a country.*

The whole world is open now, so you're not stuck in your little spot anymore. The whole world's open.

It broadens their scope. That's the first thing it does. So many times in a small community like this, we're very isolated. And you don't have a chance to see the world beyond your little community.

Teachers felt that the Internet helped students to realize how many different views there can be about one thing, and to learn to appreciate the value of exploring diverse views:

You know, where kids can see different perspectives. Religious . . . scientific . . . the general [population]*, what they think. So, I can support with newspaper articles and magazines, but Internet makes the variety much more accessible.*

For student learning I think there are a lot of great benefits because they're really able to get information from a much broader perspective. They're able to go to Web sites that people have put up saying "this is who I am and this is what I do." So they're able to get information about a variety of things, but from other people's perspectives too, and not strictly a neutral academic perspective, which is what you would get when you have just your typical reference materials. Sometimes it's good to have kids see some other people's perspectives and to see that the world is bigger than their own experience.

Expansion of Teachers' Knowledge and Skills

Teachers also found their own skills and knowledge broadened by what the Internet offered:

I use it every day for research like everyone else, to better myself on the topics that I teach.

Because I feel like to stay on top of it, I need to be there. I need to do it . . . daily. I'm sure that's probably true in most professions. But when you're in education, there are so many different directions you need to be able to go, and the Internet really opens that up for you.

I think it's made me more in touch with what's happening, both news-wise and developments in my area, but also movement within education.

I find, for my own personal use, that the Internet is such a great resource, a great way to gain access to so much information and so many different perspectives.

Sharing Original Work With a Broad Audience

Teachers reported placing their own original work, including lesson plans and other materials they had developed, on the World Wide Web so that they would be available to other teachers in their school, their district, and beyond. Some of the schools and/or the school districts compiled and maintained a database of lessons accessible to teachers within and outside their system:

More teachers are becoming more comfortable, and they are willing to share and get it out on the Web.

These are posted on the Web, and I do ones having to do with biology and rain science, so other teachers have access to them. They're put on a database that other teachers can access. They're like lesson plans that we share.

It's easier to share amongst teachers across the country. . . . So it allows us to share more. I think there's a better sharing of materials.

Facilitation of Communication

Teachers spoke about how they appreciated the ability of e-mail to ease the complications of communication. They appreciated the convenience, efficiency, and flexibility that the Internet brought to communicating with others:

With e-mail, it's so simple and so easy to respond back and ask for information or to share what's going on.

You just send a message, and the next minute you have the answer, and it is cheaper than calling on the phone.

Something comes up, you have to e-mail someone. So, it's helped me a great deal to communicate. I can't always get on the telephone.

A work-study coordinator used e-mail to contact employers who provided internships for students because e-mail was nonintrusive, and thereby helped maintain positive relationships with these employers:

I prefer to e-mail the Human Resources people in the businesses I work with, because it is not intrusive. I can remind them without their feeling like I am bugging them. So, it helps me maintain positive rapport with employers.

Teachers reported that their students were able to gain access to experts through e-mail who would not otherwise be so readily available:

She could actually talk to, present questions to, experts and they'll answer back. [To] . . . *have the opportunity to talk to an expert in that field, it might take months to do that. And she did it in a couple hours.*

Teachers were also readily able to get feedback from their colleagues, or answer colleagues' or parents' questions:

Well, again I probably am referring here to e-mail. I use that all the time. . . . It [the Internet] *is wonderful for that. Just getting a quick answer, and there it sits on the other person's computer and it won't get lost until that person deletes it.*

Students, too, used the Internet to facilitate communication, especially with their friends. They appreciated being able to communicate with several friends at once, as in a chat room or instant messenger service:

Now you can talk to 10 people at the same time. No problem at all.

In chat rooms and instant messages, you can talk. If you're trying to get your plans together for the night, or whatever, and you've got your friends on line, you can talk to all of them at the same time and figure out whatever your friends want to do.

Students also appreciated the instant and effective delivery of messages:

You can talk to people across the world about anything. . . . It's easy and you don't have to wait 6 months.

You can write a note to your friend. It helps you get in touch with them when you are sending them e-mail with the computer, and you don't have to worry about it getting lost in the mail or not getting there.

Finally, students appreciated the cost savings that they felt Internet-based communication made possible, compared to alternative forms of communication:

I used to call my friend every day out in LA, and my girlfriend's and my phone bills would stack up, and my parents said, "Buy a cell phone and pay for it yourself." Six or 7 months ago, I had a bill that was $800 just from using my phone, and now I pay $20 a month for Internet access. I just use the instant messengers, and you don't have to call your friend, and it's almost like free. Same as talking on the phone.

Because the Internet made it possible to communicate with a group all at once, the schools and teachers used e-mail to distribute information, such as announcements and bulletins. Teachers reported that this practice helped them stay informed about what was happening in their building and with their students, as well as notify other teachers about meetings and student trips:

In the school, most of the announcements and information is through e-mail. So anything that is really important we get through e-mail.

Our "do not admit" list is posted on it every day. That's students who've been suspended or dismissed that we don't allow into our classroom unless they come in with a parent.

Department heads can access all, everybody in the department, by just putting in a memo, and it goes to everyone.

We're going on a field trip tomorrow, and it's going to be real nice to be able to tell the staff, "These are the students who are not going to be in your classes tomorrow."

Every Thursday with the e-mail I remind the science department that we're having a meeting. Just little things like that, which are really huge in the big picture. So, communication-wise, it's been really good.

Teachers with responsibilities in professional organizations could communicate readily and easily with members of the organization through listservs and Web sites:

I can communicate with a large number of people very quickly and get the information out, like through a listserv.

There are several Web sites that I work from in order to disseminate information, as president of the local organization.

I host a couple of listservs for teachers throughout the state on science and computers.

Teachers made frequent use of the Internet to stay connected to students and parents. E-mail communication and the Web were also helpful ways for the school to keep parents informed about school events and activities, and to alert students and their parents to new information. Web pages made it possible to continually update information:

It's a constant source of information. We put all of our advisement information on it, all of our college advisement information, everything like that goes on that [Web] *page.*

We do a little school e-mail home every week for all of our kids and all of our parents. It's just general information, what's going on.

Some schools and teachers had Web pages that not only kept parents informed, but also allowed parents to e-mail school representatives and teachers right from the school's Web page:

Parents, through the Internet, can e-mail me without even knowing my e-mail address. Just click on the icon or the graphics.

We also have another home page that a lot of our parents use as a startup page. That's updated every day. It includes all school information. . . . We send home stuff to the parents over this. . . . We get so many comments from the parents because they can e-mail us directly off the page.

Teachers encouraged parents to contact them by verbally inviting them to e-mail, and by giving parents their e-mail address:

Next year I'll encourage them again: "E-mail me as often as you want. I check that daily." . . . Parents then feel like they have contact with teachers, and then . . . it's a dialogue.

I've gotten a lot of e-mail from parents this year. When I put up my e-mail [address] *on back-to-school night, almost everyone started writing it down. And it was really beneficial.*

What I find most valuable to me is the communications opportunity of parents e-mailing me. I give them my e-mail address. I ask parents to give me theirs. Some don't have them, obviously, but I had, for example, a meeting this morning. A parent e-mailed me yesterday, wanted to know if she could set up an appointment to talk about her daughter.

Teachers felt that e-mail allowed them to respond to parents faster than using the phone, and that posting information for parents on a Web site saved teachers time:

If some parent e-mails me, "I'm worried about so-and-so in class. How are they doing?" I can look right away and send, "Okay, maybe we should talk," or "They're doing okay." Phone calls . . .you get the phone call. By the time you get back to them, it might be 2 or 3 days later. It loses the impact.

Instead of having 20 parents calling you and wanting you to tell them the homework, "Go to this Web site and find out what the homework is."

Teachers also gave students opportunities to contact them through e-mail:

I give all my kids my e-mail [address] *so they can* [ask]*, "Hey, what's going on here that I need to do with this homework assignment?" or, "I'm going to be absent tomorrow. Is there anything I should read before I come to class again?" So . . . it's on every syllabus that I've ever given any kid, so they can get in touch with me at any time.*

Teachers in schools with students for whom English was a second language sometimes got help in understanding a student from Internet translation:

This class was beginning English. I don't understand their language, so I found from the Internet. . . . I can get the Web site . . . to translate for some Latino students, and for Vietnamese, I can get the same thing. We can work together.

<u>An Accepted, Expected, and Even Demanded Part of Our Culture</u>

Teachers conveyed the sense that today the use of computers and telecommunication via the Internet are considered basic skills in popular, workplace, and educational culture:

I think it's been very healthy. I've been here for the past 3 years, and every year there's more access, more technology, almost like being immersed in it. It's pretty much the way our society is.

I just wish all the kids could have the opportunity of getting to know this. Knowing how to use the Internet is like knowing how to read or write. It's such an essential part of our life.

Teachers saw the Internet as having become a common tool in the United States for obtaining information and communicating in the workplace:

I really do see it becoming an important part of everyday living in the workaday world, and so I just really do feel the kids have to be at home with it.

I work with a lot of employers, business personnel, and they will often tell me that the students I send them are so comfortable with it [computer technology and the Internet]. *I think that our students are learning to be more comfortable with it when they are younger and younger. It's just part of their life now.*

Teachers believed that their students would be cheated if their educational experience did not expose them to the Internet and develop their skills in using it:

And so, for me, I would feel like maybe then I would be cheating my students. . . . I just feel like I wouldn't be able to give them all that they need, if I didn't have those [Internet] *resources.*

Teachers saw themselves as becoming dependent on the Internet, and the Internet as becoming interwoven with life and culture:

How did we live before? How did people live without cars? I have become very dependent on the Internet. When the system is down, we panic.

Students also reported becoming dependent on the Internet:

I don't know how people can do their projects without the Internet.

Discussion

Some of the teachers' and students' reasons for using the Internet were based on the Internet's superiority in some way to alternative resources for doing what they needed or wanted to do. The Internet made their tasks or communication easier, more convenient, or more efficient in terms of time, effort, or money, or in providing more of what they were looking for than other media. They perceived the Internet as providing more comprehensive and more up-to-date material than alternative sources.

Other reasons for use of the Internet reflected the nature of what teachers and students perceived that they received from the Internet. They experienced pleasure in using the Internet; they saw using it as fun. They received ideas and materials that were helpful to them in their work and life, that enriched them in some way, that helped them improve the quality of what they were able to do. For example, teachers felt that their own skills and knowledge were enhanced by what they received from the Internet, and that the Internet helped them connect their students with the real world beyond school. Through the Internet, teachers and students saw themselves as having access to resources and opportunities that they could not get any other way. They were able to do things they had not been able to do before.

Teachers and students also used the Internet because it was "the thing to do." Teachers felt caught up in a trend they wanted to, or felt they should, be a part of. If they were not part of the trend, they felt guilty. They feared being behind the times, or even that they or their students would not be as successful in the culture, in education, and in the work world, if they did not become skilled Internet users.

Conclusions, Implications, and Recommendations

Conclusions

- The reasons given by teachers and students for using the Internet reflect the benefits they see in its use.
- Provided that resources allow it, use of the Internet is likely to increase, because it is consistent with and reflects values predominant in the culture, and addresses basic human needs and desires.
    - The convenience, speed, and efficiency ascribed to the Internet are highly valued in U.S. culture. Because of its comprehensiveness, the Internet is a one-stop entity where many needs can be met.
    - Being an Internet user helps one feel in step with the culture and the direction in which it is moving. Teachers felt that they had a responsibility to use the Internet in their teaching because of trends they perceived in the broader society.
    - The Internet helps teachers be up to date, to feel that they have the most current information available. In U.S. culture, being "out of date" is anathema.

- The Internet allowed teachers to do what they needed to do, to meet their environment's demands and overcome its obstacles, which gave them a sense of efficacy in dealing with their environments.

- Because teachers saw the Internet as widely accepted, by using it and supporting its use by their students, they addressed a basic human need for acceptance by others.

- The communication capacities of the Internet address a basic human need for social interaction. E-mail, chat rooms, and instant messaging all represent expanded opportunities for human interaction.

- The characterization of Internet use as fun and unique reflects the human appeal of pleasure and novelty.

- The Internet's ability to remove barriers to access to information can be a significant step toward equalizing educational opportunities across schools, teachers, and students—no matter where they are located. The Internet removes limitations associated with traditional information repositories, such as libraries. Specifically, it is available 24 hours a day, does not require travel to a different location, and allows continual updating.

- The Internet expands the avenues available for parent-school communication.

- The ability of the Internet to expand students' exposure to the real world, including places they couldn't easily travel to and experiences they couldn't safely have otherwise, seems to offer an educational advantage, as long as the Internet does not replace their opportunities to directly experience real-world contexts accessible to them.

- The opportunity the Internet gives teachers to share their work has the potential to help teachers benefit from each other's work and receive recognition for their work.

Implications

- Because the reasons given for use of the Internet by teachers and students reflect predominant societal values and basic human needs and desires, any one of them could be sufficient to persuade someone to become an Internet user, and together, they represent powerful inducements to become involved with the Internet. Understanding why people use the Internet helps explain why it has become relatively ubiquitous in a few years' time, and suggests that its distribution across schools and homes is likely to continue.

- The potential of the Internet for aiding home-school communication is significant, and raises concern about inequities between parents who have access to the Internet and those who do not. School access to the Internet may alleviate lack of access among students, but does not address inequities among parents in their opportunities to connect with school personnel through this means, nor the additional student study hours that home-access may provide.

Recommendations

- Research on Internet-based teaching should examine the potential of the Internet to infuse the real world into the classroom. Career- and technical-education programs that have traditionally emphasized real-world experience provide an excellent context for exploring potential contributions and limitations of the Internet to expand this dimension in students' learning experience.

- Those responsible for providing teacher training regarding integration of the Internet should assist teachers in exploring and capitalizing on the potential of the Internet to infuse multiple perspectives and the real world into the classroom .

- Ways should be found to extend parents' access to the Internet in order to increase their access to their children's school information and personnel.

CHAPTER 5: INFLUENCES ON THE USE OF INTERNET-BASED LEARNING OPPORTUNITIES BY TEACHERS AND STUDENTS

Teachers and students asked in the interviews about what had facilitated their school-based use of the Internet and what had hindered it identified more factors that hindered use than facilitated it. Furthermore, factors were interrelated. When they did not have access to the Internet (a barrier to Internet use), it was hard to gain experience with it (experience facilitated further use). This chapter discusses the influences on Internet use that emerged from the interviews with teachers and students, and presents information related to these influences that was obtained from the questionnaires that teachers and students completed.

Factors That Encouraged Teachers' and Students' Use of the Internet

Seven variables encouraged or facilitated teachers' and students' use of the Internet in their educational pursuits: (a) access to Internet-connected computers; (b) access to a high-speed network; (c) technical and curricular support and training; (d) positive experiences, comfort, and familiarity with the Internet; (e) administrative support, encouragement, and commitment to technology integration; (f) grants received; and (g) a supportive, knowledgeable family.

Access to Internet-Connected Computers

Not surprisingly, access to the Internet was a determining factor in teachers' and students' use of it. The survey questionnaires asked teachers and students to report where they gained access to the Internet. These data, reported in Table 12, show that the majority of teacher and student respondents gained access to the Internet at home and at school. A higher percentage of teachers reported gaining access at school than at home, but for students, a higher percentage gained access to the Internet at home than at school. More than one fifth of the student respondents reported gaining access to the Internet at the community library.

Table 12

Locations at Which Teacher- and Student-Respondents Gained Access to the Internet

	Number	%
Teachers		
School	307	95
Home	265	82
Community library	27	8
Any other place	24	7
Cyber cafe	3	1
Students		
Home	3,002	79
School	2,768	72
Community library	846	22
Any other place	303	8
Cyber cafe	101	3

Because the schools differed in interesting and informative ways concerning teachers' and students' access to the Internet, comparative data across the five study schools are presented in Figures 1 and 2. Figure 1 shows that similar proportions (90–100%) of teacher respondents across the schools reported having Internet access at school. Teacher home access, however, differed more among the schools (74–91%). The lowest proportions of teachers reporting home Internet access were in the inner city schools; the highest proportion was in the suburban school. In all schools, a higher percentage of teachers reported having access to the Internet at school than at home.

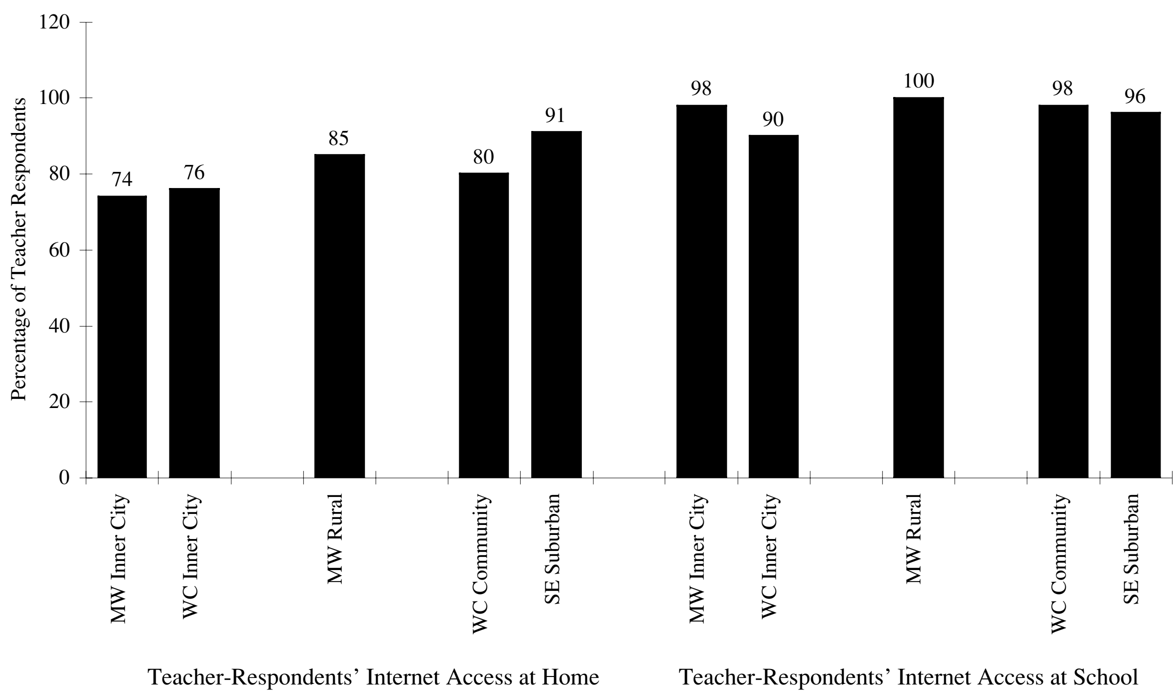

Figure 1. Teacher-respondents' home and school Internet access by school.

Figure 2 reveals more stark contrasts in the student data regarding Internet access than in the teacher data. Both home and school access varied more across the schools for students than it did for teachers. The highest frequencies of home access were reported by students in the suburban and community schools. The lowest frequencies of home access were reported by students in the midwestern schools—Midwest Inner City and Midwest Rural. Student school access was the opposite of student home access. That is, the highest frequencies of school Internet access were reported by students in the schools with the lowest frequencies of home Internet access among students, and the lowest frequencies of school Internet access were reported by students in the schools with the highest frequencies of student home Internet access. These data suggest that the access that students in the inner city schools and the rural school had to the Internet at school compensated for the access they lacked at home. It should be noted that the students were asked where they actually used the Internet, not where the Internet was available to them. Presumably, a number of students in the West Coast Community school and the Southeast Suburban school chose not to use the school Internet access they had, preferring instead to use their home access. Interview data reported later confirm this presumption and show that students who have a choice in where to use the Internet may prefer to use it outside of school because of convenience and in order to avoid the limitations that accompany school access. Internet use in community libraries was reported by a higher proportion of students in the two inner city schools (29% and 30%) than in the suburban, community, and rural school (20%, 13%, and 13%, respectively).

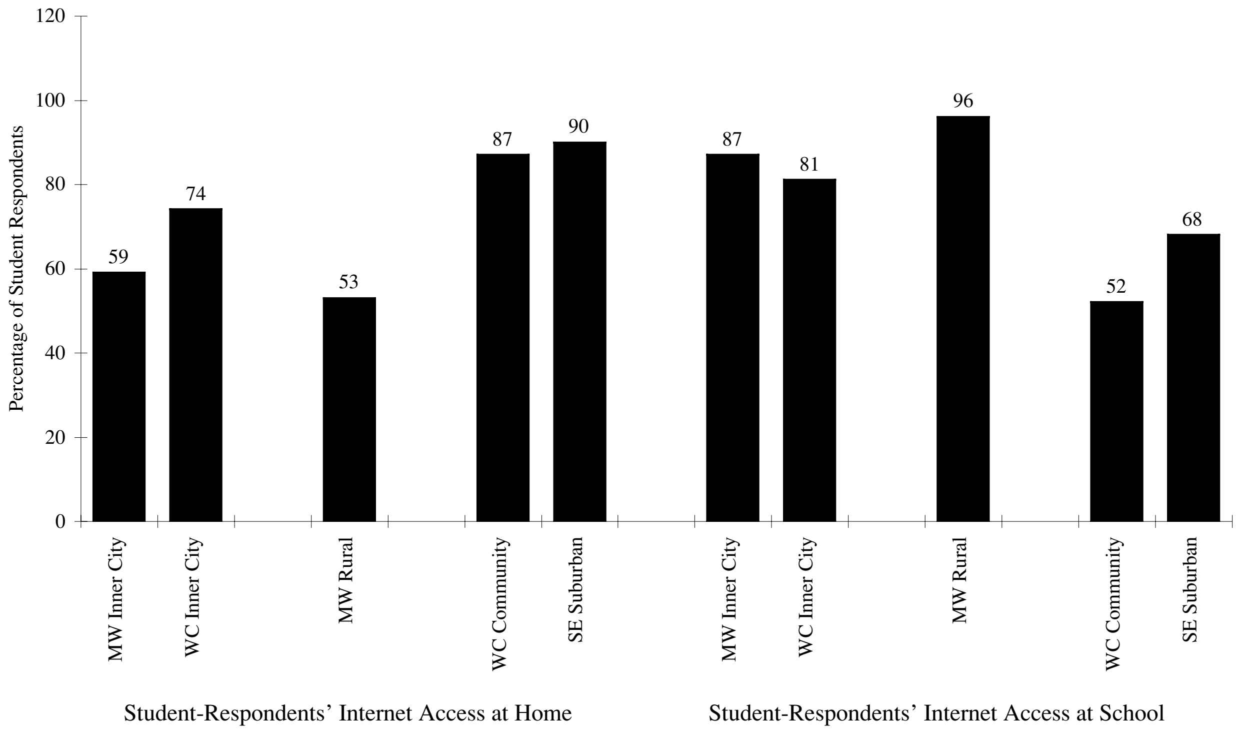

Figure. 2. Student-respondents' home and school Internet access by school.

Students were asked in the survey questionnaire how important Internet access at school was to them. These data are illustrated in Figure 3. Figure 3 shows that a higher proportion of students (approximately 75%) at Midwest Rural than at the other schools responded that Internet access in school was very important. Midwest Rural students were accustomed to using and depending on the Internet in school. This school had stopped buying dictionaries and some other kinds of materials, asking teachers and students to instead use those available on the Internet. In addition, students at this school had to submit their work electronically in some classes. The reality for students at this school was that they had to use the Internet in order to function at school. The lowest proportions of students (about 30%) who said that Internet access at school was very important were at West Coast Community and Southeast Suburban, the schools located in communities with the widest distribution of computer technology. These two schools also had the highest proportions of students who said that Internet access at school was not important. Students at these schools were the most likely to have access to the Internet at home. About half of the students at the two inner city schools said that Internet access in school was very important. A higher proportion of students at the three schools with the most racially diverse student bodies and the highest proportions of students from poor families said that Internet access at school was very important, compared to the two schools with less diverse and more affluent students.

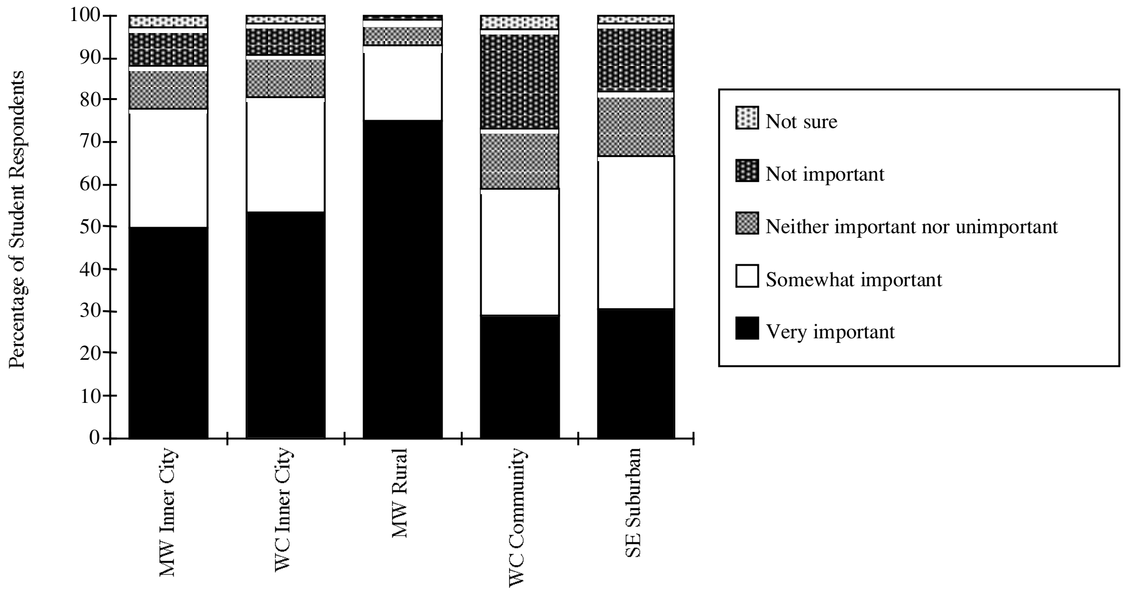

Figure 3. Value placed on Internet access at school by student respondents.

Tables 13 and 14 show where within the school teachers and students most often gained access to the Internet. A majority of the teachers reported that they most often gained access to the Internet within their department, either in their own office, classroom, or work space, or in a department classroom or work space (Table 13). About a tenth, however, reported most often gaining access to the Internet in a central location in the school—in a computer lab, library, or media center. Teachers reported an opposite pattern for their students (Table 13). More than half of the teachers indicated that their students most often gained access to the Internet in a central location in the school. Classroom access by students was reported as most common by about one fourth of the teachers, and almost a tenth reported that students most often gained access to the Internet in the teacher’s office or workspace. These data suggest that students and teachers gained access to the Internet at school in a variety of locations.

Table 13

Location of Computers on Which Teacher-Respondents and Their Students Most Often Gained Access to the Internet at School

Location	Teachers*	Students*
My office/work space		
Number	174	28
%	54	9
My department's work space		
Number	30	2
%	9	1
Another department's work space		
Number	3	0
%	1	-
Classroom(s) in my department		
Number	63	73
%	20	23
Classroom(s) in another department		
Number	4	12
%	1	4
Central location in the school (e.g., media center, library, computer lab, etc.)		
Number	35	177
%	11	55
Other		
Number	9	9
%	3	3
No response		
Number	4	21
%	1	7
Total		
Number	322	322
%	100	102**

*As reported by teachers.
**Reflects rounding.

Table 14

Location of Computers on Which All Student-Respondents Access the Internet at School

Location	Number	%
Teacher's office/work space	146	4
Classrooms	827	22
A central location in the school (media center, library, computer lab, etc.)	2,648	69
Laptop computer I carry with me	79	2
No response	122	3
Total	3,822	100

Students were asked directly about the locations at school where they used the Internet. Confirming their teachers' reports, most students reported using the Internet in a central location in the school, almost one fourth reported gaining access in classrooms, and a few reported using the Internet in a teacher's office or work space (Table 14). Tables 13 and 14 indicate that teachers most frequently gained access to the Internet at school in their own office or workspace, whereas students most frequently gained access to the Internet at school in a central location.

In the interviews, teachers spoke about being able to gain access to the Internet as a major factor facilitating their use of it. Access meant having Internet-connected, Internet-capable computers and infrastructure (e.g., an adequate network) in places that were convenient to get to and available when teachers needed them:

> *I have a nice computer here that is hooked up, high-speed. Ease of access right at my desk.*

> *The fact that there are computers that can access the Internet in almost every corner of the school makes it convenient. It doesn't matter if I'm over there or over here.*

Teachers in several of the schools reported that being able to check their computer out over the summer or having a laptop that they could take back and forth between home and school was an important part of their access to the Internet:

> *I do check mine* [school computer] *out. . . . I take mine over the summer.*

Access to the Internet in classrooms and teacher offices. Most teachers reported that they had one or more Internet-connected computers in their classroom. Their classroom was a location highly appreciated by teachers for such computers:

> *I love having a computer in my room. The whole world is better.*

You know, [I] *have it right in my classroom. I'm able to use it whenever I want to.*

When we put a computer in almost every classroom, [we] *saw a huge jump in . . . access immediately, because it is easier to sit down during your lunch period and get material.*

At Midwest Inner City, teachers had offices with an Internet-connected computer on each teacher's desk, as well as one or more computers in each classroom:

There are six or seven people in an office, and we each have our own computer at our desk. And each classroom has one. If a kid comes into class and needs to do a little research, they can get on in the classroom, too.

A number of the teachers in three of the schools had acquired one or more classroom computers during the academic year in which the interviews took place, and reported that having more computers promoted their Internet use:

This year, I've got the iMac computers, and last year I didn't have that. This year I have seven working, plus two other teacher stations, for a total of nine, whereas last year there were three.

Students indicated that they had significantly more access opportunity when a classroom had five or six computers than in classrooms with only one. Students at West Coast Inner City preferred the wireless laptops on the computer cart to other computers: *"They are easier to use, and faster."* Students also appreciated it when they were allowed to use their teacher's laptop, office, or classroom computer:

Sometimes we don't have to go to the lab. The teachers let us use their laptops, so it's very convenient.

Teachers who are usually here after school all the time, we can use their computers.

Access to the Internet in central locations. All five schools had one or more computer labs open to students and teachers across the curriculum. In most of the schools, a computer lab and the media center were combined or were adjacent to each other. Teachers' comments reflected the importance of these facilities:

Another good thing that has helped us, we have lots of computers up here in the media center.

I think the library here has done a great job in setting up a computer lab. That's a first step.

These computer labs could accommodate an entire class of 25–35 students. In addition, smaller computer labs were dispersed throughout some of the schools. These were used by smaller groups for specific purposes. Teachers reported using all of these facilities in addition to the computer in their classroom:

> *Now they have Pentium 500s* [in a new school-wide computer lab]. . . . *It is something that I utilize all the time. Being next door to it, I do have ease of access.*

> *The main thing is: all the new equipment in the library. Having the number of iMacs now and stations more available—far more than before. The fact that I could bring students over and they could have fairly modern equipment . . . and that there were enough stations for enough students to be using the Internet. That really helps a lot.*

Students also mentioned that the computer labs in their schools were important means of Internet access for them:

> *The computer bank back there* [in the library]*, 30 iMacs hooked up to the Internet is really helpful.*

> *The Internet is easily available. In the library, you can come in here basically any time and get on the Internet.*

Student access to a computer lab outside of class time was important for some students who said that their teachers did not generally give them class time to go to the computer lab to work on assignments:

> *Very rarely will a teacher let you use the Internet during class time. I know teachers who will give you . . . places you can go on the Internet, but most of the Internet use is at home or on your time in the library.*

> *Pretty much it is on our time because our teachers wouldn't let us use the Internet . . . tomorrow, we have a specific time in my English class where we will come to the library to use the Internet for our research paper . . . other than that, it is on our time.*

Students who were willing and able to stay after school had Internet access, especially at the schools that maintained after-school computer lab hours:

> *After school, our technology-computer-center lab is open for an hour.*

Access to a High-Speed Network

Teachers noted in the interviews how much they appreciated high-speed Internet access. In some of the schools, this was a very recent development:

> *Having really quick connections really helps a lot.*

> *As far as getting to a computer, that's not an issue at all. We can get to it and get in real fast.*

> *We're all on line here. We all have Internet. It is a very fast connection. So it would make sense to try to use it somehow.*

Technical and Curricular Support and Training

The survey questionnaire asked teachers and students to identify the support personnel and/or materials they sought out to help them with their use of the Internet. These data are reported in Table 15. For teachers, technology coordinators and their teacher colleagues were important sources of assistance and support. Media personnel and students were sought out by about two fifths of the teachers. On-line resources and printed materials were also reported by a significant number of teachers as sources of assistance they consulted. Only a small proportion of teachers reported giving others support or not seeking assistance and support.

For students, peers were the most frequently reported source of assistance and support, but almost as many students identified teachers as a source of help. Between one fourth and one third of the student respondents consulted media personnel and on-line resources. About the same proportion of teachers and students reported using on-line sources—almost one third of each group. A higher percentage of students (21%) than of teachers (5%) indicated that they did not seek assistance or support. The proportion of students who reported that they provided support to others was twice that of teachers. Table 15 reveals that technology coordinators were used as a source of support and assistance far more by teachers than by students. In contrast, teachers were asked for assistance by substantial portions of both groups.

In interviews, students acknowledged the assistance they received from their teachers and peers, and some credited their school with having taught them to use the Internet:

There are teachers that stay after school and help you. So you get more feedback from them.

There's quite a few people I know that are computer-literate. They know everything there is to know about computers, and basically they kind of run the show as far as computers go . . . so if there's a problem with the computer, we go to one of those people.

The school really taught me.

Teachers reported receiving widely ranging amounts of training during the previous academic year (Table 16). A bimodal distribution is evident in the data: More than one third of the teacher respondents reported receiving more than 15 hours of training during the 1999–2000 academic year, but almost another third reported receiving 5 hours or less, and almost one fifth reported receiving none. The technical support and training that teachers received came from within their school, from their school district, and from professional and interest groups and organizations outside the school system. One teacher reported having 56 hours of Internet-based training during the year. This teacher had participated in training that was provided to some teachers through the school's federal Technology Innovation Challenge Grant. It should be noted that the interviews revealed that many of the teachers who received little or no training were among those who were the most skilled in Internet use.

Table 15

Type of Support Teachers and Students Reported Seeking Out Related to Their Use of the Internet

	Number	%
Teachers		
Technology coordinators	226	70
Other teachers	210	65
Media personnel/librarian	139	43
Students	129	40
On-line resources	96	30
Printed material(s)	60	19
Audio/video tutorials/resources	23	7
I provide support to others	19	6
I don't seek assistance/support	16	5
Administrators	13	4
Other	11	3
Counselors	5	2
Students		
Other students	1,709	45
Teachers	1,654	43
Media personnel/librarian(s)	1,138	30
On-line resources	1,068	28
I don't seek assistance/support	811	21
Printed material(s)	531	14
I provide support to others	489	13
Technology coordinators	453	12
Audio/video tutorials/resources	213	6
Counselor(s)	144	4
Administrator(s)	137	4
Other	127	3

Table 16

Professional Development in the Use of Internet-Based Technology That Teacher-Respondents Reported Receiving During the 1999–2000 School Year

Number of hours	Number of respondents	% of respondents
> 15	117	36
11–15	8	2
6–10	38	12
≤ 5	93	29
0	57	18
No response	9	3
Total	322	100

In the interviews, teachers reported that having technical and curricular support available, and receiving help when needed from several sources (including technical support staff, media specialists, colleagues, and students), facilitated their efforts to use the Internet in their teaching. Teachers reported that technology and media staff helped them in person and, in addition, placed helpful resources on the school's Intranet or on the Internet for them to use and refer to. Teachers also received training from technology and media staff and their colleagues, ranging from informal conversations to scheduled seminars and workshops. Teachers also participated in conferences and formal course work that helped them learn to use the Internet.

Support from technology staff and media specialists. As described in Chapter 2, technical support functions were handled differently in the five schools. Some schools spread these functions over several people, including a technology coordinator, several computer lab managers who were also teachers, teachers who were assigned technical and curricular support responsibilities for a defined group of other teachers, and the school's media specialists. In other schools, the technology coordinator or coordinators were the primary support providers.

> *They come in and play MacGyver and fix it, whether it's the Internet, or whether it's the machine, or all of a sudden I can't pull something up. And . . . I can get them in here while I'm still interested in that. Whereas, if I had to wait a day or 2 to see them, then I'm not so sure I'd be as interested. So that keeps my interest level up.*

> *If I'm having trouble searching and not coming up right, I'll go to the media center and say, "Help me define my search."*

> *In our weekly newsletter for the faculty and staff, the media center will give us* [Web] *sites that they have come across.*

> *We do have the technical people here. . . . they're here every day, they're available. We can e-mail them if they happen to be someplace else. So there's always someone.*

Large schools that were part of a larger school district also had district technical-support resources available to them. Teachers' comments indicated that all of these sources helped them and their students with technical problems, taught them better ways to do things, and provided them with helpful resources. Teachers reported appreciating not only the help they themselves received from these support personnel, but also the help that their students were given:

> *We have wonderful people in our media center, which really helps, because I do understand that not every school has that advantage. But ours work very hard to help the kids.*

Support from colleagues. Teachers reported that they received curricular and technical support from colleagues within their school, in their district, and outside their school system:

> *When we find something, we'll e-mail. We just send it to everybody in the department. So we help each other out a lot.*

> *One of the things that I really enjoy about technology is the fact that there is a great willingness by my peers around the state to help out. So it's just a case of picking up the phone or sending an e-mail and saying, "I'm stuck, what do I do?" and the response is very good.*

Teachers reported that their colleagues had taught them ways to use computer technology or helped them solve hardware or software problems. Some teachers mentioned that their membership in professional groups (e.g., teachers in their field statewide, vocational-education organizations and groups) gave them access to assistance from group members:

> *Even the . . . networking that you could be involved in . . . I do have a lot of that by going and being involved in all the vocational stuff because they are very good about all those kinds of things. It's vocational, so it's all the areas. Like we have tech ed, that's vocational, and ag, that's vocational.*

> *I came across this listserv purely by luck. I was talking to* [a colleague at an advanced placement meeting] *and they said, "I've been teaching advanced placement forever and I wouldn't be able to do it if I wasn't part of this listserv." And they gave me the address, and I got on.*

Support from students. Teachers found many of their students to be very knowledgeable about the Internet and generous in sharing their knowledge:

> *I've learned from so many kids how to do shortcuts.*

> *I have two gentlemen who are seniors on my staff who are very Internet-savvy in terms of being able to do things over the Internet, downloading programs. They know a great deal about it. So they kind of tend to help me when I get stuck at times.*

My first line of defense is try to fix it myself, and if that doesn't work, I usually ask a student in the class.

I go to [my students] *and say, "How do you do this?" and they zip, zip, zip, it's done.*

Training from technology staff and media specialists. However they were configured within a school, technical support staff also provided guidance and training for teachers, which ranged from informal interactions to solve a particular problem to more formal workshops and classes:

The technology director did courses with us for developing Web-based designs.

I've just taken . . . the 7-day staff development . . . that is 56 hours, and basically, it was all Internet-based. We brought in a lot of things from the Internet to do. Every project that we did had something to do with the Internet.

Friday afternoon training really helps a lot.

About four times a year we have workshops, and they'll be on a wide variety of different topics. . . . those are very helpful.

Last year, I took a little miniclass with one of our media people who's in the library this spring, and he offered many sessions on how to use search engines and things like that. And that was really helpful.

Teachers reported that training was especially helpful when it focused on something that teachers could see a direct use for in their teaching:

We've had a few staff development things, like when we go into the media center and they show us how to isolate sites. But they actually gave us time to work on stuff that we could use in class. Some in staff development have their own agenda, and it has nothing to do with what I'm teaching. So when we are allowed to pick a project, we know we're going to teach about that subject. Then generating information sounds good.

Workshops sponsored by the school district, the state, and organizations or individuals outside the school. Teachers had participated in a variety of workshops that dealt with the Internet and other instructional technology. These workshops were sponsored by a variety of groups, and varied widely in their format and timing:

I had an in-service. That was a private company who gave it. . . . They made use of the Internet. . . . It was how to incorporate technology into your curriculum.

I went to one of Jack Hazzard's conferences. . . . One of the things was technology-based strategies in the classroom. Everything that he gave out, it was a tremendous amount of stuff, but a huge amount of information that is available on line, and where it's available, the types of programs that are available.

Four years in a row . . . I went to this summer institute. We did technology. It was a scope, sequence, and coordination project, integrated planning. . . . Actually, it's nationwide now. . . . It was the most ideal conference. . . . They paid you to go, plus you got room and board. We did curriculum stuff and we did field trips.

Formal training via course work. Teachers commented that formal classes sponsored by higher education institutions and the state were helpful to them in supporting their use of the Internet:

They had a full-year course on Internet through the state . . . dealing with how to use the Internet, how to use Web pages, how to use all the different areas, developing and implementing them in the classroom.

The class that I took was on developing lesson plans and using Web sites. In fact, from that class I got a lot of information that I used this year. . . . That was where I got the idea for the PowerPoint presentation and connecting the Web sites on the presentations.

Positive Experiences, Comfort, and Familiarity With the Internet

A question on the survey questionnaire asked teachers and students to rate their level of comfort in using Internet-based technologies. The responses are shown in Table 17. Almost three fourths of the teacher respondents indicated some degree of comfort in using the Internet; they were almost evenly split between those who reported feeling very comfortable and those who reported feeling somewhat comfortable. A higher proportion (84%) of student respondents reported some degree of comfort: Half of all student respondents reported feeling very comfortable, and another third reported feeling somewhat comfortable. Very similar proportions of teachers and students (11% and 12%, respectively) reported feeling neither comfortable nor uncomfortable. Thirteen percent of the teachers reported some degree of discomfort in using Internet-based technologies, compared to just 4% of the students.

Interviews with teachers indicated that when they had positive and successful experiences with the Internet, they became less fearful and more confident in using it:

The more you use it, the better it gets. And I feel a lot more comfortable. And I noticed that this year with my students, when they had problems, I didn't feel like, "I have no idea." So I can solve a lot of problems.

I feel that I'm more experienced on the computer. Last time that we had an in-service for the school, I was in charge of teaching e-mail. We taught other teachers.

Table 17

Teacher- and Student-Respondents' Levels of Comfort in Using Internet-Based Technologies

	Number	%*
Teachers		
Very comfortable	113	35
Somewhat comfortable	123	38
Neither comfortable nor uncomfortable	37	11
Somewhat uncomfortable	36	11
Very uncomfortable	8	2
No response	5	2
Total	322	99*
Students		
Very comfortable	1,969	52
Somewhat comfortable	1,214	32
Neither comfortable nor uncomfortable	460	12
Somewhat uncomfortable	86	2
Very uncomfortable	66	2
No response	27	1
Total	3,822	101*

*Totals not adding to 100% are due to rounding.

When teachers got to the point of feeling knowledgeable and comfortable, they were more likely to try more things, to venture into the less familiar. Teachers indicated that the training they received had helped them gain skills and feel comfortable. Some also said that using computers was "just easy" for them because they had a special aptitude or inclination:

> *Before I was a physics major, I was a computer science major. So I've been around computers for a while. I'm comfortable around them. . . . I'm not scared to try something new like that.*

> *I'm one of those people that technology is kind of an easy thing, automatic to get into. So I'm just comfortable using it, looking up and exploring, and I'm the person, whenever a computer goes down, who has to figure out what's wrong.*

Some teachers credited a teacher education course they had taken with helping them achieve a degree of familiarity with computers and the Internet:

> [My teaching-credential educational-technology course] *really taught me a lot, and that got me over the fear of getting connected and getting my e-mail and getting on the Internet, and things like that. So that's pretty much when I started using it.*

Some of teachers' comfort with the Internet seemed related to their sense of being able to navigate the Web and find what they needed:

> *I feel comfortable navigating on the Web, and as far as showing other people, as well.*

> *I'm familiar with the Internet enough where I can find Web sites and addresses that I need.*

Administrative Support, Encouragement, and Commitment to Technology

Administrator support perceived by teachers varied among schools. For example, teachers at one school described administrators as supportive and encouraging of their technology-related efforts and committed to improving integration of technology in the classroom:

> *I think it's very, very supportive. We have a very technology-friendly environment, and it is encouraged from the top down.*

> *The principal is very supportive. You go in with any technology, and she says, "Why not? Let's do it."*

> *We have an excellent assistant principal who gives us a weekly newsletter, and she puts new educational sites on there all the time.*

> *If you find a particular grant that you'd like to write, the principal's more than willing to provide that support. You can present that, and she's willing to support you 100%.*

Teachers at another school mentioned being challenged by administrators to use the technology made available to them. These teachers indicated that having the technology available to them, coupled with the expectation to use it, had been an impetus for them to do so:

> *The only reason why mine is cutting-edge is 'cause I happen to have the tools and an administration who says, "figure out how to do this."*

> *They just kind of opened the doors and said, "Go to it." The administration has been just fantastic. They are visionary. They see how computers are being used everywhere else, except in education. And education's just got to catch up. And so, that's been the major, major help and motivation.*

Teachers at a third school said little about administrative influence one way or the other, and a staff member described one administrator, who was not seen as either supportive or antagonistic, as "getting out of the way" so that others could assume leadership for technology integration.

Teachers pointed to administrative policies that had facilitated their efforts to use the Internet. Keeping a computer lab open beyond school hours and requiring teacher participation in Internet-related training were two examples. Teachers said that keeping the computer lab and media center open before school, at lunchtime, and after school promoted student use of the Internet in school:

> *And there were computer staff-development classes that we had to take. They were required, so we were there.*
>
> *We have pretty good library hours. They'll stay after school and use the computers in the library.*
>
> *Lunch, after school, before school.* [The library is open until] *4. And school's over at 2:35. They have time if they choose to use it that way,*

Some school policies forced teachers to use the Internet by requiring them to check their e-mail every day or several times a day. In other cases, all of the important school information that teachers needed to receive and send was done only by e-mail—so teachers had to use e-mail in order to be informed and to inform others:

> *I would say just with the e-mail issue. . . . I had to learn it. I had to know it to be able to communicate with the building. It was something that I had to learn out of necessity.*

Grants Received

Three of the five schools had been involved in federal Technology Innovation Challenge grants that they or their district had received as part of a consortium. Two of the schools had received major state grants. Teachers noted several important influences that these federal and state grants had had on their opportunities and efforts to use and integrate the Internet in their work. One was a sense of pride in being awarded a competitive grant. A second was the additional hardware, software, and infrastructure that had been purchased with grant monies, making Internet access possible:

> *We take great pride in the fact that we have had a number of awards and grants that have come about, and the hardware and software that have come about, as a result of these grants.*
>
> *Our grant that we got from the state . . . that's made possible the funding for us to get hooked up to the Internet first of all.*

A third influence was the staff training that the grant made possible:

We're doing in-services . . . through the . . . technology grant. Got a bunch of money to fund some things. And one of the things they had to do was upgrade the technology knowledge of the staff.

Another positive influence was the fact that teachers had been paid for their grant-related work and training time:

The Challenge grant has energized this beyond all imagination. It's the money and often the opportunity to be rewarded for some of the time you put in by being paid for the work you do on some of the Web page development. That helps teachers and is an extra incentive, particularly if you're doing it over the summer.

Finally, teachers had opportunities for grant-supported travel to other schools, where they were exposed to ways of using the Internet in teaching and inspired to try what they observed:

The Challenge grant sent me down to [one of the grant consortium's schools]*, and I got to observe a teacher down there. All of her classes are Web-delivered. They have a setup where the entire calendar each day pops up with a new screen, and you can see what the previous day's had and what the next few days have upcoming. If you miss yesterday, you back up a day and you can download the worksheet or see the assignment for the previous day. She has on-line quizzes, so on quiz day she can change the security on the quizzes and make them open to the kids, and they can download them, take them, and upload them back to her. It creates the quizzes. It's actually all done fairly easily, believe it or not.*

A Supportive, Knowledgeable Family

Some teachers mentioned their families' support of their efforts to use the Internet as encouraging them in their Internet use. Family members supported teachers' Internet use by being patient, providing time, and sharing useful information and resources:

It helps to have a loving family who have the patience to give you the time necessary.

My sister works for a school system. . . . We communicate a lot back and forth because she is on so much and sometimes knows the things I'm looking for that I don't have time at home to access.

My husband has had a lot more experience. He's had a lot more time to fool around with it, and he really knows about routes into useful areas that I don't know, and I really do lean on his expertise often, 'cause I think it is helpful.

Factors That Discouraged or Hindered Teachers' and Students' Use of the Internet

As mentioned earlier, interviews with teachers and students revealed more hindrances to their use of the Internet in education-related pursuits than facilitating factors. The hindrances included: (a) insufficient access to Internet-capable, connected computers; (b) central controls and filters; (c) hardware problems; (d) network problems; (e) unavailability of software needed for Internet work; (f) insufficient support personnel; (g) insufficient training and guidance; (h) questionable quality of Internet material; (i) overwhelming amount of information on the Internet and its lack of organization; (j) teacher fears, preferences, and skepticism; (k) competing agendas, responsibilities, and priorities that leave teachers little time for Internet work; (l) student skill levels, distractibility, and misbehavior; (m) perceived risks posed by Internet use; and (n) lack of funds.

Insufficient Access to Internet-Connected Computers

In contrast to the teachers and students discussed earlier, who said they had sufficient Internet access, many teachers regarded their access as insufficient. One barrier teachers and students described in interviews was insufficient access to Internet-connected computers. The problem arose for a number of reasons. A few teachers did not yet have a working, Internet-connected computer in their classroom. Most teachers did have a computer in their classroom; but some teachers reported class sizes in the neighborhood of 40 students. Even in classrooms with lower student-to-computer ratios, teachers found themselves challenged to provide enough Internet access to students to accomplish the learning tasks they felt were important for their students. In some cases, several teachers had to share an office with only one computer:

> *There would be one computer that has Internet access in our office, and 19 people in that office.*

Computer laboratories were not always an answer to these problems, either. Teachers reported insufficient access to computer labs because labs were heavily scheduled and were not always supervised. Teachers who wished to send only some of their students to a computer lab could not supervise both the classroom and the lab. In one school, the computer lab was not open due to lack of supervisory staff.

Moreover, teachers were reluctant to assign work to students that required use of the Internet if they did not think student access in school was sufficient to enable students to complete such assignments. A number of teachers reported that many of their students did not have home access to the Internet. Teachers were concerned about inequities they saw for students who did not have home Internet access, and thus could not spend as much time on Internet-dependent assignments as students who did have home access. All of these conditions limited teachers' willingness to incorporate the Internet in their teaching and in student assignments.

Lack of access to an Internet-equipped classroom. A few teachers did not have an Internet-connected computer in their classroom:

For instance, the room I have my first-period class in is not even wired for the Internet.

And depending upon the classroom, the computer may have Internet accessing on it . . . and maybe not.

Some of the schools faced space challenges due to enrollment increases. This created situations in which teachers might not have access to their classroom and their Internet bookmarks and computer files during their preparation hour:

I have to share it [my classroom]*, that one period, with somebody. As we become more crowded, then we need to go in and use the computer for the Internet while the other teacher is teaching. I won't bother a first-year teacher.*

Some teachers did not have a classroom in which they consistently taught and had to move a computer on a cart with them to various classrooms:

When you don't have enough classrooms, you end up traveling, and you have to push a cart [with a computer on it] *around.*

Students also mentioned the lack of computers and Internet access in some of their classrooms:

Depends on the subject, because some classrooms don't have them [computers] *at all.*

Insufficient number of Internet-connected computers available. Teachers reported that having just one or a few computers in a classroom with many students discouraged them from using the Internet in their teaching:

In the classroom it's not used very much because there aren't computers for each student.

To me, that's the biggest thing, not having one for every kid. Still, the biggest barrier is not having one for every kid.

Especially at the beginning of the year, you might have 35 to 38 kids, and just two computers.

In order to use the Internet in classrooms with many students and few computers, teachers had to devise logistical strategies:

I wish it were one-on-one, but right now we put anywhere from three or more [students] *to a computer, and then try to break it up where each person will do a different thing.*

Using one computer for 37 students is a real problem and requires quite a knack on how to use it, how to time your lessons.

Teachers reported that the result was that curriculum time was not as well-used as it might be and, despite the strategies, students' time on the Internet remained limited:

It's very frustrating to only have two computers with almost 40 students. You really have to modify things or give more time on the assignment to let everybody in the class get to the computers. It would take a week to get through the project when you could do it in 1 or 2 days if you had sufficient computers in the classroom.

Even computer courses taught in a room originally equipped with the intention of each student having their own station sometimes had more students than computers:

We decided as a class. I said, "All right, there are 22 computers. There are 33 of you. Everybody does 50 minutes on a computer a day." So I split them into three sections. A and B were on the computers, C was off. And then A and C were on. . . . And they agreed to that and said, "Yeah, that sounds good." They were really, really good about it.

One teacher divided students into pairs. Each pair got 10 minutes during the class period to work on the Internet at the one computer in the classroom:

We're always sharing anyways, and doing timing, so I think they were used to that. I just had the clock up and I said, "Okay, next group, 10 minutes." And then I said, "Okay, we have a countdown to 2 minutes, and the next group get ready." Boom, boom, boom. If we did have time left over (some groups got skipped because they said, "Oh, we already have our research"), I just went through everybody and said, "Who wants to do another round?"

Another teacher resolved the lack of student access to computers in class by having students come to her classroom after school to use the Internet and to learn from her how to do Internet searches:

During class, we have only one computer in there, so that doesn't work. After school, I've been helping lots of students on their research, showing them how to do Internet searches.

Although labs typically had more Internet-connected computers than classrooms did, even labs did not necessarily have enough computers for the number of students in a class:

[Another barrier] *we have is that our lab is ineffective. It has only about 20 computers.*

Sometimes I take them to the library, and when . . . we're there, there are groups of five or six on each computer.

Heavy use and lack of supervision staff in computer labs. Although access to the school's computer lab helped to compensate for limited classroom Internet access, teachers found that labs were not always accessible when needed:

> *And of course, we have the new Internet lab with access. Of course, it's hard to get in. . . . It would be nice to have more* [Internet-connected computers] *in the classroom.*

> *So I tried to sign up for a block of time* [in the computer lab]. *And every year I'm getting consistently bombarded, "Why do you need that much time? Do you need all that time?" And that should never be an issue.*

> *The computer labs are really full and hard to get. . . . I guess I haven't used the computer lab, partially because it is so full.*

> *The lab is not available when you want it because there are too many people who need to use that lab.*

Lack of supervision in computer labs kept teachers from sending some of the students in a class to a computer lab while the others remained in the classroom, and sometimes closed the lab to students altogether:

> *One of the things I find frustrating at school is we're supposed to be a technology high school and, yes, there are computers around. But the little computer rooms that we have by the offices that the kids are supposed to be able to use, you're not supposed to let the kids go in there without a staff person in there. But* [if] *there's only you teaching, there's no way you can send three or four or six* [students to the minilab by themselves].

> *The lab is there so it can help students who need time to work on projects after school, and sometimes the students say, "Oh, I can't go there, it's closed." So . . . they didn't have access to it on a regular basis.*

Interviews with students reflected concerns about the computer labs similar to those voiced by teachers:

> *Sometimes all the computers in the library are full, and I have to wait until someone gets off. That's usually all the time I have to stay here.*

> *The computer lab isn't always open at lunch.*

Lack of Internet access at home. Counting on students to do their Internet work at home was not an option for teachers who reported that some or many of their students did not have access to a computer and the Internet at home. This discouraged them from incorporating the Internet in students' assignments. Teachers felt that when they did assign computer and Internet-based work, students without a computer at home were at a disadvantage because of their lack of experience, and the more limited Internet-access time they had to work on their assignments:

What I run into in the classroom is that there is an inequity in access. There are students who do not have these things at home, and their parents can't help them.

So a student is really at a disadvantage if they don't have it at home, and it's kind of a Catch 22. You want to have a project that has high standards, yet you know that some students are at a disadvantage for it.

The lack of home access was especially a concern of teachers in the two inner city schools, but was reflected in four of the five schools. Poverty and language barriers were identified by teachers as primary factors underlying students' lack of home access, but teachers also reported that some parents did not want their children to have exposure to the Internet. Only at Midwest Rural were these issues not concerns of teachers, because in that school, even though many students did not have home access to computers or the Internet, student-to-computer ratios were much lower, and school access was widely available to students. In addition, at the time of the interviews, the school had provided all freshman students with a laptop computer to use at school and at home.

Students described in more detail in interviews the home Internet access issues they faced. Some students' home computers were too old to be Internet-capable.

I don't use the Internet at home because I have a really old Macintosh . . . I can't use it very much.

In other cases, an Internet-connected computer was available at home, but there, as in school, several people had to use one computer, so access was limited:

The hard thing at home is, a lot of times, it is hard to get on the computer.

Some students also said that their parents discouraged them from spending much time on the Internet:

My dad uses the Internet a lot, so he gets frustrated when I'm on there too long because he wants to use it himself. Then my little brother is always on the Internet because he has the computer games that he plays on there, so he gets mad at me if I am too long on the computer.

My mom, she is a professor, and she thinks that a computer is just for work. You just type on it. You don't do anything else. Check your e-mail and type. It bothers her. She thinks you're wasting your time.

Uneven distribution of school computer equipment. A number of teachers observed that equipment was concentrated in departments or subject areas because it was a central feature of the curriculum, or for some other reason:

We have a lot of really neat technology, but it's basically for the info-tech area.

Since the equipment was heavily used by the area in which it was concentrated, it was not available for others:

> *I'm going to have a meeting to show what it is that I want to do here. And if they would be willing to let us use one of the labs, if we could arrange that now. Most likely they'll say no. They do that because they're busy, as well, and it makes it more difficult.*
>
> *It's* [the equipment we need] *all down here in the library or it's in the technology department where we don't have access to* [it] *because they use it full-time.*
>
> *We do have one computer lab that's not available because they're teaching either word processing or computer ed in there all day long up in the business department. There's five classes in there each day.*

These distribution patterns led some teachers to feel that they did not have the access to computers that they needed:

> *I asked if I can get 15 computers because I figured out that I can control 15 students at a time. So they say, "Okay, 15 computers." But that didn't work, and then they told me they have no computers and had given them to somebody else.*

Central Controls and Filters

All of the study schools exercised some form of control over the Internet sites accessed in school. The controls were operated either school-wide or district-wide. Two forms of control were used. One was a surveillance system that allowed an individual (usually the technology coordinator, but media personnel in some schools) to monitor the screens of computers in use throughout the building. If a screen was discovered that indicated the user had accessed a forbidden type of site, the manager of the surveillance system could close the site on the user's computer. School policies also permitted the school to impose sanctions against individuals who were discovered using inappropriate sites.

> *We do have the Big Brother* [surveillance-type] *software. . . . We haven't blocked out any sites, because we found out that's just too restrictive. We do teach anatomy and physiology here . . . the kids . . . in the anatomy and physiology class . . . have to write out a children's book explaining one of the body systems. The kids will choose reproduction from time to time, just like they'll do the endocrine system. And those kids who did the reproductive system couldn't get on the Internet. So, that was one of the problems. I don't even know if they piloted it* [a filter-type system] *here, but our librarians knew that that would be the problem right away. So we have opted not to do that. Instead, they use the monitoring software where the technology person can have a screen running, and that will monitor all the different computers in the labs.*

The second form of control, as noted in this comment, was a filter system that automatically disallowed access to sites containing certain terms. Filters were used in four of the five schools (and some of these also used surveillance control). Filters blocked not only sites considered inappropriate for students in school to be on, but also sites that were categorized as legitimate sites for study:

> *It's a good filtering service . . . but it does definitely cut down on the time the kids spend. . . . when I was doing a section on cancer genes and I wanted to go to one of the obvious ones* [Web sites] . . . [I] *couldn't get there.*

> *Most districts have blockers on certain kinds of sites. But at the high school level, sometimes kids are doing research on those topics. I had a girl who was trying to do research on child prostitution and children being kidnapped and being brought into prostitution. . . . You can't bring those sites up.*

> *We have a Bess, which is a system that screens, and it's annoying because when we were researching the Holocaust, a lot of those sites are off limits because they're pretty graphic, but at the same time there has to be something there for the kids.*

Certain subjects and topics were reported to encounter more episodes of blocked sites than others:

> [The] *school's getting so uptight with the idea of "we can only go to these sites," and I understand why they do it. But your . . . classes like health. You are teaching sex ed. These kids can't get into the site.*

In some schools, teachers had passwords that enabled them to override the filter and allow students to gain access to legitimate sites that contained one of the key words that activated the block. Sometimes the reason for the block or a pattern in blocked sites was unclear when the teacher used the override password and checked the sites:

> *Well, the reason is because they can't control what's on those sites. Therefore they have to ban them all. So I understand it, but it's frustrating for the kids when they're looking for research on whatever it might be, and all of a sudden this banner comes up, "You can't go there." And I go to the sites 'cause I've got an override password, and there's nothing wrong with the site.*

> *Even with the WebQuest that my kids are working on right now, one of the sites has an X on it, and it's a Web site that I checked last year. It's a Web site for a nation, the country of Sudan. For some reason it's coming up blocked, and I have no clue why.*

> *The problem is that I haven't been doing it long enough to have worked the kinks out, and it just arbitrarily blocks things. Sometimes it won't let things with JavaScript through. It won't let some "Flash" utilities through. I've never been able to get a handle on which ones it will let in and which ones it won't. But the main thing is, the filter just gets absolutely overwhelmed and just arbitrarily kicks you out.*

A filter was identified by teachers as a deterrent to their own and their students' use of the Internet in school:

> *That's frustrating because there are some good sites that I pull up from my house to prepare for my class. Then I bring them to class to use, and it won't let you get to them.*

> *I think there's a lot of restrictive access. And that's why students don't get the school* [Internet access account] *. . . they would rather pay 35 bucks a month, or their parents have to pay 35 bucks, so that they can have full-range access to everything.*

Students themselves indicated in interviews that being blocked from certain sites was frustrating. Like teachers, they complained that filters blocked their entry to legitimate Web sites:

> *At school it is really limited because the way they have it here . . . the filter really limits your choices and what is available because if there is a key word in the list, they are going to block it.*

> *We can't go into some sites, just like an SAT study site. We can't even get into it. The Border Guard will just pop up for no reason, randomly.*

> *The filter keeps us from getting on even the basic Web sites. . . . I couldn't even get on my own Web site.*

Students who had to depend solely on school access to the Internet were seen by their peers to be at a disadvantage because they could not obtain information relevant to their school work using the school's system:

> *Bess successfully blocks a lot of sites they don't want you to go to, but it also successfully blocks many sites that you should be able to see. When you do a research project, it's very difficult, especially if your topic is controversial. It's very difficult . . . for people who don't have Internet access at home, and they have to use it at school to get information. It's so restricted.*

Students in schools where teachers had passwords to override the filter acknowledged that this helped some, but they didn't like the extra time this procedure required:

> *Having to ask someone to type in their password is a hassle, and it slows you down.*

> *The only way they will show you or let you get to that site is* [if] *there are not very many people around. Or you have to give an in-depth explanation as to why you need to get to that site.*

Students who had Internet access at home were discouraged by these restrictions from using the Internet in school, preferring instead to use their home access:

> *At home, you can do all the things you want.*

That filter thing, and I just don't like the hassle at school because of that.

Hardware Problems

Computer hardware that was too slow, lacked sufficient memory, or was not powerful enough discouraged teachers' and students' use of the Internet. Some computers didn't work, and some that did run were too old to handle the demands of the Internet and current software programs. The continual expansion of technological requirements had made it difficult for the schools to keep up with replacement of older computers at the same time as they were trying to expand the number of computers in the school. Because some of the schools' computers could not handle all of the demands of the Internet, the systems crashed frequently, which resulted in lost class or work time.

Computers that are not working. Some teachers mentioned that computers in their classroom or in a computer lab did not work:

We're limited because we have only one computer in the classroom, and sometimes it's not working.

One [computer in my classroom]*, and it doesn't work.*

He's got eight; I've got six . . . two workable.

When I can get a computer time slot, I take my kids down and oftentimes find the software doesn't work, or the machines don't work.

At one time, there were 30 functioning machines [in that lab]. . . . *It's now down to 24, for whatever reason.*

Outdated computers and insufficient memory. One of the hardware problems teachers encountered was outdated computers with older processors and not enough memory to handle graphics-oriented Web sites:

When we get to doing the projects, there's just not enough memory on the machines. They are slow, and most of them are just truly outdated and need to be upgraded.

Unfortunately, the computer I have in my classroom is a Mac 520, so it's old and it's slow.

We have a bunch of LC550s. I'm lobbying that those will be the first ones replaced. One of them is mine, in my classroom. And it's slow. And you know, then the kids get bored.

Computers here are now 4 years old and need memory updates. We're running on computers with 8 megabytes of RAM.

The computers we have in the classroom are the same as we had 5 years ago.

The slow processing speed and frequent crashes with these old computers were frustrating, and discouraged teachers' and students' use of the Internet:

I've had students come into my classroom occasionally after school who want to use it, and when they discover how slow it is, they say, "Well, thanks anyway."

We have computers available, but the computer in the classroom takes 10 minutes to do something. . . . I don't mean to exaggerate, but it is very slow. You want to be able to tell the kid, "Go over to the Web site. Pull this up." Twenty minutes later we all say, "Here it is." And now your lesson plan's blown for the day.

Too often I'll get in depth [within a Web site]*, and all of a sudden it freezes, and then I have to shut it down, and I'll never get it back.*

You try to open a Web page and the computer freezes, and you restart it again, and the computer freezes again.

Teachers reported that students, discouraged by the frequent freezes and slow speed of the computers, gave up trying to use them or used these problems as reasons for not turning their work in on time. As a result, teachers were discouraged from assigning students Internet-based work:

A lot of them use that excuse for not getting their work in on time. In that sense, I don't assign a whole lot of work that demands that they have to use the Internet.

They maybe use it as an excuse to give up. . . . if they get frustrated, or can't find it, or the computers are slow and everyone is logging on to one site and it's taking forever. You get a lot of complaints that our server is slow.

Preference for home systems. Several teachers avoided using the Internet at school because their computer systems at home were newer and had more capacity than those at school:

If I really do use it, I'll use it from home. If I know there is something I'm [going to] *look up and spend some time, I would rather do it at home.*

I would rather just wait 6 hours, and go home and look it up than try to do it here.

One teacher took Web addresses that he found at school home in order to do more extended exploration on a faster system there:

When I work at the computer at school here, I bring a pencil and notepad along because I need to write things down and write the Web address; so I go home where I have a better computer and I can do the work.

Some teachers commented that it didn't seem right to them that the school's computer equipment was less powerful than what they and some of their students had at home:

> *I have DSL at home and it is immediate and it's so impressive. . . . and I have an expensive modem. I don't understand why we don't do that here. There are kids who have a lot better technology in their own homes, and I think a school should take the lead in that.*

> *They're slow. I can do better at home than I do here, which shouldn't be the case.*

Whether students preferred using the Internet at home or at school depended on the level of equipment they had at home and how it compared to that available at their school. The contrast in levels of computer equipment that students had available to them at home was considerable. Consequently, students with more limited equipment at home appreciated the school's Internet access, while those with new and sophisticated equipment at home preferred using the Internet there:

> *Some of us might use it more often at home, but a lot of people either don't have Internet access or . . . it's very slow, and it's so slow it's not worth my time. I pretty much use the Internet at school or at the* [public] *library. It really depends on the person's situation whether they* [use the Internet] *at school or at home.*

> *I think it's better now that they got newer computers. . . . they're trying to get a better system going. It's not terrible using the computers here.*

> *My sister has her own computer and I've got my own computer. . . . I'm just speaking into my computer and it's typing everything for me, and I can be doing four things at once on my computer. It makes it more productive.*

Network Problems and Other Reliability Issues

Many teachers mentioned problems with the infrastructure—the wiring, the network systems, and servers. The network in some of the schools was too old and too limited to handle the demands of the Internet, leading to some of the slow speed and computer crashes teachers and students experienced. When the network and computer systems were in heavy use, processing time could be slow. The network was not always available when teachers wanted to use it. In some schools, this was a frequent experience. Web sites and Internet service were also down at times. As a result of these issues, curriculum time was lost, and teachers felt they needed to always have a backup plan. Not being able to count on systems and Web sites operating when needed, and doing so at reasonable speed, discouraged teachers from using the Internet:

> *But the problem with this program was that it so frequently was down. The server would be down, they would be upgrading, whatever. . . And in a high school environment, you can't plan a lesson around going to a computer lab so that every student can have access, and then get there and then the program just is not there.*

Students, too, identified unreliability as an aspect of Internet use that discouraged them:

Sometimes the Internet just decides to shut down on you and you don't know why.

Unreliable systems. Teachers reported that their school's and district's computer and network systems were unpredictable and unreliable:

Sometimes the systems are not up and running. Things are breaking down.

I check my e-mail at least three times a day, and I would say at least half the time, the system's down, or something's screwy, or I have to restart because of some error.

When the system was down, staff could not do what they had planned to do:

We have things happen here where the whole system will be down for a while. Sometimes you're all signed up, you come down, and we're off line. So if you plan to use the Internet and something goes awry with our communications with the Internet, then you're in trouble.

I'm almost too dependent on it. I use it for ordering. . . . All requisitions go on line. If that system breaks down or if the local 'Net breaks down, then I'm high and dry until it comes back. They won't even accept hard copy any more. I'm always concerned about system reliability, and I view that as a weak spot. It's pretty reliable, but it's not absolute, and to make full progress it's going to have to be absolute.

Sometimes the system was down for an unknown reason. Sometimes it was shut down because repairs or upgrades were being done:

When I did my presentation and projects, I timed it where they were in the lab researching by the beginning of March. The paper was due at the end of March, and the presentations were due the first of May. I took them back to the Internet lab after spring break one time to prepare for the presentation. Now here's what happened, and it's no fault of anybody's. I want to emphasize that. The week I was signed up for Internet lab is the week that the telephone company decided to come down and fix and repair whatever. That was in lab one. When it came to the presentation Internet lab [lab two]*, as you can see we're under construction right now, and that became problematical too. Now they got access in, but again the telephone company was down, so we have up and down situations, and I can't predict that.*

One teacher reported that student files representing a quarter's worth of work were lost when a change was made in the server or system:

Kids are losing files. One of the civics projects that I do right now kids are losing, so you put all that work in there and it's gone. They changed or updated something and lost things. It's frustrating to work all quarter long, 3 days left, and it's gone.

Even though problems were reportedly fixed quickly, the network was reported to be down from time to time in all schools, and frequently in some schools.

Server problems. Servers went down also, which created further unexpected lapses in system functioning:

I came up with a really neat activity on the Internet . . . and I got to the lab and the server shut down 3 minutes before my class went in there. Those are things you can't help. I can go back in there another day and do that.

It's hard when you have two servers in the building and they're down a lot. Mainly, the biggest problem I see within the building is just downtime and not working properly. They're pretty good about fixing it quickly.

In addition, server space was limited and could not always accommodate what Internet users wanted to do. Servers quickly became clogged with material because of the kind of material students saved and the number of users. Teachers noted that students tended to save memory-consuming material, which quickly overloaded the schools' servers:

Our servers can hold only so much. We have 1,400 students. They all get on a computer and they all save their documents off the Internet . . . a lot of times they save things that are not necessary to their research or their learning, but they save illustrations and pictures, which take up 10 times more space than text. So you have to have somebody go in there and constantly weed out, so that's a lot of upkeep.

Students, too, were frustrated by server problems:

Sometimes there's not a restriction problem, but the server's down and it gets really annoying because yesterday the server was down pretty much all day and we couldn't get on and do anything.

Unreliable nature of Web sites. Teachers became discouraged in their use of the Internet when Web sites that they had found or heard about and planned to use disappeared or changed when they went to use them:

Sometimes a site that you really, really want is not available. You've found one that you think, "This is it!" and you go to the URL and it's not there anymore.

There are so many places where they give you Web sites for certain. Then you go and they're not there.

Need to make two lesson plans. Because teachers could not count on the technology to allow them to accomplish what they had planned for a class session, they found it necessary to have a backup lesson plan whenever use of the Internet was integral to their primary plan. Teachers felt that this consumed an inordinate amount of their time:

Well, we've had trouble recently in our network here at school. I think it was county-wide and it has been very slow. It goes down. I headed up a staff development here at school and on Friday night it was down, and on Monday morning it was still down and we had to go to plan B. It was full-day staff development for everybody at school.

You have a limited amount of time. I'm not a clock watcher, but our periods here are about 55 minutes from bell to bell. By the time you get them in, get the roll, get them settled down, and they get through talking to their neighbor, you may get 50 minutes. So then when you give them whatever they need to do or get them into the [computer] *lab, before you know it the bell rings. If the Internet is not there ready for you, then you're faced with "Now what will I do."*

When you plan computer time, you always have to plan double: Double time and [an] *alternative activity in case you can't get on.*

It was easier not to plan to use the Internet at all than to plan two agendas in case the system happened to be excessively slow or down. Even having a second plan in reserve was not always a safeguard against lost time, because sometimes it was not clear that the first plan was inoperable until it was too late to implement the alternative plan.

You have to plan twice. But actually, you can't even plan twice, because once you say this is what you're going to do, you're not going to stop in the middle, 15 minutes later. We need to sit there the whole time and see if it comes in. But towards the end, like 40 minutes later, you realize, "Okay, this is not going to work today."

Slowness of the network. Teachers described the computer networks they depended on at school as overcrowded and slow, both for initial log-on procedures and for downloading material from the Internet. The network was reported to run slowly because it was overloaded by too many users for its capacity and because it needed updating:

When you have a lab situation like our lab, and you have 28 computers going into the same Web site, it usually slows it down.

We have so many computers on one line that just to load it up will take, depending on the day, 5 minutes, 10 minutes, and I have limited time.

When you have 32 computers up and going and trying to get on the Internet at once, it takes anywhere from 45 seconds to a minute and a half just to load one page. With seniors it's not a problem for the most part because they'll just sit there. . . . But you've lost younger kids. Oh, with the freshmen it's just a nightmare. You try not to do anything like that if you can [avoid it]. *Freshmen will just keep clicking the mouse, which slows everything down even more. . . . So that would be another reason why I'm not real keen on it.*

Some teachers were sufficiently discouraged by the slow network speed that they had abandoned use of the Internet in their classes:

> *Our particular system is extremely slow and time-consuming. So you think long and hard about the downtime waiting for things to come up. So maybe I don't use it as much as I could, knowing that I've got only a certain amount of time. Until they fix the problems with the access into the World Wide Web, I maybe won't use it as much as I could.*

> *For me, the benefits of it in terms of bringing the whole class down to a lab don't outweigh the time spent trying to access something.*

> *I also don't like to do a lot of Internet stuff because our network is so slow. I mean, we're a new school, but we're still just using 10 BASE-T lines, and so it's very slow.*

Students also complained about network speed. Some students reported that they had better network capability at home than the school provided, and that because of this, they preferred using the Internet at home for both personal and school work tasks:

> *It takes forever to get on line.*

> *Here it's just like 56K modem, but at home I have T1 and I can download stuff like a whole MP3 in 5 or 10 seconds.*

<u>Lost curriculum time</u>. The ultimate result of the slowness of the computers, the unreliability of the network, and the computer crashes teachers experienced was lost curriculum time:

> *I mean, sometimes, when everyone goes on the Internet at one time it's hard, but it eventually comes up. A lot of dead time in the class then.*

> *We have a lot of stuff here that if you try to apply it to a classroom situation, you find out that your curriculum actually is hurt by the technology,* [rather] *than helped by the technology. For example, we get 30 kids going on the Internet, and then it crashes, and you've wasted a whole day.*

> *I would say the only barrier would be . . . when the system's down and you have planned to use it that day. You've signed up ahead of time, and then that day the system's down, and so you lose your day.*

Teachers were concerned about the time students spent waiting for a Web site to come up and restarting a frozen computer, and the limited portion of assignments that students were actually able to accomplish under these circumstances:

> *We have a capacity to do real-time chat with . . . like Antarctica. It's frustrating. We did it one time with <u>Jason's Team</u> going down through the rain forest, and we're typing in and we're typing in, and nothing. So you're teaching a curriculum. You want them to learn about the rain forest, but you're lucky if you can ask one question, and so, in the*

meantime, the answer wouldn't come back and the kids are all sitting here and waiting. As a teacher, you hate to have that kind of downtime.

Long wait times made students restless, which further threatened teachers' curriculum goals:

I'm impatient enough, but my students get really impatient. If it doesn't come up, I have to stop and switch to something else.

You have 35–40 kids in a class and only 30 computers, and kids are trying to pair up anyway, and it's easy to get frustrated. One problem goes wrong, and you can easily start to lose control of the class.

Network closed down daily for security. In one of the schools, teachers reported that the system closed down in the late afternoon, apparently for security reasons. Since several teachers reported that late afternoon was their primary time to explore the Internet, this shutdown policy was frustrating to them, even though they understood why it might be needed:

The time that I have [available] *to spend on the Internet is usually after 5 or 6 in the evening, when I'm still here. The system is down at that time and so it makes it very difficult. The only access you have is the e-mail, so I could not go on the Net and surf or seek out information, or go to Web sites that I know, which would be the most advantageous time to do it and prepare for the next day or oncoming lessons.*

My biggest concern is accessibility with the district shutting down or taking us off line as early as they do in the day. I understand the security reasons as to why that is done, but I would think with longer access we would have more people perhaps making use of it.

Unavailability of Software Needed for Internet Work

Teachers were unable to use some of the things the Internet provided because the school's computers did not have a needed plug-in or version of a Web browser. These software problems could not always be solved by simply downloading the needed item. The school's computers or operating systems were sometimes too old to run the needed item.

My computer [at home] *can do more than the* [computers in the] *computer lab. I've come across great Web sites and they* [students] *can't access them. It's too big, or it requires peripherals that the school doesn't have, or a plug-in.*

A lot of the computer programs that I'm interested in using are now JavaScript that are on Web sites. So math programs where you don't have to have the software anymore, they're just on the computer, on the Internet in the form of a JavaScript. Those are things that I'd like to use, but I've noticed in the computers, at least upstairs in the building, . . . they aren't equipped to handle the form of the Java. I can't run the JavaScript here. So we need to update the browser. I believe it's just updating the browsers. . . . I think for right now, until the technology is able to keep up, I won't be able to access a lot of the neat JavaScript things that I've been seeing.

Insufficient Technical Support Staff

A shortage of technical support staff was perceived by teachers as a barrier to their use of the Internet. Teachers reported that technical support staff had to serve too many teachers and students, or had too many responsibilities:

They're . . . usually backlogged. . . . They will help you, but you can't always count on them being available.

The technology coordinator is bombarded with everyone after him. I feel bad and I hate to bother him because he's so bombarded.

Our technology person comes around when he can, but he's so busy doing five or six jobs.

Insufficient technical support staff contributed to problems with computer lab supervision:

We don't have a full-time lab person to support the lab.

There [isn't] *a person in the lab after school, so the kids can't get their projects done.*

Technical support staff were often located in a part of the building far from the teacher experiencing a technical problem in a lab full of students:

You can sign up for a lab and use it as an Internet classroom and . . . there's nobody on hand regularly for technical advice, or, if you don't know quite what you're doing, there's nobody on hand to advise you.

But there's nobody handy. I mean, if you're in the classroom and something happens, it may not be possible for you to get assistance until . . . 3 or 4 days later.

In this situation, help that came several days later was too late. Teachers reported that although they could do some things themselves, they needed someone with more expertise than they had to help them with the more technical aspects of computer equipment and Internet use.

Teachers in one of the schools that depended heavily on teachers to provide technical expertise to their colleagues felt that their needs for technical support were not adequately addressed:

Unfortunately, the teachers are not, none of us are very technologically savvy. It's sad. I'm considered one of the top people, and I know very little. So I find that besides [one or two other teachers] *there is no one on campus I can go to. That is probably the weakest link in the whole thing. . . . We need a professional person on campus.*

Somebody needs to come in, plug it in, and say: "When it doesn't work, give me a call."

I know that a lot of faculty people are really upset because we can't get basic services. Even though wired for the Internet, some of the classrooms have computers that don't work on the Internet. Nobody has gotten around to putting them on since September. We have work orders since September to do that, and I don't know what to do with them.

The teachers who provided the technical expertise felt stretched too thin to do an adequate job of providing technical support:

They keep saying, "Just teach teachers, and then they can help each other." We already have a full-time job. This sort of [technology] *stuff is full-time. You need a person who is dedicated to it, has time to spend with teachers.*

Students also reported that insufficient technical support was a problem for them:

Your friends. The teachers. There is not enough help to go around usually. They don't have a designated computer person.

[We need] *more knowledgeable staff that could help us out occasionally.*

Insufficient Training and Guidance

Teachers indicated that they felt a need for more guidelines and more training that was tailored to their teaching situation and subject, to their mode of learning, and to their level of experience with the Internet:

I wish for more guidelines, explicit guidelines for what I'm teaching, to help me to find the best sites. . . . What I need is a magazine or somewhere that I can go to on the Web (and maybe there is a place that I don't know about) that will tell me, "These are excellent programs."

So any kind of general information session, which is what they seem to have most of from the things that I've seen . . . just haven't been of interest to me because they seem to either [be] *too focused in another discipline, or too general.*

I need a college class that focuses on teaching teachers how to use Internet and the Web more effectively in a classroom with a limited number of computers, and the other challenges emanating from that. There are classes like that out there. But they charge us $400 or $500 a unit. At this point, I can't quite justify that expense. What the district offers is a class from 2 to 5 in the afternoon, or from 3 to 6 in the afternoon, on PowerPoint. And then a class 2 weeks later on using Web sites in your classroom. But for my way of learning, I would need a consistent class.

One of the things I find frustrating is there are no manuals anywhere. I would rather sit down with a manual and figure it out on my own time. Sitting at home or even sitting here, coming in on a Saturday and just playing around. . . . The problem is, I find that the people who are taking these things [training sessions] *are way up here already, and they're asking questions that I don't even know what they're talking about. It could be a*

> *foreign language for all I know. If I knew the basics, if I had a manual that I could look this stuff up, I think I would feel much better about it and maybe take some* [training, courses]. *I've got the okay to go get a manual and start doing that.*

Students indicated in interviews that they saw teachers as insufficiently trained to give them the help they needed in using the Internet:

> *Maybe if some more teachers were a little bit more educated about how to use Internet, you'd feel free to ask them about it.*

<u>Questionable Quality of Material on the Internet</u>

Teachers expressed concern about the quality of material on the Internet, primarily in terms of its questionable validity and credibility, and its commercial orientation. These concerns led teachers to avoid using the Internet or to limit their use to only certain kinds of sites.

<u>Questionable validity.</u> Teachers had doubts about the validity of material found on the Internet:

> *When I've been going through different Web sites myself looking for information, I'll come across things that I just know are wrong that people are writing. I think there is a natural human tendency to believe what's in print, and that concerns me because there are a lot of kids now that their primary source of information is on Internet.*

They noted that inaccurate information was sometimes presented in a way that looked official and factual:

> *All the sources are not always reliable . . . I don't think all the students understand that. Not always, but at times we see things in print or posted in a certain way that sounds official, or seems official, and it's taken as truth.*

> *Here people can just go out on their own Web pages and put out whatever, and there is no one else who says, "Yes, that's worthy of publication." There is no screening system that I know of. You could really get misled.*

Some teachers limited their use to government or organization sites, and avoided commercial Web sites to address the credibility problem:

> *Mainly I use, like, Library of Congress, or I use things that I know are not dot com, mostly dot org or dot gov, as resources.*

Despite teachers' contention that students did not critically evaluate the quality of what they found on the Internet, some students did express concern about the quality of material on the Internet:

> *Sometimes the pages are more updated than books. But sometimes the pages are not true. There is no way of knowing if it is true or not, unless you read the book.*

You've got to determine what's false and what's real 'cause there is no publishing, there is no copyright, there is no nothing. There is no law saying, "You can't put this on here because it's not true."

Student interview comments revealed that teachers had worked with students regarding some steps they could take to deal with questions about the validity of material on the Internet:

The only thing that they tell us that we could use to [determine] *what's true and what's not is our own common sense and judgment. You can't be just a complete moron on the Internet, just thinking, "Okay, this said that, print this out, turn it in." And all that information could be wrong. You actually use the little bit of knowledge that you have. You can verify specific points in it. Even if you have a site, you should still look into that, and get another site.*

You should go to a site that has a reliable source, like the LA Times*, something like that. You know they're pretty reliable. They don't give you false information 'cause they've been trained not to do that. You've got to find reliable sites. That's why I don't really like going in a new site to get information 'cause I have a list in my mind of reliable sites to get the information from.*

Commercial orientation. Advertising on the Internet deterred some teachers from using it for educational purposes:

One of the things starting to bother me about the Internet is the commercialism of it. It's gone so much towards the commercial, just being another store you walk into. That bothers me.

I don't use it very much. I use it very sporadically. I get tired of looking at the advertisements.

The whole commercial side of the Internet I avoid. I really don't like that part of it at all. . . . The whole commercial side of Internet is just advertising right there at your fingertips. It's just another place where advertisers can market things. That, to me, is a really negative thing.

Teachers noted that this aspect of the Internet was becoming more prominent:

I know it's so commercial. I remember when it first started. It was harder to get to places and harder to find things, but there weren't commercials slapping you all the time.

Overwhelming Amount of Information

Although teachers and students appreciated the comprehensiveness of the Internet and the vast array of material it made available (see Chapter 4), the disadvantage to this feature is that so many resources could be overwhelming. A number of teachers noted how difficult it was—for both them and their students—to deal with the volume of information on the Internet:

What I don't like is that you see so much stuff that you don't need—that you have to dig through.

The amount of information out there is enormous. And for some reason, that makes the Internet a bad thing, because we have to go through so many things that are irrelevant.

I've heard the analogy that it's like drinking water from a fire hose. You put in terms that you want information on, and you get 17,000 hits. . . . you can't even sort through it.

Teachers worried that the information overload led their students to give up too early in the search for the best information:

I can see how they're overwhelmed by it. . . . And they're likely to think, "Well, there's no way I can learn or assimilate all this." So they'll go to one or two spots, and run off some stuff.

As much as students liked the wide range and volume of information available to them on the Internet, they also noted the downsides to this amount of information. They were frustrated by the volume of material and the difficulty of wading through it to find what they needed:

Sometimes you go in there and you just can't find the information, and it gets frustrating, and you get headaches, and you're looking at the screen for hours, and you looked through all these pages and all these sites. I think that's kind of a barrier.

The downside is the fact that when you are looking for very, very specific pinpoint ideas, you have to go through layers and layers of pages just to get to what you have to find. And it'll take forever. For something that you can take, like, 3 minutes to do in a normal encyclopedia probably takes you up to 30 minutes or 3 hours just to look for on the Internet. And that's one of the biggest downsides to it.

Lack of Needed Organization

Teachers perceived what they described as a lack of organization as compounding the difficulties in handling the volume of information available on the Internet. Teachers thought the lack of organization made it harder to find things, especially for students:

I think the Internet will be around forever, but I think it needs to be organized a little better. They could probably do an alternative Internet that was made for students directly and have it more organized.

The thing I don't like about the Internet is that it is not organized. It's really a mess. When you go in there and do a search, you never know quite what you're going to come up with. Students get real frustrated with that because they'll come up with 180 hits, and none of them are really applicable.

And the organizational factor. People try to do their best, but you've got every day a thousand more people dumping on their Web sites, and how are you going to organize that? It would take an immense amount of effort to try to organize it.

Teacher Fears and Preferences for the Old Ways

Some teachers felt that their own lack of confidence and inadequate skills were holding them back from effectively using the Internet:

We've had various training things here for the faculty. I don't know, I guess it may be my lack of self-confidence in just embracing the computer and the Internet. Some things that they have provided for us I just haven't picked up. The barrier may be my own lack of expertise in using it.

I'm not a computer genius. I'm technologically impaired. That's the reason I think my usage is not where it should be. I'm taking classes all the time, but it seems like I'm always two steps behind and trying to catch up.

Although I know how, from his classes, to pull things off the Internet to use in a project I might be building, I haven't done it enough that I feel I could do it comfortably.

Internet searches were mentioned as especially challenging: teachers said that searching took them too much time or was unsuccessful:

I'm not very good at searching on my own. I think searching is very difficult. To figure out what topic, what word somebody else used to [get to] *the page you want is very difficult.*

I've been very frustrated because I can't find what I want on the Internet. I have never been very successful . . . it takes so long that it is not worth it half the time.

I know how to use a search engine, but I have no idea what to begin to say to call up [what I want] *to find. I'm not sure how to narrow it down. If I had more things like that, where I knew how to find things more readily, I might use it more.*

Teachers also talked about preferring to do things in ways that were familiar to them, rather than using the Internet:

I'm old-fashioned and I like to look it up in the book, or the phone book, or a phone-call-type-thing. That's what I know.

Sometimes they saw the old familiar ways as easier and quicker for them to use than learning new ways on the Internet:

I do [have the Internet at home]*, but I don't use it. I don't like it. There are faster ways for me to get information that I need. . . . I know other ways to get information quicker.*

It gets complicated, and I guess that's why I see it sometimes as an impediment. I've found it so easy to go to the library. I knew the research tools, I knew how to access information that I needed, and I didn't waste time.

Sometimes their preference was based on the value they placed on their familiar ways of doing things:

I know, for myself, I try not to rely so much upon it because I'm still kind of from that (even though I'm not terribly old yet) school of thought where you do a little digging if you want to find something out. Books are a valuable resource.

To communicate with other teachers and with the administrators, I'm still the type of person, I like to walk into their room . . . . I need to sit in front of them and talk to them instead of e-mailing them what I need. [If] *it's important . . . I still go to their offices. I don't like to communicate with people on the Internet.*

More Appealing or Compelling Interests and Agendas

Some teachers were simply not interested in the computer or the Internet, and found other pursuits more appealing:

It also doesn't draw me. It's not something that I enjoy. For me, it's more a learning tool and that kind of thing. It's not something I really enjoy doing. I would much rather be outside or reading.

I don't even have a computer at home. So . . . I don't go home and troubleshoot and play around and try networking my own computers . . . which is what I found all the other teachers that I've ever taught with do. That's not how I spend my time.

Teachers in some schools were preoccupied with responding to state- or district-imposed agendas that, for the moment at least, drew their attention and energy, and those of the entire school, away from Internet integration. Because of the student populations they served or because of state- or district-wide initiatives, some schools were focused on goals that did not highlight or include Internet integration:

I think our priority right now has been graduation standards . . . and how we can meet and exceed those. So . . . all the in-service training was geared towards that for the past couple of years.

Whether or not teachers were interested in Internet integration, the competing agendas took precedence:

I came here to this school because of the technology. The first year I taught here was 4 years ago, and the first year and a half I used a lot of technology. I had kids on computers all the time. They were doing Web pages and HyperStudio and digital imaging stuff. Then they weren't passing the basic standards, and I thought it doesn't do kids a lot of good if they know how to use HTML code and they're not getting the basics. So now I

> *don't use* [the Internet]*. . . . I've kind of scrapped it all. I've gone back to 1950s teaching now.*

> *I've been hired to get kids through the basic standards, and this school is judged by how many kids are passing the basic standards. I really see that as my primary job, as much as I would like to do some* [other] *things.*

Some teachers, however, had found ways to incorporate the Internet in addressing these external agendas:

> *Most of them do not pass the basic standards test. So we have a Web site that has the content with the test examples, and they do that, and then I help them to correct and then understand them so we can be able to pass. Especially math. We have a program that we use in the Web site with examples for them to do.*

<u>Skepticism About Computers and the Internet As Learning Tools</u>

Some teachers viewed the Internet as an ineffective or unnecessary learning tool. In these teachers' minds, its results did not justify the investment required to use it:

> *I look at computers as just a delivery system. I don't think it teaches them anything that they can't get anywhere else.*

> *Just 'cause you access the information, it doesn't help you think.*

> *I think it is way overblown. . . . I had a colleague . . .*[who] *got some good stuff off of it and for the time she spent, for every few hours, she would get one usable assignment. I think it is overrated.*

> *I think my time is spent better as a teacher developing their internal cranial processes rather than how they access a menu. Their cognitive development, I guess.*

Some teachers did not think valuable class time should be, or needed to be, spent for students to learn to use the Internet:

> *They have to be at home with it* [the Internet]*, but I don't think being at home with it is that complicated. It's not something that you have to study for a long time. These kids can pick that up quickly. What they need to pick up is how to read and write. And they don't do that from the Internet.*

> *This is not something you need a lot of study to do. You don't have to be a rocket scientist to know how to get on the Internet; you don't even have to be literate. Just barely literate, you can get on the Internet. And what I say is, "So what?" If you can't read and write, if you can't produce things, if you can't reproduce your ideas in a written form, you're not literate. If you can't read other people's ideas, you're not literate.*

<u>Lack of Time to Prepare for Using the Internet</u>

Teaching with technology did not necessarily save teachers time in preparation. In fact, many teachers reported that incorporating the Internet in their teaching took added time:

> *There's just no way I could guess at how many hours it's taken to get that Web site where it is. And, if a teacher's going to get something to that point, they have to believe in it and be committed to it. There's an awful lot of teachers that wouldn't spend anywhere near the time that that Web site has eaten up. I never say to anybody that the technology, whether it's the Web site or the PowerPoint or anything else with technology, that it's going to save them time. Because it's not going to save them time. In the short run, it's going to take tons of time. The only way you could ever say it saves time is in the long run. So, if you can use it for years and years, then okay, you might say it saves time. But you have to be looking at a very long run. So the technology costs teachers time. . . . It's time both ways. It's time on sitting in front of the keyboard, and it's time on the applications, and figuring out how to teach kids with it, get them to appreciate it, all that. Technology takes a teacher a lot more time than not having the technology.*

> *This takes a lot of time. Even if you're taking existing work and putting it on the Internet, it takes time.*

> *It can be frustrating because it does require a tremendous amount of time to really produce an effective lesson using the Internet.*

The time required to use the Internet was a deterrent mentioned by many teachers in all of the schools. Even before preparation of an Internet-based lesson, simply exploring the Internet to locate sites they believed would be good resources for their students took considerable time out of their already heavily scheduled day. Teachers felt that this kind of work took extended time at one sitting, a luxury that they did not often have. In-service days, a potential source of this kind of time, had been discontinued in some of the schools because of state and school-district policy changes. Teachers' responsibilities were many and varied, and pulled them in many directions, making it difficult for them to focus sufficiently on the preparation they felt was needed to use the Internet as a learning medium in their teaching. Teachers' comments suggested that many of them saw integration of the Internet as an extra—something that was over and above their other teaching responsibilities.

<u>Little opportunity in daily schedules for Internet exploration.</u> Teachers' days at school were so full of regularly scheduled activities, there was little time to fit in working on the Internet:

> *I have five classes, and then my sixth class is a sports one. . . . another teacher . . . comes into my room and teaches, and so I have no time really available except for after school and, unfortunately, I'm a coach. I coach immediately after school, and so I really don't have a lot of time to even play around and learn a little bit of how to access the different things on the Internet.*

Time is a factor because after school is out, there is so much else to get done that I don't have the time to go on line to seek information, and by the time you do . . . it is 5:30 or so that they go off line. . . . I would love to use the Internet more, but my day is spent consumed with so many other things.

Many teachers indicated that they did not have time to learn to use the Internet, to practice skills in using it, or to search for sites that might be useful. When teachers did have a preparation hour in their classroom, students came in for help:

When I'm in there, unless I lock the door, kids are coming. So I don't have time to mess around with it.

Teachers said they needed an extended period of time in order to do Internet work, not just a few minutes here and there:

Many times, I'll start and I have to stop again because of time. So it's just this interruption. You need more, longer, spaces of time in which to do that.

Most teachers thought the school should provide them with at least some of this extended time, but some teachers saw finding the time as their responsibility:

What would get it there [is] *giving us as a staff a workday that is a normal workday, but without students. . . . We have no days like that. We had . . . only* [one] *in-service day . . . all year long. And that day was filled with stuff on the graduation standards. We used to have somewhere between 6 to 10* [in-service days]. *The state asked that we add a couple days to the school calendar. And the district decided to add even more* [school] *days, and they just took them* [the in-service days] *away.*

It is my responsibility to find more time. It would be really nice if this school could find the time for me, but unfortunately, you know, we get one planning period and you get after school, and you get before school, and you get summers, and breaks. This semester I haven't, but in the past I've spent an awful lot of Sundays up here. So, teachers are really responsible for finding their own time.

Competing responsibilities and demands. Teachers' multiple responsibilities—such as being the department head, being assigned to coach, being assigned to head up school initiatives, and meeting with parents and students—pulled them in many directions, making it difficult for them to create the opportunity they felt they needed to learn and incorporate the Internet:

I wear so many hats, it's very hard for me to juggle them all.

I don't have time at school to do anything else. I'm department chair and my time is either in my classroom, after school with my kids, at lunch with my kids, or in department meetings and school meetings. I just have no time to use my school computer. I do most of that in the evening or during summertime.

I do typically use the computer in relation to Internet use for e-mail and some [other] *Internet use, but not a lot of looking at Web pages. I frankly don't have much time. If I had more time, I would explore more what is available to me as a professional. Frankly, I'm just so busy with my many responsibilities.*

The responsibilities awaiting teachers when they returned to their classroom after receiving training in using the Internet made it difficult for them to apply what they had learned before they forgot it:

It's hard sometimes when you're at the training sessions and you have some great ideas, and then you come back and you have so many other things on your plate. Things get pushed to the side.

For some, the Internet seemed to loom as yet another added responsibility, rather than something that was integrated into their day-to-day activities:

I haven't had the time to sit down and do it. And it just seems like an extra piece, rather than a complementary activity, at this point in our lives.

<u>Student Fears and Lack of Confidence or Skills</u>

Teachers mentioned that their students' abilities to do the conceptual work needed to deal with the Internet were limited:

They don't know how to narrow down to the little thing that they need to be looking for, and they're too global, and they don't know how to get it down to an easier thing to research.

Sometimes there are kids who need more of a structure, more linear kinds of instructions. They have a hard time with such a huge, massive database.

Teachers observed that many of these students avoided using the Internet so as not to reveal their lack of computer literacy to their peers:

Students are inhibited by technology, and don't want to look incapable in front of their friends.

They don't really understand how they [computers] *work, so they don't want to get on there and look dumb. It's pride.*

<u>Wide range in students' knowledge and skills.</u> Widely varied levels of computer literacy among students in the same classroom made it hard for teachers to meet everyone's needs:

When they come to us, they're all over the board. Some of them have used it a lot; some of them have never even touched it.

I've got kids (in the 9th grade) who could work at the technology university, and then I've got other kids that are computer-illiterate.

Some students actually had the needed computer skills, but lacked confidence in their skills:

I've really got a wide range. I've got some that are very comfortable. In fact, they are teaching me how to use it effectively and I'm learning from them, and then I've got others that really struggle with it. I've got some that really cannot do it on their own. And I think it's more like confidence for them than lack of skills. They've got the skills, but they're not confident that they do. So they're hesitant, and they're very concerned about messing something up.

Low basic skills levels of some students discouraged teachers from using the Internet. Teachers reported that students needed to have a certain level of basic skills before they could use, or were interested in using, the Internet:

They need to have a certain minimal level of skills before computers become interesting.

If the kids could read better and were better, more savvy readers, I would be more inclined to use it [the Internet] *more times a week.*

The work teachers needed to do with some of their students in basic skill areas took precedence over exposing students to the Internet:

I rarely send them to the Internet. . . . I rarely use it. I'm just trying to get my ninth [graders] *and tenth graders to find the area of a square and the perimeter.*

I would like complete academic freedom to do what I want. . . . Given that, I think I would use computers more often because that is the reality of the workplace. . . . I think that is the direction things are going. But [until] *they pass their basic standards, that's the business I'm in.*

<u>Opportunities for Distraction</u>

Teachers bemoaned the ability of the Internet to distract students from their academic tasks:

Sometimes they go off task because it is easy to become distracted on the Web.

I think that the World Wide Web has gotten so large and has so many different sites that . . . students have a hard time learning how to find a site, and they can get easily sidetracked.

They . . . get Madonna's latest CD, and that will distract them, as opposed to going places [they are assigned].

This was enough to keep some teachers from allowing students to use the Internet in their classes:

I don't allow them to [use the Internet in class]. *I do allow students to do that under certain conditions, but it's too distracting to have the kids surfing the Net while class is going on. So we have a hands-off policy, except for certain things.*

<u>Plagiarism</u>

A number of teachers felt that the Internet promoted plagiarism. Sometimes students committed plagiarism because it was so convenient to just print material off the Internet and claim it as their own:

> *If they have a paper due, they can actually go and print it off, and change the name on it and hand it to you. So that's something that we've had to deal with. A lot of times they will give themselves away because of the wording. We know they can't write like that.*

> *I find a lot more cutting and pasting and not really reading. . . I think a lot of them don't even understand the whole concept* [that] *just because you found it on the Internet and you can print it, that doesn't mean you have a paper yet. Students do just literally put their name on the top. They don't even bother to cut off the Web page where it came from 'cause they don't get that that's not what we're looking for.*

> *It has become the modern version of* CliffsNotes*, where they will plagiarize or just plain copy off the Internet. I've had papers that they have handed in that they haven't bothered to remove the headers or footers or the side carets, so it gives it away that they've gone on the Internet the night before a paper is due and just taken something off.*

In other cases, students who struggled with English were overwhelmed by the task of sorting through information they found, and abdicated their writing responsibility by submitting their printout as their work:

> *I . . . have foreign-born students with various levels of English proficiency. One thing I don't like about students doing their reports on the Web is that I notice that they just download and have the material there, and they sort of staple it as their report. . . . It's just like you would xerox a page from an encyclopedia.*

<u>Student Abuse of Equipment and Privileges</u>

Teachers mentioned a few cases where students had intentionally or unintentionally damaged computers or systems. Such problems were reported at several of the schools, but in each case they were identified as limited to a few students.

> *Students get on there that don't know what they're doing, or they mess something up inadvertently, or they're really hacking the computer but they don't realize it.*

> *We had a situation last year where a couple of students abused it, and it happened again this year. Some students abused it by using it inappropriately, and because of that we had to sign papers saying that we would not do those sorts of things. We would not shop online, we wouldn't put ourselves at risk of getting into controversy.*

> *Perhaps a few barriers that we may have come across are people using it inappropriately, students. And so then they'll . . . have to shut down the Internet for a while. Recently that happened, and because* [of that]*, kids getting into porn sites or something, we have a filter. So that shouldn't happen, but things happen. And so that*

kind of thing makes me very angry, that those few students, anyone who might do that, would create such a problem for the rest of us.

Students, too, discussed the issue of students misusing their privileges of access to computers and the Internet at school. In particular, they mentioned peers who learned and then used other students' log-in codes or teacher-access codes that allowed the school's filter to be overridden:

They [teachers] *all have an access code, they can dislodge* [the filter]. . . . *Each teacher has their own code. But some students steal the code. . . . Some teachers type it in for them, and* [students] *have abused when teachers tried to be nice to them.*

One school had established equipment-security measures to reduce the potential for student misuse. Students had to sign out a computer mouse to use. They were given stickers for their school identification cards to verify that they had parental permission and a signed acceptable-use agreement on file. Students showed their sticker and were then issued a mouse, which they had to return at the end of a class hour. Some students complained about the time this procedure took and questioned its effectiveness in preventing unauthorized use of equipment, while others thought the procedures were reasonable and not overly onerous:

You have to have your sticker and you have to give them your ID card, and they give you a mouse and you have to plug it in. The ordeal of sitting down and using a computer and getting up and finishing takes 5 or 6 minutes, and it's such a long line in the library, and they make you wait in the whole line to return your mouse.

That's not a very good idea because most of the kids, they just have a friend check it out and they just grab the mouse from their friends. They just plug it in without even having a consent form. Then their friends get in trouble. So, that's not that effective.

You have to expect a school that doesn't get much funding to be protective of their property. To have a sticker on your ID card, it's not hard. All you do is you sign your name on a piece of paper with a parent's signature. And you turn it in during your orientation. . . . What's really wrong with it? It's just another paper you sign.

The checking out of the mouse and keyboard, that is a good idea because they don't want to get any of these vandalized or stolen, even.

Risks of Internet Use

Teachers identified risks for students and themselves in using the Internet, including Internet addiction, information security risks, and risks associated with students gaining access to inappropriate sites. These risks gave teachers pause in considering how they used the Internet themselves, and whether to involve their students in using it. They were torn between wanting access to the information on the Internet and recognizing the potential risks to individuals of this availability.

Addiction. Teachers had seen the effects of what they described as the addictive qualities of the Internet. They wanted to avoid these effects for themselves:

> *I had a colleague in our small offices . . . she would be on there for a couple hours every day. She is addicted and liked it and admitted it. In fact she had it at home, and she finally got rid of the computer because she was spending too much time.*

> *I know that I don't use it as much as I'd like to, but then there's kind of that Catch 22. Once you start really using it a lot, it's like you're sucked in and you don't do anything else.*

Security risks. Teachers were not convinced of the security of information on the Internet, and did not want to expose themselves or their students to possible problems in this regard:

> *It makes me nervous that so many people are so willing to give out so much information. I do not buy anything over the Internet, whether it tells me that it's a secure site or not. I just don't want to take that risk until they can convince me that it is secure and that my information isn't going to go to the wrong place. I think about my old high school, when they put grades on the computer. There were kids who hacked in and changed all kinds of grades. . . . that does make me nervous.*

> *It's so wonderful, especially if I want to look up somebody from my high school that I haven't seen in years. In a way that is great because they can find out pretty much anything about you on line. But in another way, you've got access to pretty much anything you want. The benefits far outweigh the cons for me because I tend not to think of how exposed people are that way.*

> *There are liability issues if you e-mail something to someone else. It's very possible that someone can use your user name and send something that you didn't send* [in your name] *to someone else.*

Teachers expressed awareness that people intending to harm youth obtained information about them on the Internet:

> *One kid with a digital camera said, "I would like to make a Web page about what we do." So they took pictures of the kids and then posted them. But I had to point out that you cannot put any of the kids' faces up there and so he . . . digitally, it looks like he tore off the faces. It's unfortunate that it has to be that way, but the nature and publicity of the 'Net requires us to do that because of the manipulation of images. I don't want to put any of my students through anything like that.*

> *I'm in Boy Scouts. I was shocked to find out that you cannot publish pictures of scouts on the Internet because there are people who actually surf the 'Net looking for kids and then start stalking and stuff like that. It's totally alien to me. I just couldn't believe that.*

Students were also concerned about security risks in using the Internet. They reported that a common practice among their peers was to avoid giving their real name to Internet acquaintances. But they also thought that Internet contact information (such as an e-mail address) was safer to share with a stranger than their home address:

Most people I know don't give out their real names on the Internet, so it stops stalkers on the Internet who tell you to meet at such-and-such a place.

When you meet someone, you can just give them your e-mail address.

Access to inappropriate sites. Teachers were also concerned that they or their students might accidentally open inappropriate sites while doing a search. They were worried about parents' reactions to such an incident and also about potential negative influences the Internet might have on their students:

Also the high probability of if you do a search, you end up with some kind of pornographic site, unless you have some kind of filtering software.

You could have an irate parent or an irate constituent go absolutely off the wall over something that happened even innocently. So I hate, from that sense, that you have to look over your shoulder and be mindful instead of just worrying about your job and worrying about your daily routine. So that's a bother.

I do fear how it impacts students' lives with some of the things they can get into on the Internet.

Lack of Funds

Teachers in all of the schools saw the lack of sufficient funds for equipment, infrastructure, training, and time to do the needed curriculum development as the main underlying barrier to their Internet use. No matter how much funding a school had, there never seemed to be enough to cover the computer upgrades and expansion of Internet access that teachers felt they needed and wanted. They saw this barrier as one that their school had limited ability to address.

Our budget doesn't allow us to keep up with the software or the Internet. Especially Internet.

I would say a lot of it is monetary. Just the fact that we can't get better equipment quickly enough, we can't upgrade quickly enough. There are just not the funds available, and that kind of goes along with the computers being slow and not responding.

Yeah, here's the problem though. It's economics for the high school. If I were going to develop a course that was totally Internet-driven, I'd need the time. . . . And I don't see the school's being able to afford to pay me to do that.

> *The time isn't insignificant. I think the school would, if they could, give all the teachers the time, if they would do it. But you can't have teachers having two or three periods free to develop these kinds of thing, because then you'll have three times the staff.*

> *This school is at the lower end of the scale, and that is reflected in a lot of different ways here. So the economics of it is a terrific inhibitor.*

Discussion

Teachers identified adequate hardware and infrastructure, Internet access in their classrooms and computer labs, technical and curricular support, adequate and appropriate training, positive experiences with the Internet, administrative support and leadership, and adequate funding for equipment, infrastructure, and training as factors that encouraged their use of the Internet. Students identified ease of access to the Internet as facilitating their use. Teachers reported more factors that hindered their use of the Internet, and students concurred with many of these. Some of these factors stemmed from problems at the school, including limited access, filters, outdated technology, and insufficient technical support staff and training. Other obstacles had to do with the nature of the Internet itself, such as the dubious quality and organization of material on the Internet and the overwhelming amount of material to be found there. Some teachers were inhibited by their own fears and lack of confidence or skills in using the Internet, their preference for familiar ways of doing things, their lack of interest in or dislike of activities that involved computers, or their skepticism about the Internet's effectiveness as a learning tool. Some hindrances were related to the nature of teaching, which left teachers little time to learn to use the Internet or to prepare lesson plans incorporating it; some had to do with school agendas that emphasized other priorities. Some deterrents were related to students. Having students in the same class whose basic and computer skills varied widely made it difficult for teachers to provide sufficient assistance to those who were fearful or who lacked confidence or computer skills, and less skilled students were reluctant to expose their lack of knowledge in front of their peers. The tendency of the Internet to distract students from their assigned learning tasks detracted from teachers' willingness to use it. Students who plagiarized Internet material and abused the technology available to them also discouraged teachers from incorporating the Internet in student assignments. Teachers saw risks for both themselves and their students associated with the Internet. Lack of funds was a root problem underlying many of the technical limitations and the insufficient training and support they experienced.

Many of these influences were interrelated. Figure 4 summarizes the factors identified by teachers and students as influencing their use of the Internet, and indicates how they are related.

Access

Having enough Internet-capable, Internet-connected computers available was a basic factor in whether or not teachers and their students used the Internet at school. Almost all teachers who participated in the study reported having access to the Internet in their school; the majority also reported having access to the Internet at home. In schools with diverse student bodies and high proportions of students from poor families, more students used the Internet at school than at home, compared to students at other schools (Figure 2), and more of these students viewed Internet access at school as very important, compared to students at other schools (Figure 3).

In all five schools, Internet-connected computers were distributed throughout the school in labs and classrooms. Almost all classrooms had at least one computer, and this was typically the computer that provided Internet access for the teacher. Teachers who had access to a computer in their classroom and/or office reported that this facilitated their use of the Internet. More teachers accessed the Internet in school from a computer in their office, workspace, or classroom than in a central location (such as a computer lab or media center). More students, on the other hand, gained access to the Internet in school in a central location than in a classroom.

The absence of a sufficient number of Internet-capable computers impeded teachers' efforts to use the Internet. Although teachers did have Internet-capable computers available to them in all of the schools, the teachers noted a need for more Internet-capable equipment to allow them to do the things they wanted to provide for their students and to attain the degree of Internet access they felt their students needed at school. Teachers also emphasized that connecting to the Internet over a high-speed network facilitated their Internet use. If the school's network were shut down during part of the day when teachers' schedules allowed them to prepare Internet-based lessons, their access was hindered.

Students who did not have Internet access at home said that access to the Internet at school was important for them. Students whose home systems were faster or better than those at school preferred using the Internet at home to using it at school. Because of this, school computers may have been more available for use by students whose primary source of access to the Internet was at school. Both teachers and students evaluated the school's computer systems in relation to the level of equipment they had at home, but this comparison was most pointed in the student interview data. Students whose primary access to the Internet was at school did not seem to mind putting up with slow speed, filters, and servers that were down as much as students who had better Internet access at home.

The data gathered from interviews with teachers and students concerning the barrier of insufficient access to computers and the Internet reflect the transitional stage of computer and Internet distribution in schools and homes. Most teachers had Internet access; a few did not. Some had multiple computers in their classroom; others had one or none. Even computer labs did not solve these inequities, because they were used intensely and were often difficult for teachers to schedule. Teachers identified lack of funds as the fundamental barrier to adequate access to the Internet. Teachers could not count on their students having access to the Internet outside of school, especially in the inner-city schools, but to some extent in all of the schools because of economic disparities and varying parental attitudes toward their children having access to the Internet. This discouraged teachers from assigning students required work on the Internet.

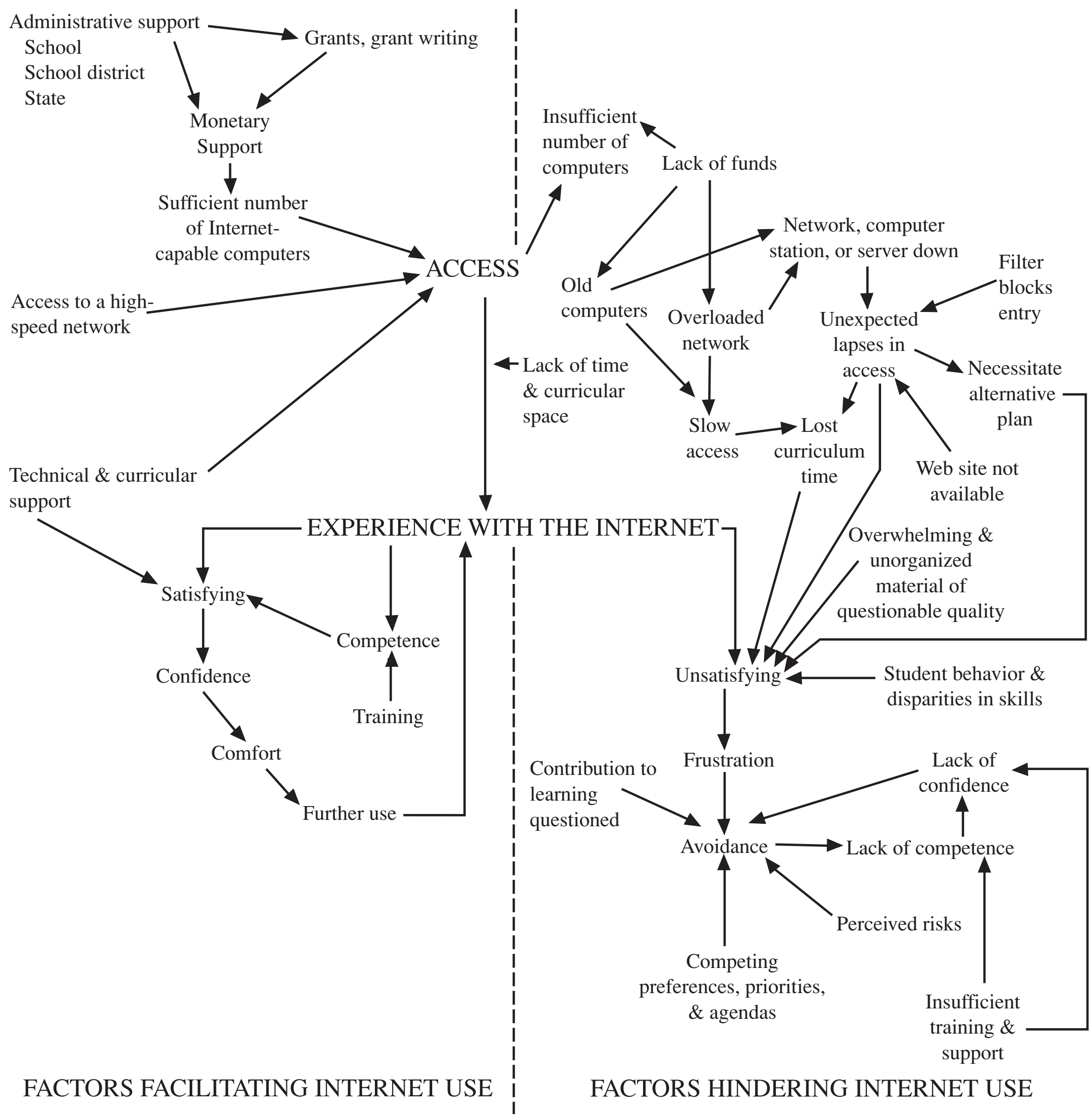

Figure 4. Relationships among factors affecting high school teachers' and students' use of the Internet.

Teachers indicated that monetary support had been essential in supplying the equipment and infrastructure that allowed them to access the Internet. Just how much money is needed to install the computer systems and networks necessary to handle Internet transmission at reasonable speeds is reflected in the special allocations and grants four of the five schools had received for these purposes. The data clearly show the demand for up-to-date equipment and infrastructure on the part of teachers and students, but more subtly also reflect the demand imposed by the technology sector, as software needed to run the Internet requires even more memory, and an increasingly graphics-oriented Internet requires ever more system capacity.

Teachers in several of the schools identified administrative support as an important factor in having funds available for technology. Administrative support was acknowledged at the school, district, or state level, or some combination of these. Seeking grants, providing equipment and training, and providing supervision for computer labs throughout and beyond the school day were some of the forms of administrative support that facilitated teachers' efforts to integrate the Internet in their teaching.

Amount and Quality of Experience

The interview data implied that the more experience teachers had in using the Internet, the more they developed their competence, which in turn enhanced the likelihood that their experiences with the Internet would be satisfying ones. Satisfying experiences with the Internet encouraged teachers to use the Internet, to integrate the Internet in their teaching, and to make the time to do so. Adequate training was mentioned by teachers as important in developing their competence. Teachers had been able to develop their competence in using the Internet through the training that had been provided them by their school and school district; through workshops, courses, and programs provided by colleges and training centers; and through on-line help sites.

When a problem arose that teachers could not solve, being able to get help promptly was important. In each school, a network of on-site technical support staff, media staff, knowledgeable colleagues, and helpful students all contributed to making this kind of responsiveness available to teachers. Teachers who could not count on such support and whose own technical expertise was limited were more hesitant to use the Internet in their teaching for fear that problems that could not be quickly resolved would emerge at the beginning or in the middle of a lesson.

Teachers' comments revealed a close connection between comfort with the Internet and familiarity with it. Those who had been using the Internet for a long time, who felt they knew how to search on it, and who were familiar with some Web sites reported feeling comfortable using it. Positive experiences with the Internet increased teachers' confidence and comfort in using the Internet, leading them to further use the Internet, which led to greater competence. Greater competence led to more positive experiences with the Internet. This mutually reinforcing cycle (depicted on the left side of Figure 4) appeared to be a powerful process leading to continued Internet use on the part of teachers. Because the teacher questionnaire data included quantitative information about teachers' Internet access, Internet experience, and comfort in using the Internet, relationships among these variables were analyzed statistically to confirm or deny what the interview data indicated.

The analysis supported the qualitative linkages shown in Figure 4 among access, experience, and comfort in using the Internet. Table 18 indicates that teachers who had home access to the Internet reported significantly more years of experience with the Internet than those who did not have home access. School Internet access and length of experience with the Internet were not statistically related, perhaps because almost all teachers—both those who had more Internet experience and those who had less—in the five schools had Internet access at school (see Figure

1), whereas teachers' home Internet access was more variable (see Figure 1). The data in Table 18 support the link in Figure 4 between Internet access and experience with the Internet. Teachers with home access to the Internet have more experience with it than teachers with no home access.

Table 19 shows that the length of teachers' experience with the Internet and their degree of comfort in using Internet-based technologies are related. A higher than expected proportion of teachers with more years of Internet experience reported feeling comfortable in using Internet-based technologies. A higher than expected proportion of teachers with little Internet experience reported feeling uncomfortable in using Internet-based technologies. These data lend support to what is depicted in Figure 4: That greater experience with the Internet and comfort in using it are related.

Table 20 indicates that teachers' level of comfort in using Internet-based technologies is related to the extent of their use of the Internet in the classroom. Teachers who reported using the Internet frequently in their classroom were more likely to be comfortable using it, and teachers who seldom or never used the Internet in their classes tended to be uncomfortable using it. It might be argued that this statistical relationship lends some support to the link depicted in Figure 4 between comfort in using the Internet and further use of the Internet.

Table 18

*Relationship Between Teacher-Respondents' Length of Internet Experience and Home Access to the Internet**

Home access to the Internet	Experience with the Internet					Row subtotal
	< 1 year	1–2 years	3–4 years	5–6 years	≥ 7 years	
	(32.1)	(61.7)	(85.6)	(55.1)	(30.5)	
Yes	20	61	88	61	35	265
	(6.9)	(13.3)	(18.4)	(11.9)	(6.55)	
No	19	14	16	6	2	57
Column subtotal	39	75	104	67	37	322 Total

*Expected frequencies in parentheses.
Chi-square = 33.5.
Degrees of freedom = 4.
$p < 0.001$.

Table 19

*Relationship Between Teacher-Respondents' Level of Comfort in Using Internet-Based Technologies and Length of Their Internet Experience**

Experience with the Internet	Level of comfort: Comfortable	Neither comfortable nor uncomfortable	Uncomfortable	Row subtotal
< 1 year	11 (29.2)	4 (4.55)	24 (5.29)	39
1–2 years	51 (55.3)	13 (8.64)	10 (10.0)	74
3–4 years	82 (76.3)	14 (11.9)	6 (13.8)	102
5–6 years	60 (48.6)	4 (7.59)	1 (8.82)	65
≥ 7 years	33 (27.7)	2 (4.32)	2 (5.02)	37
Column subtotal	237	37	43	317 Total

*Expected frequencies in parentheses.
Chi-Square = 101.
Degrees of freedom = 8.
$p < 0.001$.

When teachers' and students' experiences with the Internet were not satisfying, another cycle emerged, which was as damaging to Internet use as the cycle described above was motivating. Negative Internet experiences resulted when teachers' and students' goals and intents were thwarted by having to wait a long time for a slow connection to the Internet and when they couldn't access needed sites. Teachers and students complained about having to wait a long time for the log-on process to run or for a Web site to come up. Wait times could be long when teachers and students were using older computers, when the load on the school or district network was heavy, or when a web-site's server was taxed (as was the case frequently, for example, when a lab full of students were all trying to access the same site). Having to wait discouraged Internet use in school among those pressed for time (most teachers and classes) and those who had faster computers at home. Unexpected lapses in access to the Internet because of hardware or network problems, or a suddenly unavailable Web site teachers or students had planned to use, frustrated teachers and caused them to feel the need to make alternative lesson plans, which required time they felt they didn't have. All of these problems resulted in lost curriculum time. Teachers also reported that the security filter seemed to arbitrarily block access to sites that they viewed as needed and legitimate for school use. These negative experiences reinforced feelings of uncertainty regarding the Internet, especially for those who lacked confidence and skills in using it. Both teachers and students said that they preferred accessing the Internet at home where they could avoid these frustrations.

Table 20

Relationship Between Teacher-Respondents' Level of Comfort in Using Internet-Based Technologies and Their Use of the Internet in Their Classroom[*]

	Level of comfort			
Frequency of teacher use of the Internet in the classroom	Comfortable	Neither comfortable nor uncomfortable	Uncomfortable	Row subtotal
	(37.5)	(5.84)	(6.66)	
Never	29	11	10	50
	(48.8)	(7.6)	(8.65)	
< once/month	41	7	17	65
	(42.8)	(6.66)	(7.59)	
1–3 days/month	39	9	9	57
	(26.2)	(4.09)	(4.66)	
Once/week	30	4	1	35
	(75.8)	(11.8)	(13.4)	
≥ 2 days/week	92	5	4	101
Column subtotal	231	36	41	308 Total

[*]Expected frequencies in parentheses.
Chi-square = 36.4.
Degrees of freedom = 8.
$p < 0.001$.

Some factors that affected teachers' and students' use of the Internet had to do with what was on the Internet. Although the comprehensiveness of the Internet was one reason teachers and students gave for using it (see Chapter 4), the formidable amount of information it made available and its lack of organization could leave both students and teachers feeling overwhelmed. The quality of material they obtained was also disappointing to many. Teachers were concerned about the validity of information they and their students obtained, and the commercial nature of the Internet in general. Teachers felt that material on the Internet needed, but did not get, critical evaluation. Students expressed similar concerns.

Other Factors

Other factors that affected teachers' use of the Internet had to do with their own situations and personal preferences. Teachers reported that using the Internet in their teaching required a lot of preparation time, and that they lacked the needed time to prepare. Teachers who perceived their curriculum as already filled with mandated requirements did not see themselves as able to integrate the Internet into their teaching. These teachers seemed to view the Internet as an "add-on" to the curriculum, rather than as an integral part of it. Perceived risks to students and themselves, and student behavior were deterrents to teachers' use of the Internet. The latter included plagiarism and worries about a few students' intents to damage or misuse hardware, software, and systems. Disparities in students' Internet skills, and fear and lack of confidence on the part of students whose skills were undeveloped added to the complexity of teachers' tasks when using the Internet with 30 or more students in a classroom. Some teachers reported a preference for using old, familiar ways to do things and for activities that did not involve the Internet and computers. Others questioned the Internet's effectiveness as a learning tool. Related to this, some teachers weighted their own and students' time-investments in favor of achieving state-proficiency levels in basic knowledge area, versus gaining Internet skills. A number of teachers said that the training and support available to them was insufficient, or the wrong kind to build their skills and bolster their confidence. These were all factors that teachers found discouraged their use of the Internet.

Conclusions, Implications, and Recommendations

Conclusions

- Factors that facilitate teachers' and students' use of the Internet in school include:
  - Access to Internet-connected computers
  - Access to a high-speed network
  - Technical and curricular support and training
  - Positive experiences, comfort, and familiarity with the Internet
  - Administrative support, encouragement, vision, and commitment to technology
  - Grants
  - A supportive, knowledgeable family
- Factors that discourage teachers' and students' use of the Internet in school include:
  - Insufficient access to Internet-capable, Internet-connected hardware that is in working order
  - Inadequate infrastructure for the demands of the Internet and the number of users
  - Central controls and filters

- Lost curriculum time and extra planning required because access to Internet resources is unreliable
- Insufficient technical and curricular support
- Insufficient training
- Questionable quality of Internet material
- Overwhelming amount of Internet material and its lack of organization
- Fear of the Internet or lack of Internet skills and confidence
- Competing personal preferences, responsibilities, and school agendas and priorities
- Skepticism regarding the Internet's value for learning
- Lack of time to explore the Internet and incorporate it into curriculum
- Students' wide range of Internet-skill and reading-literacy levels
- Students' tendencies to be distracted by the Internet, abuse the technology, and engage in plagiarism and other inappropriate uses
- Personal risks to which the Internet exposes students and teachers
- Lack of funds to adequately support Internet use

• Three interrelated factors emerged as key to participation in Internet-based learning opportunities: access to the Internet, experience in using the Internet, and the degree of satisfaction with one's experience. All other factors were connected in some way to these three central factors (Figure 4).

  - Access to the Internet was a basic prerequisite. For most teachers in the study, this condition was met at school, although the majority of teachers also reported having home Internet access. For most students as well, the school was reported to be a source of Internet access. In the schools with the largest concentrations of students eligible for free or reduced-price lunch, fewer students reported having access to the Internet at home and more indicated that Internet access at school was very important, compared to students in the schools with more affluent students.

  - These data support the suppositions in the literature that the school plays an important equalizing role in making Internet access available to students without home access, and lend credence to the idea that providing Internet access in school is an important Internet-access opportunity for such students. Although such students still likely have less access to the Internet than their peers who have home access, school Internet access appears to have the potential to lessen the disparity in Internet access between students with and without home access.

- The disparity appears to dampen teachers' propensity to give Internet-based assignments, at least in the four schools where teachers felt that students' school Internet access was limited. Consequently, disparities in students' Internet access outside of school means that all students' assignments are less likely to require Internet use.

- The data also suggest that the community library is an important source of access to the Internet for a significant portion of students in inner-city schools.

- Access to the Internet is a necessary, but not sufficient, condition for teacher Internet use. Access to the Internet leads to experience with it, and experience with the Internet is the second key factor influencing participation by teachers and students in Internet-based learning opportunities. The link between access to the Internet and experience with it was tempered by four major factors.

  √ The first of these was lack of time. Teachers reported that they did not have time to use the Internet access provided to them at school. Many responsibilities competed for their time, and school-wide efforts directed their attention, energy, and curriculum toward other goals and activities. The Internet has added significant support and assistance functions to teachers' responsibilities beyond simply using the Internet themselves and in their teaching. Teachers are a source of support and assistance regarding the Internet for a significant portion of their colleagues and students.

  √ A second factor that interfered with gaining experience with the Internet when access was available was insufficient training. Many teachers did not feel they had enough know-how to use the Internet effectively and efficiently. For example, teachers need opportunities to become familiar with the kinds of resources available to them on the Internet and to develop their skills in using search engines.

  √ A third factor reflects the third major factor mentioned above—the quality of teachers' experiences with the Internet. Teachers were discouraged from using the Internet, even though they had access to it, by unsatisfying, frustrating experiences with it. These were caused by the condition of their equipment and networks, by disappointing quality or overwhelming volume of Internet material, and by students' misbehavior or lack of Internet or basic skills. One reason teachers find Web sites that compile links to other Web sites useful (as reported in Chapter 3) may be that such compilations organize and screen Web sites.

  √ A fourth reason some teachers chose not to take advantage of Internet access they had at school was their lack of interest in the Internet or in technology in general, fueled for some by the belief that the Internet was not an effective learning tool.

- The Internet is not a panacea that alone will cure all ills. Like most innovations, it introduces new problems as it solves old ones, and introduces new demands as it meets old ones.

  - Introducing the Internet into schools addresses some needs and solves some problems. Evidence of this is discussed in Chapter 4, which outlines the reasons teachers and students gave for using the Internet.

  - The factors that influence teachers' and students' use of the Internet reported in this chapter, however, suggest that many of the benefits of the Internet have a down-side, as well. For example, teachers and students like the Internet because it is comprehensive—but they also feel it is overwhelming and unorganized. It is fast—but not if the systems on which teachers and students gain access to it are slow. It is easy and convenient to use and saves time and effort—but only if one knows how to use it. It is fun and rewarding to use—but it can also be frustrating and unsatisfying. It can broaden students' awareness—but it can also lead them away from their learning tasks. It expands teachers' knowledge and skills—but only if teachers feel confident and capable in using it. It is expected and even demanded today as part of the culture—but some educators believe it is overrated as a learning tool. It attracts the personal interest of many—but not everyone.

<u>Implications</u>

- When schools embark upon significant acquisition of technology to provide Internet access to teachers and students, they are making a substantial long-term financial commitment.

  - Unless there are funds to continue to update and upgrade computers, software, and networks, new equipment may provide Internet access for a time, but in a few years will cease to be functional. The experiences of the teachers in this study with Internet access and use reflect the state of transition in the five schools regarding the Internet. Equipment is being acquired, but almost never fast enough to keep up with the demand for it by users or by technological developments. Nor are networks upgraded fast enough to keep up with the rapidly increasing demand. Teachers' comments about Internet access and its reliability shed light on how very challenging it is for schools to keep up with technology and demand. If it is deemed desirable for teachers to use the Internet in their classes, schools will need to regularly re-equip and update classrooms and computer labs.

  - Having functional equipment is just the beginning. The systems must operate, which implies the need for technical support—adequate and fast technical support from professionals dedicated to that task, rather than the already taxed teachers. Teachers also need training. These needs require funds that must come out of school and district budgets eventually, even if they are initially supported by special grants.

- Because these financial demands are sizeable, it is important that investments are made in what will be effective, and that steps are taken whenever possible to increase the benefits derived from technology-related investments.

  - Training that helps teachers feel comfortable in using the Internet seems to be a key factor in their propensity to use it. Unless training and other measures are provided to help ensure that teachers' experiences with the Internet are satisfying ones, providing Internet access in school may not lead to frequent use of the Internet by teachers or their students.

  - Curricular support is as important as technical support. Curricular support is also likely to spark teachers' interest in exploring and using the Internet, because it will help them see its relevance to their subject area. Helping teachers see ways of integrating the Internet in their curriculum, and giving them time and assistance in doing so, is likely to be more effective in bringing about curricular integration of the Internet than simply giving teachers a computer and a few hours of training on the technical aspects of how to use it.

  - The benefit of investments made in Technology Innovation Challenge Grant products, such as repositories of Internet-based lessons relevant to school subjects, could be multiplied if more schools and teachers were aware of them.

Recommendations

- The data suggest that what constitutes access to the Internet needs to be thoughtfully defined. Simply having a computer that is connected to a network or a modem may not be considered adequate access. The computer or the network may not have sufficient capacity to access the Internet and Web sites at reasonable speeds, or at all, if the graphics on the Web require more capability than the computer or the network have.

- The ongoing budgetary demands set in motion by introducing Internet access in schools highlight the importance of having plans in place for securing funding to continue to support the new technology initiatives.

- The findings also raise questions that deserve serious consideration. What are the goals of implementing Internet access in school? What evidence is there that use of the Internet makes a positive difference in learning (Chapter 6 addresses this question to some extent)? Such evidence may help teachers who question the Internet's effectiveness as a learning tool, and may also help policy makers decide how much Internet access a school should make available. These questions suggest avenues for future research.

- The findings regarding factors that affect teachers' and students' use of the Internet suggest recommendations for those who want to support teachers' use of the Internet.

  - Technology upgrades, ongoing technical and curricular support, teacher training, and time for teachers to do the necessary curriculum work are major areas of ongoing support that need to be built into technology integration action plans.

- Teachers' needs for training span several areas, and should be reflected in training that is made available to them: how to operate equipment and the Internet (e.g., operating computers, searching on the Internet); how to create Web-based resources, including Web publishing, Web page development, and Web site development; how to find Web sites relevant to subject areas; and how to take advantage of on-line lesson repositories and other Internet-based resources that can help teachers integrate technology in their teaching and curriculum.

- School personnel across the country should be made aware of on-line lesson repositories, such as those developed as a result of the Technology Innovation Challenge Grant Program.

• Finally, strategies for closing the digital divide should continue to focus on providing access to the Internet in schools, but should also encompass other dimensions, such as increasing the Internet access available in community libraries.

CHAPTER 6: IMPACT OF INTERNET-BASED LEARNING OPPORTUNITIES ON TEACHERS' PROFESSIONAL DEVELOPMENT AND STUDENT LEARNING

This chapter reports data from teacher interviews regarding the impact of the Internet on teachers' professional development, including their teaching practices and learning, and from student surveys, and teacher and student interviews, regarding the impact of Internet use in schools on student learning, including students' motivation for learning and engagement in learning.

Impact of Internet Use on Teachers' Professional Development

In their interviews, teachers commented on ways in which the Internet had affected their professional development. For the first time, they had access to virtual communities of professionals. Their own and their students' questions about the Internet and desires to use its features had led teachers to seek opportunities to learn to use it. As a result, they had developed a repertoire of new skills and had added Internet-based activities to their teaching. Teachers reported that their use of the Internet had improved their teaching and their curriculum, and had motivated them in ways that generated enthusiasm for and enjoyment in teaching. Teachers also reported a wide range of both self-directed and more formal professional development opportunities available to them on the Internet; the Internet had also facilitated their progress in traditional degree programs. A few teachers indicated that technology had become a major interest for them, and that they saw the Internet and related technologies as opening up possibilities for new career directions.

<u>Access to Communities of Professionals</u>

The Internet brought together virtual communities of professionals with whom teachers could share their work, ideas, and questions, and from whom they could get feedback. Because these associations were not constrained by geography, teachers had more ready access than in the past to others' ideas, materials, and cutting-edge work in their subject area. These contacts aided teachers in their lesson preparation and helped them keep abreast of developments in their field:

> *I'm on an advanced placement biology listserv. Those people probably have a lot more experience with the Internet than I do. More time to spend on it or whatever. They'll post these great pages that you should go check out. So I use those. I have no idea who they are. It's very helpful.*

> *This is actually my 18th year teaching, and it's gotten better with the Internet. . . . If I'm working on a research paper, I can go in and I can get help. I can present it on the 'Net and share with other professionals.*

<u>Motivation to Teach With the Internet</u>

Teachers used words like "enjoy," "fascinates," and "fires me up" in describing how they felt about the Internet and technology in general. Teachers indicated that they were motivated by the Internet to use it:

I think the training by our people here has made it much easier for me to use. Secondly, [I] *made it to the point where I want to use it. I want to attempt to use it; I want to try it.*

They found themselves excited by what they experienced on the Internet and by the possibilities they saw for using the Internet in their teaching. Teachers expressed enthusiasm about their work because of what the Internet had added to their lessons in the way of visual material and current information:

As an art teacher, [the technology here] *really interested me because the potential for art on line is incredible, especially right now. We've got artists who have full exhibitions on line, and that is something I'm interested in doing with my kids—having more on-line exhibitions, doing more computer-based artwork. . . . I would love to use it more.*

I enjoy it. My stuff! I'd like to show it to you. I like showing it off. I use a lot of my own stuff now . . .

Teachers were motivated to teach with the Internet because they saw advantages to it for their students and themselves:

Some of us got an Internet connection to see what we could do with that. And immediately then, it just came that if I had the lesson plans on the Internet, and if students then had computers at home, they could access all of this any time, if they were out of school or sick or whatever. It'd be there for them.

Teachers' own interest and their students' responses motivated them to try new things, to want to use the Internet more, and to find the time to incorporate Internet-based materials and activities in their teaching:

So I really enjoy that. And then I'll find the time. Otherwise, if it's peripheral, I won't come up with the time to do it. But, with that [the Internet]*, I do. That's been good.*

It makes me more eager to teach and to get here to look up extra things for them, like adding the pictures to the PowerPoint. It makes you enthused to see the kids light up.

Some said they saw the Internet as central in the future of education:

Then I saw the new technology and the opening up of the world. In one morning you know what I do? I dial in a streaming video to [another country]*, and I watch the kids over there drink coffee, and I can control the camera and that excites me to see the world right there. And I think that's the future. That fires me up. . . . I think a school is going to be a source of information, which is going to utilize the Internet a lot more.*

Need and Desire for Further Training to Build Technology Skills

Teachers explained how the Internet had required and led them to seek opportunities to learn more about the Internet and how to use it:

> *Just constantly doing it more, so that I get more experience with it. And I do that by discovering that I need something. For instance, at the beginning of the year, we did a PowerPoint presentation. I needed a Wave file put in where they could do this poem. My students created a poem, and they had to do it on the Internet, and I wanted their voices in there. And I didn't know how to do that. And so I got* [our director of technology to come and help me]*, and now I know how to do it.*

> *So the more I come across something, I'll say, "Well, can I?" How do I . . . and then I ask somebody, "Do you know how to, and can I?" And they will find a way for me to do that. And so, then in the future, I know how to do it.*

> *There were things that I learned from the technology coordinator that I didn't realize. Particularly when it comes to advanced search methods using parentheses and capital letters. I pumped a lot of questions at him, and now I'm basically applying that.*

Teachers both taught themselves and pursued formal education that could help them learn what they needed to know:

> *There's just so many things. I've gained so much knowledge. I taught myself, basically. I got a couple books and I just started going.*

> *When I wanted to do this personally, I went and got a specialist degree in instructional technology.*

Students' questions and desires to know about ways to do things on the Internet prompted teachers to seek answers:

> *They* [my students] *come up to me and say, "I* [want] *to," then I have to point out how. And so, if I don't even know that exists, I find someone who does.*

Incorporation of the Internet Into Teaching

As teachers learned about the Internet, they began to integrate it into their teaching and to make plans to do so:

> *I've been saving my projects as HTML, and then this summer, —— is going to help me put them on the Web.*

> *I set a quest for myself as a result of this degree work that I would incorporate technology into every unit that I taught in some way, and to make sure it was a variety of ways.*

> *I'm finding more and more in my area as the years go by, quite a bit more. I've added quite a few more sites this year for students' projects. It's exciting to me.*

Next fall, I'm teaching banking and finance, so I've taken a class. So I'm creating my lesson plans and using the Web for that.

Their plans and experiences reflected a wide range of Internet-based resources that they were using or intending to use:

I access the site on . . . good layouts for teaching page layout, for using PageMaker or Quark Express.

Whatever the topic of the week is, I'll go on the Internet. There are some Web sites I'm familiar with on drugs or alcohol, and I'll just see if there is any new information or activities that I can incorporate into the class for that week.

I've gotten stories off the Web and have [used them] *as literature pieces for classroom instruction, and I have found background material on some things that we are studying.*

Teaching units on the history of English and Shakespeare, and English in the past, I've used several Web sites that have been very helpful, especially college sites that have pretty in-depth materials on that.

Improved Teaching

Not only were teachers incorporating the Internet in their teaching, but they also indicated it was leading them to change the way they taught, to improve their teaching, and to offer a richer curriculum:

I can prepare better lessons, better lectures, better everything, because this is available to us.

I just know that when I used it this year, compared to the lectures I did last year, it was night and day.

I saw certain things, certain lessons that I can teach better by using the computer to manipulate the information. That's what's motivated me to get more into it. It's not using computers just 'cause I can, but realizing that using the computer or the Internet makes lessons better. That's why I do it.

On a professional level, it has allowed me to offer an enriched curriculum to my students.

Teachers were able to introduce more variety into their teaching by creating roles for themselves beyond that of information-giver and by giving students more opportunities to be information-finders:

I don't have to lecture all the time. They can go right to the material, and they can find it. Right now we're into World War II. . . . So rather than me standing there and talking about it, I say "Okay, we're going up to the library [where students can use the Internet]. *This is an area I want you to look at and see what you can find." And then we'll get it and we'll go back to class and we'll talk about it. And I didn't have to stand up there and* *look at these blank faces that are going, "Why do I have to know this?" So it enables me to vary what I want to do. So it's not just me all the time.*

As far as professional development, it gave me another whole perspective. That you can teach without books and you can teach without worksheets. It's available. It's a current thing . . . I think it's such a good addition to my teaching. I'm not in there and I'm not up there all the time. I try to give the kids a variety of activities. I've enjoyed using it. Being here has been so good for me. It's helped me with my skills, and helped me teach in another way.

I love having it [the Internet] *because it means that I don't have to go out and find all the information to give to them, and that I'm not the only source of wisdom and information.*

Additional Professional Development Opportunities

The Internet had added new dimensions to the array of opportunities available to teachers for professional development. With the resources on the Internet, teachers could direct their own professional development. For example, they could choose and visit a network of on-line sites related to a particular area of interest. They could subscribe to listservs relevant to their teaching area. They could participate in on-line classes and programs from their home or school. Even in more typical professional development settings, such as college courses, workshops, and other group-oriented formats, the Internet was used for such functions as communication, submission of assignments, group "discussions" in chat rooms, and finding resources for assignments. Teachers appreciated the convenience of not having to travel to a class, or at least being able to reduce the time they had to physically be on a college campus.

Self-directed professional development. Teachers used the Internet for self-directed professional development in using the Internet and other technology in subject-area learning, and in teaching practices:

Just for an example, today [for] *their weather assignment, I had to go to the Internet and . . . weather.com was up so I used it. To me, that's professional development. I was getting ready for my kids . . . I use it every day for research . . . to better myself on the topics that I teach.*

Even when I'm looking personally for stuff for whatever reason, I [often] *think* [that] *that would be good to put in this class or that class. . . . So I think it just even gives you more ideas of things to maybe seek, or projects.*

Teachers reported that they had learned to help themselves learn:

If I don't know how to do it now, for example, I need to learn how to do Web pages. I know how to learn it. I know how to learn the thing I need to know 'cause that's something I have developed.

I'm familiar enough with the Internet and trying to find my own sources of information. You can find a lot of information on the Web about how to incorporate the Web in your classroom. So things like that I can do on my own.

If I have a question, I just go to the Internet.

Teachers commented that they enjoyed the investigative nature of this kind of learning:

Usually I try and figure it out for myself. It's only when I'm really stuck that I'll talk to our top guy here, but usually I've run out of options then. I take some pride in trying to figure it out for myself because I like the learning process, and I enjoy that. It's like a puzzle.

I stay here hours after school just to play around with it, trying to figure stuff out.

On-line classes and programs. Teachers mentioned having participated in on-line classes and in graduate programs that were strictly on line, including the oral examinations:

In a graduate program, a lot of it is distance learning. Several of my classes have been on-line classes or partially on line.

I had this computer class on line, the whole class was.

There were a couple of courses, in fact the one I just finished, strictly on line.

When I got my master's, we didn't have orals. We had them over the Internet. So we were asked questions over the Internet, and responded.

Teachers also mentioned taking courses and being involved in programs that incorporated some on-line, Internet-based aspects:

I took a course . . . that was a combination of going to class, prescribed chat room times, and regular contribution to the bulletin boards . . . that would be a time to interact . . . around the state, and the teacher would serve as moderator of the chat room discussion. That kind of thing happens a lot for me in graduate school.

Some of our classes required listservs, and they were helpful.

Even teachers who were involved in more traditional graduate programs or who were planning to pursue this kind of program reported that the Internet had helped them, or would help them, in the processes of entering and getting familiar with graduate school, learning about the institution's policies, and completing their course work assignments:

I'm starting my master's program next fall, and I get information about this university that I am going to. You go to the Internet and get the rules and schedules . . . search for graduation information.

When I was finishing up my undergrad and doing my first master's at the U, I started out using the Internet a lot to access things at the U and to do research. It was great. I could do my research . . . and it opened up a whole new world that I could do so much stuff from home. Things I had not been able to do before, or that would take weeks to find things out . . . and would [otherwise have taken] *a lot more legwork.*

I am going to be starting a master's program in the fall, and I am already anticipating that it is going to be a big help. As opposed to when I was an undergrad, the technology wasn't there. So I'm kind of excited to see how that's going to play a role. . . . The research end of it will be a lot easier. From home on my own time as opposed to a library's time.

New Professional Interest and Career Direction

The Internet, and technology in general, presented a new direction for professional development for teachers. Many teachers reported that their graduate degree was a master's or educational specialist degree in instructional technology:

In the beginning, it really was all just self-exploration. I had no formal training in technology whatsoever. I started taking classes . . . and currently I'm enrolled in a graduate degree in instructional technology. . . . It was really just my interest in the use of technology.

For some teachers, what they had learned, coupled with their technology-related experiences, had spurred their interest in further developing their technical expertise:

I look at where I am now with computer skills, [compared] *to where I was 5 years ago. Five years ago, I didn't know anything. I was lucky if I could turn the computer on and do my grades on the computer. Now it's such a part of me, I can't imagine teaching without technology. And then, when you hear about these schools that have just gotten their first computers,* [I realize] *it wasn't that long ago when we really didn't have anything. My goal now is, this summer, I want to get my A+ certification. It's just something I thought* [would] *be kind of neat. To be able to learn the actual technical aspects of the computer, so I can do my own hardware troubleshooting. . . . It's kind of a goal I've set for myself, to prove to myself, yes, you finally have learned the computer.*

A few saw instructional technology as a potential career path along which they had embarked:

Now that I've got a master's in instructional technology, I want to use it, or I'm going to go elsewhere. That's something I'm going to look to doing. That's something that I really enjoy doing.

Impact of Internet Use in School on Student Learning

Students were asked directly in the student questionnaire how use of the Internet had affected how interesting their classes were to them. More than half of the student respondents reported that using the Internet had made their classes at school more interesting (Table 21), but two fifths said that use of the Internet in their classes had had no effect on the interest level of the classes. Relatively few students reported not using the Internet in their classes.

Table 21

Impact of Internet Use on Interest Level of School Work Perceived by Student-Respondents

Effect of Internet use for classes at school	Number	%
Makes my classes more interesting	2,205	58
Has no effect on my classes	722	19
Makes my classes less interesting	73	2
Not sure	562	15
The Internet is not used in my classes and/or schoolwork	192	5
No response	68	2
Total	3,822	101*

*Reflects rounding.

Teachers were asked in interviews to comment on the impact of Internet use, if any, in their students' learning, and students were asked in their interviews about the impact using the Internet had on their learning. Many of the responses concerned students' interest in and motivation for learning. Teachers generally indicated that they saw students responding with more interest to classes and schoolwork that involved the Internet and that, as a result, students were willing to do more and work harder. Some teachers reported that this had led to improvements in students' work, and especially in work by students who had not been successful in school before. Teachers found such students more motivated to do their schoolwork when it involved use of the Internet. Teachers saw the Internet as an alternative, a change, a new medium for learning that was motivating and interesting to students. Consequently, teachers tried to intersperse Internet work with other kinds of work they asked their students to do, in order to vary learning activities.

<u>Student Interest in the Internet</u>

Teachers noted that students were excited about using the Internet and requested opportunities to use it:

> *They are just dying to get on the Internet. They want to go and look and see what's there.*

> *It's very motivating for students. They love getting on the Web. They are glad every time we go.*

Usually the first question is, "Can we use Internet?" They really want to use it.

Teachers reported that students were interested in learning tasks when they could use the Internet:

If you sit them down in front of the terminal after a lesson and say, "here, explore," . . . it's made a big difference. They are more interested in doing it. They are willing to do it. And they are willing to share. It's usually like . . . "wow, look at this!" And everybody brings up that site to see what you're talking about.

If there's certain things they can do on the computer, . . . [some students are] *more likely to do it. So, for some people, it's a good motivation. They're more likely to want to do it and do a good job.*

One assignment was to research and on the Internet find actual prices of things, where to go, where to stay, actual addresses. They were just so excited to come in with their packet. "Look what I found! This map!" They were really excited about it.

My thing is to try to make my students more interested in what we're studying Most of them are very computer-literate, and so it's very easy to get them involved. They like working on the computers. They're always well-behaved, so you can tell they're interested in what they're doing.

Student Preference for Using the Internet

Teachers described the preference they had observed in students for using the Internet over more traditional learning activities and the use of books as resources:

For students, it makes some of the graphical interfaces much more interesting to them than working with a book.

At this point, they tend to be more interested in Internet activities than some of the standard stuff.

There's also a site called Kia. I can put on quizzes for the kids to do. Throughout the whole group, most of the students hate paper and pencil. They're so willing to go to the computer and just punch, so this has been a great motivator for me.

They [WebQuests] *take a lot of work. But once they're done, you have them, and the kids seem to enjoy them much better than some of the other traditional stuff that goes on in class.*

Students indicated in interviews that use of the Internet added excitement to classes, and that they preferred the Internet to more traditional alternatives:

It can make class more exciting rather than regular class.

I think the Internet has kind of taken away my patience when it comes to academics because I'm used to going on the Internet and finding what I want like that. So then, when I have to look at something in depth, and look through books in the library and make note cards, I just have no patience for it.

More Varied Learning Experiences

Several teachers mentioned the variety and change of pace that the Internet introduced into the learning process, which they saw as appealing to, and helpful for, students:

It was something different. We were working on something in class, but then the kids were like, "Can I go on the computer now, can I go on the computer now?" Sometimes, if they're visual learners, that's good. It's good to break things up.

It's just another avenue for them to learn something. Even though it is the same concept, it's just another avenue, which makes it more fun for them and for me too.

It's a nice change of pace for them. They like getting out of the classroom and using the media center and the computer lab.

Students also mentioned the ability of the Internet to introduce variety and change into their learning procedures:

It kind of breaks the cycle of going to textbooks every time you need to find something, and it makes it more fun. It seems a little bit more fun.

Motivation to Complete Assignments and to Learn

In addition to the enthusiasm for using the Internet that they had observed among students in general, teachers had noticed that students who hadn't been successful learners in the past were more likely to complete assignments and show evidence of learning when they could use the Internet:

I think the Internet can be used to enhance lessons, maybe to motivate certain students who may not have the learning style that others have. They can learn because they're seeing the . . . video presentation. They are more attracted to a television screen than they are to a person. So I think it is important that way.

I have a couple kids who are very, very, very interested in the Internet stuff. I've got one kid who . . . if I said "I want you to do this on the computer," he would do it . . . but [if I said] *"go write out the words here," I may not see it.*

I can pretty much predict the kids who are going to turn in that [Internet-related work]. *Some of those kids don't turn in anything else. But because they're addicted to the computer, maybe they'll turn off that computer game for a little while and do that extra credit assignment because it's right there and they can do it. Whereas, they're not going to do my other homework assignment. . . . I can pinpoint five kids who are going to come in with that who wouldn't come in with their regular homework.*

Teachers reported that they saw the Internet as helping these students want to learn and to feel good about themselves when they were able to be successful in their efforts to learn:

> *I have two or three kids who do not write well at all, but it's real easy to be able to pull up pictures and then tell everybody about them, or pull up information they can read and then bring it down onto their own presentation. It gives kids who are not as adept in their skills another avenue that they can succeed in.*

> *When I've assigned research projects in the past, you have your sharp kids who handle it well, but you have a big drop-off where the kids who just are not interested in going that route—card catalog, etc.—they just turn off to the whole idea of libraries. I've noticed that they are a lot more enthusiastic about doing research, finding materials, references, using the Internet. That has been a big plus.*

> *It's interesting that some of the kids who aren't doing so well in the course, when you get to the WebQuest project, they suddenly come out and blossom.*

> *You know, everybody's realizing how it can have such a positive impact on kids. And some kids who don't really show their ability in regular classroom settings will just astonish you with what they can do, and what they will do. And they're doing the academics. It's not just the technology bells and whistles. It's content.*

<u>Student Complaints About the Internet</u>

Although teachers indicated that most of their students found the Internet appealing and motivating, they also reported that this was not the case for all students:

> *Not all kids love it.*

> *And then we made them do research papers. They had to use the Internet for their research. They either loved it or they hated it.*

Some students were not enthusiastic about Internet assignments. In contrast to the students described above, their curiosity was not sparked by the Internet, or they felt it was easier to do the assigned work using other materials and tools:

> *They'll all word process, but a lot of the kids don't like the Internet because it takes too long, it's too confusing, and they would just prefer to look it up. A lot of them also say that* [they] *would rather look at print resources than look off the screen. I'm getting lots of that.*

> *Some students just aren't curious about what goes on past their neighborhood. It's too distant, it's not real, it's not tangible or something. So for some students it's great, but they have to have a curiosity of something. . . . It's like a big library.*

Some students resented Internet-based assignments, seeing them as added work beyond their "real" schoolwork:

> *For the majority of them, they don't see it as something to go on the Internet* [for]. *They see it as a project that's going to take more time after school, or that they have to write a paper for. I don't think they see that the medium of what they're learning is different. They just see it as, "I've got to do this on top of my homework."*

Student Engagement in Learning

Teachers talked about the power of the Internet to engage students in the learning process. When students were able to use the Internet, they became, and stayed, engaged. They persisted in learning tasks:

> *When you first got on the Internet* [when it just started, almost a decade ago] *and you looked at pages, it was just typed script, and there were no pictures, no buttons, no flash, and I think that now, because things are really immediate, and they can go to different things, it really holds their attention.*

> *We do have some kids that I'll just label "computer nerds," who just love to live on the computer, and so therefore they are so fascinated with it that they really want to get in and do this type of assignment.*

> *The biggest advantage is that kids, for some reason, are much more engaged in front of a computer than they are in front of anything that's hard copy or written material.*

Teachers described this engagement in terms of its depth (attentional focus, emotional excitement, self-directedness, active involvement physically and psychologically) and its length (taking on more learning tasks, working harder and longer on learning tasks, and pursuing further learning in response to interests and questions that arose during the course of their experience with the Internet).

Teachers reported that students' attention was focused on learning when they were able to use the Internet:

> *They're very busy, and they're very focused on what they're doing.*

> *They seem to be more interested in keeping on task when I bring them down here* [to the computer lab], *for example. And that's been a plus.*

Students visited with one another, but their conversations tended to be about what they were finding on the Internet.

> *They're paying attention to what they're doing. They might be talking to the person that they're researching with, but they're not chitchatting. They are more focused on the screen than they are on the other things that are going on around them, so it makes a difference.*

The Internet also held students' attention by providing current material that made what was being taught more meaningful:

> *The other thing is you can just keep up with information. They don't really care what happened back in 400 B.C., or when they first discovered atoms, but if you can relate things that are ongoing and current, that really helps keep their attention. The only way we can keep up is through the Internet to do that.*

Teachers described the Internet as involving students actively in the learning process. This active involvement was reflected in students' emotional engagement in their learning:

> *The kids got so involved, and they get so heated up and charged up.*

Active involvement was also reflected in students' self-directedness in searching for information and material:

> *The ones who really, really love the computer, anyway, they would rather look something up than sit there and have you tell them about it.*

> *The whole idea that it is self-directed is really nice. It's not me standing up there, "blah, blah," and giving them information. They can get the information themselves. They can kind of direct what they're interested in, too.*

> *They just said, "Can I look at this?" and I said, "Oh, that is a good idea," and they found Web sites themselves.*

Finally, students' psychological engagement helped them remember what they encountered:

> *In what I'm teaching and the kids I'm teaching, I've seen a big difference. . . . I didn't use it as much the first half of the semester, but once I started pulling things from the Internet, they would make their own PowerPoint, or I would bring in a PowerPoint that I've pulled things* [into] *from the Internet. They see it up on the wall, and they remember it. I've been trying to do more and more of that during the year, because that's what they remember. I use the PowerPoint with the multimedia projector, and it seems to really grip them.*

Engagement in Learning Tasks That Involve the Internet

Several teachers mentioned that their students' interest in using the Internet was subject-matter related. Students found Internet sites that engaged them with content related to the subject they were studying:

> *He was trying to look up welding or something. Something he was really interested in. He wasn't one of your run-of-the-mill students. . . . It's rare to find something that he's interested, in and he found that. . . . He stayed into it and kept looking at it.*

> *Kids will come back in and just start a conversation about it* [Iditarod site]. *Right now, it's Biosphere Two that they're studying 'cause we're studying ecosystems. . . . It has a view-cam that walks them through it. . . .We use that just for those kids who want to do that, and I have it available to them. They'll go to it—without requirement.*

> *They come to me all the time and say, "Last night I was on studyspanish.com, and I really understand that, and it gave me a lot more practice." That type of thing. They respond back to me. Or, "I went to the Paso a Paso site and tried to relate it to my textbook, and I found how to do that." Or, "I was just browsing through things and I found a really interesting thing about Spain." . . . A lot of them mention studyspanish.com to me once they've had that reference. They really like it.*

Teachers spoke about the curiosity that students displayed toward what they discovered on the Internet, and how this stimulated students' questions and sparked their desire to continue their learning efforts:

> *I think sometimes it spurs me or the kids on to even look for more. Even more questions come up, and so then we look for some more stuff.*

> *I think it makes them more inquisitive. Sometimes they'll find something, and then they'll wonder, and it'll generate more questions. They tend to branch out from a certain point and will get more information, or it will lead them on to something else that they may not have thought* of.

Teachers reported that when their students were able to use the Internet in learning tasks, they were willing to exert more effort, both in terms of doing more things and in terms of working longer and harder on learning tasks:

> *So having the Internet available, they're more willing to do extra or different assignments.*

> *Actually, they find another one* [Web site] *and another one, and go beyond what I'm asking.*

> *What I also have done is, on all levels, given them optional assignments, enrichment assignments. A lot of times, students find it very motivating. They're very willing to do that. And I think that sort of illustrates some of the power of letting students use Internet access.*

> *I've found a couple of sites that aren't just textbooks that are on line. . . . The kids like those, and they'll go to those if they want extra help.*

Teachers reported that students worked harder because their Internet work did not seem to them like work, and that they produced high-quality work as a result:

Whenever they have the chance to go in there and do something toward an end product and work hard . . . my students have just finished presenting all their multimedia projects, and there was not one that wasn't an A project. They presented them in all kinds of ways. They did a great job, and it was because they didn't perceive it as work.

Especially with our access to the Internet, and to some of the software that we have. . . . They spend more time, I think. Quite a few of them spend more time in production of a quality assignment.

Impact on Academic Performance

Students were asked in the student questionnaire about the impact that use of the Internet had had on their grades. It is recognized that grades do not always accurately reflect actual learning, but students' estimates of the effect of using the Internet at school and at home was believed to be a reasonable reflection of how they saw the Internet had affected their learning performance. About one fourth of the student respondents reported that using the Internet in school had improved their grades, whereas almost half said that use of the Internet had not affected their grades (Table 22). One third said that using the Internet outside of school had improved their grades, in contrast to two fifths who said that it had had no impact on their grades. Again, relatively few students reported not using the Internet in their classes or outside of school.

Students' interview comments reflected the mix of responses that Table 22 indicates:

I think it helps my grades because I learn more.

I just use it for my homework. It helps.

I don't think it improves my performance.

It doesn't really affect my learning very much.

Some students said the Internet had improved their grades because it enabled them to produce longer papers and work that looked better:

With the use of technology, you get a better grade on your report because it looks better, plus it can be longer because you get all the information.

Table 22

Impact of Internet Use on Academic Performance Perceived by Student-Respondents

Effect of Internet use	Number	%
Using the Internet <u>in</u> school		
Has improved my grades in school	1,044	27
Has had no effect on my grades	1,747	46
Has lowered my grades in school	81	2
Not sure	661	17
The Internet is not used in my classes and/or schoolwork	230	6
No response	59	2
Total	3,822	100
Using the Internet <u>outside</u> of school		
Has improved my grades in school	1,284	34
Has had no effect on my grades	1,590	42
Has lowered my grades in school	89	2
Not sure	594	16
I never use the Internet outside school	212	6
No response	53	1
Total	3,822	101*

*Reflects rounding.

Some students said that having the Internet available in school had improved their grades because it had helped them overcome time constraints in getting their work done:

> *Mine* [my grades] *have gone up because sometimes I have a project and I didn't have time to go to the public library to search the information either on the Internet or in a book, but in school, like if I have time after school, I can get and copy the information, so it has raised my grades from help on the Internet.*

Other students saw the Internet not so much as improving their learning or grades, but as making their work easier:

> *If you're going to do badly, it doesn't matter whether you have the Internet at all. It just makes it easier to do stuff.*

My grades have always been around the A *average. . . . The Internet has made it easier. It hasn't really improved my grades. It just made it easier. Also, what I use Internet for is like for the AP, free-response question, multiple choice. Because it also helps you with SAT and all that other good stuff.*

Teachers were asked in interviews to comment on the impact of Internet use, if any, they had noticed on their students' actual learning. Several of the themes that emerged from the interview comments continued the mixed response pattern noted above. Teachers reported that the Internet helped their students develop research skills and technology skills. But they also indicated that the Internet did not aid students' learning in other areas, and that it even hindered students' learning. Teachers worried that the Internet detracted from students' depth of learning because information was so easy to get that students had no need to process it, and students' comments supported these observations. Teachers also observed that students tended to give little thought to the quality of the information they obtained from the Internet.

Improvement in Students' Capabilities

Teachers said they had observed improvements in students' research skills, ability to use and feel comfortable in using technology, and subject-matter learning as a result of using the Internet. Students were better at locating information for research papers and projects. Their use of the Internet had enabled them to acquire technology skills and to feel comfortable in using the Internet and other computer-related technology. The Internet had strengthened student learning of course content as well, by allowing students to review more, and thus solidify their understanding and retain what they learned. Teachers also observed that the Internet sparked students' creativity.

Better research skills. Teachers indicated that they thought students' use of the Internet had improved their abilities to find information and develop research papers:

I think if a student wants to, they can do much better research than they used to be able to do.

Students take the time to do more research, or [more] *thorough research, using the Internet, or they have more information that they can draw from. Definitely have much higher quality projects.*

I think that I'm more confident that if I assign students a research area, whether it's a long- drawn-out project or whether it's really rather quick and dirty, that their ability to research that now is much better. I think that there is a much better quality to what the students can produce.

I would say that the Internet has certainly improved their ability to do research, and they get better and better every year.

Students' search skills, in particular, were mentioned as having improved:

A lot of my students . . . get onto the Internet real quickly, and they know exactly. Really, I'm rather amazed at how well they know, how quickly they can find what they need to find.

They're learning to focus. We did the microscope comparison—"Pretend that you're looking at your topic through a microscope, and narrow it down to a pinpoint that you can focus on." . . . getting them to actually whittle it down to a manageable focus area I think has really helped them a lot. That would be the biggest improvement I think I've seen.

It's just amazing, some of the projects they've done, and then I just check on them, ask them the sources they used. I say, "Will you access this for me? I'm interested in seeing where you got this from." And, believe me, they access them so quickly, so these kids are really good at the computer.

Better technology skills and more comfort with technology. A number of teachers mentioned the improvements that they had seen over the last several years in students' overall computer literacy, their technology skills, and their comfort in using technology:

They're very familiar and comfortable with it [the Internet]*, for one thing. They go there all the time; they know how to find things quickly.*

Teachers had observed their students move from being reluctant and timid users of the technology to being capable users:

I think they are less timid or scared to use a computer.

The most important thing is that they are not afraid of computers. I think there are a lot of people who are intimidated by and afraid of computers. You may be super bright, but if you don't feel a certain comfort level . . . that's one thing that everybody here really has. They get it real quick, because a lot of teachers use it a lot.

Several teachers noted that their students' Web-based skills, in particular, were well-developed:

They're getting smarter at building the Web sites and learning more tools.

The kids here, they're good on the Web.

Students also commented in interviews how using the Internet had helped them develop their skills in using technology:

The Internet helped me with my typing because you're typing so much when you're chatting with your friends, and I end up knowing where all the keys are.

I just did it on my own. . . . there's a little bit of help I needed to get with HTML to be able to get an actual efficient site going. But I got that all off the Internet, step-by-step pages.

<u>Increased knowledge, understanding, creativity, and retention.</u> Teachers mentioned that because students can return to the same information again and again on the Internet, interact with it on line, and look at numerous sites, they could learn more:

I think they learn a lot more whenever we go on the Internet and they can recheck what they're doing, or they can look at different sites.

Maybe it has increased their performance a little bit, but it has definitely increased . . . their knowledge and level of understanding.

I've seen their scores go up tremendously. On their test scores, they have gone from 5-point increases from one test to the next, to as much as 20 points. The comprehension is there. It's like the actual manipulation helps them to take more knowledge away than perhaps just the individual standing in front of them lecturing.

In addition, some teachers noted that students retained more because of the visual nature of the Internet:

The first thing I noticed in the classroom is they retained the information a lot better when the information was tied to something, particularly something visual. If I could point them to a Web site and say, "Okay, take a look at these," even if it was just pictures of something we were talking about in history, or anything that we could tie that to visually.

They just retained it better.

Teachers also remarked that, in exposing students to new possibilities, the Internet had opened students to new ideas and helped them to be more creative:

As far as students learning, once again, I think it's exposing them to a new world. Especially with our access to the Internet, and to some of the software that we have, Inspiration, PowerPoint, that sort of thing. The kids are getting . . . more creative. . . . They are learning to explore.

Students reported in interviews that the Internet helped them to review and prepare for tests:

They have this little Spanish Web page where you can go and take a self-test. I went in and took all the self-tests before our end-of-quarter Spanish test, and that's how I studied for it. So that helped me.

<u>Impact on Students' Reading and Writing</u>

Teachers were less certain about the Internet's effect on students' reading ability:

As far as improving reading skills, I'm not sure.

Teachers felt that students' reading skills were being affected by the Internet, but they disagreed about exactly how. Some teachers expressed the view that reading on the Internet was different from reading books in the way the two are approached:

The other thing I worry about with using the Internet or using the computer screen is that there is a style of reading there that is different from reading a page, and those of us who love books and are traditional in terms of what we think we get from the book experience notice a marked difference in the way students want to read. For instance, a screen of full text is a very difficult thing. Bringing students to the computer as a school tool is often a hard transition because they've seen it as a play toy.

<u>Reading level of Internet material.</u> Teachers' observations regarding the impact of the Internet on students' reading capacities seemed to depend on the types of students they taught. Some teachers commented that the Internet did not present students with material challenging enough to develop their reading skills:

I haven't been pleased with the detail in some of the information that the kids have needed.

I'm not sure that using the Internet develops their reading skills, because . . . the Internet information is more condensed. As far as my area is concerned, sometimes it doesn't offer them those higher-level thinking skills to analyze and interpret that fully developed text would. That has been my experience.

Other teachers, particularly those who taught students with learning disabilities, found the reading level of Internet material either fit their students' needs or was too difficult for them:

I think they learn a lot if they take advantage of it. One of the difficulties with a lot of the Internet stuff for LD kids is the reading is too difficult a lot of the times. It's at a level that is beyond their ability to comprehend, and so when they do research, they really can't do it by themselves. They need to have somebody sit with them and really pick it apart and figure out what that might mean. A lot of it is written at too-high an educational level for a lot of urban kids.

Time spent reading on the Internet. Some teachers thought that working on the Internet contributed to students' reading abilities; others felt reading on the Internet detracted from students' book-reading experience and ability:

> *They're reading. They have to get on there and know what they're doing. They are using it effectively. They have to put in the right stuff to get out the right stuff. They have mastered some skills. They use how to read, how to process information, how to understand it, get what you need.*

> *The Internet is something that can help some kids who may not read as well. If they can get the information (of course they still have to read stuff coming off the computer, but they're just turned off by textbooks), and if they can get that same light of discovery or awareness by getting it off here, that encourages and helps.*

> *I think that it prevents them from reading* [books]. . . . *They need to have that skill.*

> *I think they spend too much time on the Internet that they could have spent reading* [books].

Some thought that if students did enough reading on the Internet, it could help their reading levels:

> *I think they can become better readers, if they get to get on there* [the Internet] *enough.*

Other teachers mentioned that use of the Internet in class had the effect of reducing the reading that students did in class:

> *It cuts down on in-class reading.*

Student writing. Some teachers observed that students' writing had improved with Internet use, but others said that they had not observed writing improvement in their students:

> *With students, I see a lot more of the critical-thinking skill development. When you get into something like an Internet class, it's not just spitting back information. It's not rote learning, because that's not acceptable. They're having to take things a* [step farther] *than they normally would. And so, I see a real growth in critical-thinking skills. I've seen a growth in writing skills, because anything they're communicating to me, it's in writing.*

> *With the Internet, the kids are more apt to grab and start writing without doing careful comparison. . . . In other words, there is a motivation to get started. For the reluctant writer, it probably gets them going faster because they know . . . whatever you write you can change. Sometimes they grab a bunch of stuff and don't synthesize it as well as if they had to do the whole writing process.*

I wouldn't say at school we've changed that much. Probably the reason they're using it [the Internet] *is for research, and then you still need the writing to go along with it. So I don't think their writing has really improved. . . . I don't think it's that much better.*

Harmful Effects on Student Learning

In contrast to the observations reported above that Internet-motivated students worked harder, many teachers commented that with so much information readily at hand, students seemed to be seduced by the Internet into putting in less effort on their schoolwork. Teachers lamented that students did only enough to just get by or turned in material they downloaded from the Internet as their own work. They doubted whether material on the Internet, which they saw as limited in depth, fostered deep learning. They saw students producing lower quality work when they used the Internet, and believed students' learning was more shallow than with more traditional teaching-learning approaches. Teachers perceived that students relied too much on the Internet as their only source of information, and neglected developing skills involved in more traditional methods of finding information. If students didn't think about the information they obtained from the Internet and didn't bother, or had difficulty, discerning the quality of the material they found, they were vulnerable to accepting unverified information as truth.

Students' comments in interviews indicated that they agreed with teachers on several of these points. Students also said that the Internet had a negative influence on their schoolwork because the time they spent on the Internet took them away from doing their homework:

Sometimes I spend way too much time on the 'Net and I don't do my homework. I'm always stuck in the morning in one of my morning periods doing my homework. . . . I guess it has negatively affected me school-wise just because it takes away some time from doing schoolwork. . . . Sometimes you'll find yourself [realizing] *"I've been on this for 14 hours and I should get off."*

Limitations of information available on the Internet. Teachers suggested that the information that students obtained from the Internet was often superficial or simplistic. Teachers worried that students were not adequately challenged:

At some point, it's superficial, the information they're getting.

What you see an awful lot of on the Internet is . . . a lot of elementary stuff.

I think the kind of information they get in working on these projects and this type of thing, you have to be careful. . . . because the information they'll get sometimes [from the Internet] *is like* USA Today *and not really in depth like it should be.*

Other teachers pointed out that at least for some students with limited English skills, who might be overwhelmed by more complex material, the level of material on the Internet was just about right, and helped these students complete work assigned to them:

I know that the times that I've asked them to research on the Internet, the research gets done and the learning, I think, seems greater because the material . . . doesn't bog them down as much, even though it may not be as complete.

Overreliance on the Internet as the sole source of information. Despite teachers' observations reported earlier in this chapter that students' research products and skills had improved, teachers also expressed concern that students relied too much on the Internet as their only information source. Teachers saw this as limiting students' understanding and preventing them from developing skills related to other information sources. Teachers weren't always convinced that using the Internet, rather than books, fostered students' learning in the best ways:

I also find that they get lazy and expect to go to one source. They don't know how to use the index at the back of a book.

I don't even know if they go to books anymore, which is a double-edged sword. There is a lot of new stuff out there [on the Internet] *for them, but they still should be able to go to the media center and find a book that is specialized in one area. . . . I think they tend to rely on that* [the Internet] *as their only research tool.*

One of my students brought in something that looked really neat, and when you read it you found out it was a 4th-grade student paper from somewhere in Iowa. A 4th grader had written it, and the student thought it must be all there was about the topic. So the impact there is negative. I think they tend to rely on that as their only research tool.

Sometimes we take a kid to the page right there in the book. We take it right to them, and they're still on the Internet trying to find the same information. "But," we say, "here it is right here." But they gotta try the Internet.

Ease of getting information. Although teachers and students both were attracted to the Internet because it made it easy for them to find information (see Chapter 4), teachers perceived that the ease of getting information could also deter students from processing, interpreting, and internalizing it. That is, teachers saw the potential of the Internet to reduce students' engagement in thinking and learning:

The thing that concerns me in working with students on Internet is that when they access information, they have a tendency to just take that information. It becomes immediately a source to submit as a means of meeting a requirement for class. For me, part of the process that is missed by the student is looking at the content, understanding information, drawing questions from it.

There's a process that is missing in obtaining information. The information is there, of course, but there are questions that I think need to be asked before the information is accessed so there is greater depth and understanding.

Because information was easy for students to obtain on the Internet, the Internet encouraged students to become oriented to simply getting information to finish an assignment, instead of reading, interpreting, and understanding it:

> *There are times when material comes from the Internet to the teacher without being filtered by the student. That's one of the dangers of it.*
>
> *And another danger is that sometimes they don't assimilate the material as well as if they had . . . researched it out of two or three books.*
>
> *But it seems to be, a lot of times, not just in my classroom but in a lot of classrooms, I see kids in a task-oriented thing: "Get the information, print the report, hand it in," without passing through the brain. That's a criticism, I guess, or a problem I have with it. I see kids doing that a lot, rather than really getting in depth and really researching stuff and really gaining the knowledge. I'd rather they researched stuff in depth.*
>
> *Particularly if they're doing things like cutting and pasting, even if they're writing the body of the paper, they may just cut, "Oh, this looks like a good quote." Boom. Boom. Drop it in. Now you didn't have to type it in, so do you really know what it said? "Oh, you put it in your paper, but do you know what it said?" "No, not really. It just sounded really good." They're not really sure what it said. I see that as a drawback.*

In contrast to the teachers who said that use of the Internet encouraged students to persist in learning tasks, some teachers suggested that the Internet made it easier for students to spend less time engaged in learning activities, and led to students becoming lazy:

> *Sometimes, instead of using it to help them think, they use it so they don't have to think. There is nothing sadder than watching someone copy, cut, and paste into their own document and say "this is my work." . . . that's what I hate the most, because it makes them more slackers. I think the biggest downfall is that it can contribute to their being lazy.*

Students' comments in interviews agreed with what teachers had to say about the ease of obtaining material on the Internet. Some said that they avoided the work of developing papers themselves by downloading them instead from the Internet:

> *It helps me when I'm too lazy, and I can download a whole paper on the 'Net and get an* A+.
>
> *A downside is that it makes us kind of used to not having to do a lot of work. We can just type it in, and it's there for us.*
>
> *Whenever we have research papers, we go on the Internet and we find certain sources, because most teachers say we are allowed at least two sources from the Internet, and at the most four. Other than that, I get my whole papers from the Internet because there are lots of nice sites on there that help me.*

Students' comments also were consistent with those of teachers regarding the ease of putting together a paper at the last minute:

> *I had a term paper due 2 days ago, and I had no information, and I just started last weekend. The library was closed because it was Sunday. So I just typed on and got all my information on Sunday, and I wrote a 10-page report, and I had it done the next day because I had access to the Internet.*

> *Most teachers don't grade about how much time you put into it, just what the final effort is, what the final project is. And the Internet just helps with the time problem. You just go in there and find a whole bunch of information real fast, instead of looking for hours in the library.*

Students saw the consequences of this, however, as having more free time, not as learning less:

> *It just saves me a lot of time so I can do what I would like to do, rather than my homework.*

<u>Uncritical acceptance of information.</u> Teachers reported that students were so focused on obtaining information on the Internet, they failed to consider whether the information they found was relevant to their purposes:

> *They end up sometimes using pieces of information that have nothing to do* [with their topic]. . . . *"Where did that come from?" "I needed another quote." "What does this mean?" "I don't really know, but it looked good."*

> *I see so many students just seeking, information gathering. Whether it makes any sense or whether it makes a connection, it doesn't matter; they're just gaining information. I question sometimes how useful that is to them* [without] *direction as to what this information is going to do for you or how it would be used. So I feel a lot of students on line are just surfing to the point of seeking information.*

Teachers indicated that students did not question the validity of information they found on the Internet, and did not pay attention to its source:

> *They believe everything they find out there. That's a serious problem.*

> *Sometimes students see a Web site as being truth, and it's not.*

> *Some students who are very much into technology, some almost rely too much on the Internet. . . . they haven't learned how to discriminate* [between] *what is good information and what is bad information.*

> *To them, if it's on the Internet, it must be true.*

They also don't discern very well the quality of their sources.

Discussion

Teachers' Professional Development

Teachers reported several ways in which the Internet had helped them professionally: providing them with access to virtual professional communities, developing their technology skills, motivating them to integrate Web-based technology in their teaching, strengthening their teaching and lesson plans, and giving them the opportunity to take professional development courses and programs on line without having to travel. In addition, a few teachers saw the Internet and instructional technology in general as a potential career direction. These implications for teachers' professional development represented potentially significant areas of change and growth.

Having on-line access to other professionals they never saw face-to-face was a source of ideas, consultation, feedback, and answers to questions for teachers. Listservs and Web sites with chat or e-mail contact options were characteristic ways in which teachers maintained contact with these communities. These interactions were important supports for teachers' professional development efforts regarding both technology and subject matter.

Access to the Internet had piqued teachers' interest in learning ways to use it. Teachers appreciated the variety of professional development opportunities that they had been able to gain access to on the Internet. Self-directed learning opportunities and courses and programs that were offered completely or partially on line saved them travel time and effort. Teachers took advantage of these opportunities to help develop their understanding of the Internet and the skills needed to use it and related technologies. Teachers reported that the Internet also facilitated their professional development efforts within traditional graduate programs by allowing them to obtain on line some of the information and resources they needed to participate in and complete such programs.

As teachers became more familiar with the Internet, they found that their sense of its possibilities motivated them to incorporate it in their teaching. As they did so, teachers became aware of changes that were taking place in their teaching style as well. Teachers said that the changes they had noticed represented improvements in their teaching and lessons, most notably in terms of providing more variety and in coming to realize that they did not always need to feed information directly to students. They discovered that students were able to direct and conduct their own searches for information on topics being studied.

A few teachers who had obtained graduate degrees in instructional technology, who had pursued or were planning to pursue technology certifications, and who had been given opportunities within their schools to do training and provide technical and curricular support for their colleagues saw a potential career path for themselves, focusing on providing these services full-time.

Student Learning

Teachers valued the Internet for what it could contribute to student learning, but did not view it as a cure-all for helping all students learn. The Internet could motivate students to learn and engage them in learning. Because students were interested in the Internet, they were willing to participate in Internet-based activities, including learning activities. Students often preferred Internet-based learning activities to more traditional alternatives. Students' preferences for working on the Internet compared to traditional media sometimes helped them start on work that eventually took them to books and other more traditional resources. The Internet helped some students begin and complete their work who would otherwise not do it. But other teachers were concerned that this preference led students to ignore other important materials.

Teachers reported that integration of the Internet in teaching and learning infused variety into students' educational experiences that kept students motivated to learn, fueled their creativity, and appealed to some students whose learning styles and needs were not addressed as well by more traditional learning modes. In these ways, teachers believed that the Internet aided student learning. At the same time, however, some teachers reported that use of the Internet did not have this same motivational effect on all students.

Because the Internet stirred students' interest in learning, teachers reported that use of the Internet encouraged student persistence in staying physically and psychologically engaged in learning activities. It deepened their engagement in learning by focusing their attention, allowing them to direct their own learning, and stimulating their excitement and curiosity about what they discovered as they worked on the Internet. Students were willing to work harder and longer on Internet-based assignments. These findings need to be considered in light of the findings reported in Chapters 5 and 7—that the Internet also distracts students from their learning tasks.

Findings regarding the impact of the Internet on students' motivation for learning and engagement in learning, although mixed, more clearly portrayed the Internet as an aid to learning than did the findings regarding actual student learning. Student and teacher questionnaire and interview data regarding the impact of the Internet on what students actually learned painted a very mixed picture. On the plus side, teachers were in substantial agreement that students' use of the Internet had improved their research skills and the quality of research papers that students submitted. Likewise, teachers and students generally agreed that use of the Internet had helped students to improve their technology skills and to feel comfortable in working with technology. Some teachers also believed that use of the Internet had helped students in their subject-area learning. Students' comments in interviews about their improved grades, however, emphasized efficiency rather than increased learning. With the Internet's help, they were able to create papers that received better grades because they could get more information faster and produce better looking, longer papers.

Other findings regarding the impact of the Internet on student learning were contradictory, or pointed to the Internet as hindering learning. Teachers reported that use of the Internet helped some students improve their reading, and hindered some students' reading (at least book reading). Teachers who said that reading a book is more demanding than reading on the Internet discounted the Internet as contributing to developing students' reading capacities. Teachers who found it challenging to engage their students in reading at all reported that the Internet encouraged students to read and expanded their reading experience. Similarly, the Internet was seen by some teachers as encouraging reluctant students to write, and even to be better writers, but by other teachers as having little impact on the quality of students' writing.

Teachers discussed a number of ways in which they had observed the Internet to undermine the depth of students' educational experiences. Some teachers were concerned about what they saw as limited depth of the material on the Internet. It did not sufficiently challenge their students. Teachers of English Language Learners, however, indicated that the level of Internet-based material was appropriate for their students' language capabilities. Teachers reported that students tended to rely too heavily on the Internet as their sole source of information. Another shortcoming of the Internet mentioned by many teachers was the ease with which it allowed students to incorporate information into their work, and thereby avoid processing, interpreting, evaluating, and internalizing what they took from the Internet. Student interview comments supported teachers' observations that the Internet allowed them to spend less time and effort on their schoolwork—especially writing papers. These findings contrast with teachers' reports noted earlier that students were willing to work harder when they could use the Internet.

Conclusions, Implications, and Recommendations

Conclusions

- The Internet expands teachers' professional development opportunities.

    - The Internet is a delivery mechanism for workshops, courses, and graduate programs for teachers that is attractive to them.

    - Teachers' use of the Internet leads them to develop skills and to seek on-line professional development opportunities and resources not previously available to them.

    - These new professional development opportunities are more convenient because teachers do not have to travel: Geography is no longer as limiting a factor in teachers' professional development as it may have been in the past.

    - This suggests that the Internet can create more equity among teachers in access to professional development opportunities.

    - Furthermore, teachers in remote areas may feel less isolated when they can participate in a virtual community of professionals, and in both formal and informal learning opportunities on line.

- The Internet also expands teachers' needs for professional development, particularly in the area of learning about the Internet and its possibilities.

- A deeper impact of the Internet on teachers, however, is its potential to change their conceptions of teaching and learning, and of their career possibilities.

  - Because students could use the Internet to get information themselves, teachers were able to see other teaching roles for themselves beyond that of information-provider. They could envision and allow new learning roles for their students that involved more self-direction.

  - Both students and teachers must change their conceptions of teaching and learning, and of their roles, in order for this shift in responsibility to occur. Certainly the Internet is not required in order for teaching and learning to involve self-direction for students and a supportive, facilitative role for teachers besides that of information-giver. But the data presented here and in Chapter 7 suggest that the Internet can be a catalyst for change in these conceptions. When students are interested in what they are doing, they are willing to assume more responsibility. This makes it easier for teachers who may have a mind-set of teaching as giving information to see new possibilities.

  - Use of the Internet in schools is creating a new career path opportunity for teachers with technology expertise. Increasing use of the Internet in the five schools created a need for new technical support roles that qualified teachers were filling. In assuming these roles, some teachers realized the possibility of a new career direction.

- Regarding student learning, the Internet does not appear to be a “magic bullet” that improves learning simply because it is used by students in their schoolwork. Clearly, unless introducing technology improves the quality or pattern of teaching and increases student diligence in learning tasks, there is little reason to expect learning improvements.

  - The Internet does appear to capture many students’ interest and to lead at least some students to exert more effort and spend more time on learning tasks. Thus, it would be easy to expect that learning would be improved. If students’ motivation for learning and engagement in learning are enhanced by use of the Internet, why wasn’t the evidence clearer regarding the impact of the use of the Internet on student learning? Some clues may be found in data reported in Chapters 5 and 7, which suggest that students are also distracted by the Internet and that the Internet makes engaging in plagiarism easier.

  - Evidence reported in this chapter suggests that learning may be improved for some students, but not others. Use of the Internet may have a positive impact on learning for students who have not been successful in learning with more traditional materials and tools.

- Improvement in students’ technology skills does seem to be a clear (and not surprising) result of students’ use of the Internet.

Implications

- The data regarding teachers' professional development have implications for teacher education and for those who plan professional development opportunities for in-service teachers.

  - The Internet broadens the range of potential providers of in-service teacher education, which continues and strengthens a trend that has been observed in the United States for several years. In addition to participation by individual teachers in Internet-based professional development options, schools and school districts can involve their entire staff in these opportunities more easily than when travel was required for participation. On-line programs and courses may be developed, offered, and provided by school districts; universities; regional, state, or federal agencies; or private vendors.

  - The availability of these multiple opportunities is likely to place even greater control of in-service teacher education in the hands of schools and teachers themselves than has been the case in earlier decades.

- Teachers' changed conceptions of teaching, and changed teaching practices, have implications for administrators who evaluate teachers. If administrators expect teachers to be information-givers and reflect this expectation in their evaluations of teachers, teachers will be discouraged from acting on the possibilities the Internet helps them see for encouraging students to take responsibility for directing their own learning. If, on the other hand, administrators are supportive of teachers' efforts to share responsibility for directing learning with students and show this support in their evaluations of teachers, then teachers are more likely to continue their efforts to reform their teaching practices in this direction.

- The new technical and curricular support role that technologically savvy teachers are assuming either formally or informally in their schools has implications for teachers' career development and for professional preparation and graduate programs. The combination of technical and curricular expertise is an important aspect of this role. Courses and programs that help teachers with technology expertise learn to be supporters of other teachers' technology integration would encourage interested teachers to assume this role.

- The impact of Internet use on student learning is a complex issue to unravel. The findings reported in this chapter indicate that, although the Internet may have a positive impact on some kinds of learning (e.g., learning of technology skills), it also may interfere with learning. It seems clear that answers to focused questions about the impact of the Internet on learning that are qualified in terms of kinds of learning, kinds of students, and kinds of teaching practices will be needed to sort out the various kinds of impacts that the Internet may have on learning.

Recommendations

- Teacher-educators' conceptions of teacher education need to encompass the new opportunities that teachers and schools have for Internet-based professional development. Teacher-education programs should include the Internet as one delivery mode for reaching teachers with professional development opportunities, and should focus the technology-related professional development opportunities they provide for teachers on areas of need that can be uniquely served by teacher-educators. These areas are likely to include curricular integration of technology and helping teachers who want to help other teachers integrate technology develop teacher-training capacities.

- Administrator preparation programs should include a component that helps administrators to recognize teaching practices in which responsibility for learning is substantially shared between students and teachers, and to assist and support teachers who are trying to make a shift in their role from information-giver to facilitator and moderator of students' self-directed learning.

- Schools and school districts that are infusing the Internet into classrooms and laboratories should help teachers devise ways of using the Internet that allow students to develop skills and perspectives that enhance self-direction in their learning.

- Studies of student learning related to use of the Internet are needed to clarify the Internet's contribution to learning. Such studies will not be easy because many factors affect learning, and isolating the impact of the Internet will be difficult.

  - The data presented here suggest the importance of asking questions about the kinds of learning the Internet might influence—technology skill development, subject-matter learning, basic skills, and so forth.

  - Kinds of data other than the teacher and student reports that this study provides will be needed in order to identify more precisely the impact of Internet use on learning. The data presented here can help to guide the development of fine-grained, classroom-level studies to examine the effects of using Internet-based learning opportunities within a classroom context of learning goals, teaching methods, tools and materials, and kinds of students. Data presented in Chapters 7 and 8 are also likely to provide helpful input in the design of such studies.

CHAPTER 7: IMPACT OF INTERNET-BASED LEARNING OPPORTUNITIES ON THE TEACHING-LEARNING SYSTEM

When a powerful new tool, such as the Internet, is introduced throughout a school, it is likely to invoke changes across the teaching-learning system, that is, in the social arrangements and learning interactions through which teaching and learning take place (Blanton et al., 1998). Teaching-learning systems include: the social roles of individuals and the definitions of those roles, and social relationships among the roles and the people in them; the organizational structures, communication patterns and processes, resources and their allocation, and the processes put in place and organized to accomplish teaching and learning purposes; the activities in which teachers, learners, and other staff engage; and the values and priorities reflected in decisions, judgments, and social arrangements. This chapter addresses changes and shifts in the teaching-learning system in the five schools that teachers attributed in their interviews to the use of the Internet specifically, and to the use of computers and technology in general. Students' interview comments relevant to these changes and shifts are also reported.

Impact of Internet Use on Curriculum

Interviews with teachers touched on several implications of the Internet for curriculum. First, teachers noted that teaching the Internet itself needed to be integrated into the curriculum. They felt students needed explicit instruction in the use of the Internet and computers, search skills, and evaluation of information obtained. Some were already addressing these areas in their classes. In addition, a computer literacy class was taught in most of the schools, and more advanced courses in computer and Internet technology were also offered. Teachers indicated that by integrating the Internet into the curriculum and helping students to develop their technology skills, they were helping students explore and prepare for careers. Second, teachers in many subject areas reported that the Internet had enriched their subject-area curricula. Third, teachers commented that the Internet supported their ability to engage students in thinking processes. Fourth, teachers found the Internet to be useful in supporting various teaching approaches. Fifth, teachers reported that the Internet was having an impact on the materials and activities they used for teaching.

<u>Incorporating the Teaching of Internet and Computer Use in the Curriculum</u>

Many teachers were in agreement about the need to explicitly teach students Internet and computer skills, and many had incorporated teaching students about the Internet and related technology into their curricula:

> *I have about 20 different modular units ranging from a flight simulator, aerodynamics, weather and meteorology, graphic arts. Part of that, depending on the type of student, I will let the Internet be a module, where they can spend 3 or 4 weeks surfing, learning what the capabilities are. I use a small book where they go through and learn what the Internet is and can do. . . . It will start defining the terms and tell them, "Go here, do this, look there," and it walks them through.*

Two or 3 years ago I started a thing because the kids were not familiar with Internet, things like having them go to certain Web sites and look up certain things and write down what they found. It's like a scavenger hunt on the Web to find certain kinds of things to introduce them to it.

Department-level efforts to help students learn to use the Internet were also apparent:

We also do a literary magazine. The department publishes the school's literary magazine, and that's another one of our technology uses, of course, because you teach the kids how to use the layout, how to actually publish on line.

In the gifted department, we teach the kids to help develop projects, how to do Web pages. . . . we've tried to incorporate the [computer] *lab into every aspect of our curriculum. And any one of our classes involves some kind of technology. We've written it into all of our curriculums in the gifted program.*

A number of teachers required their students to use the Internet for assignments:

A lot of my students learn it first through assignments I give them. They have to figure out [how] *to use the Internet and use PowerPoint and just word processing.*

To some teachers, being able to use the computer was a basic skill:

It's nice to make it just like you need to learn how to read, you need to know how to do math, you need to learn how to write, and you need to learn how to use the computer.

Some teachers emphasized the need they saw for students to have opportunities at school to learn computer and Internet skills because many didn't have such opportunities elsewhere:

There are kids who . . . you really have to help, who have never really been in front of a computer that much. They are very receptive to whatever knowledge you're willing to give them.

We have a lot of kids here who do not have computers at home, who are not using computers at home, who've never put their hand on a mouse. So, there's a lot of misconception that these kids are just picking it up like that. They are if they have it at home and they're using it. But a lot of kids don't, still. . . . And so if that's not involved in the curriculum of the school or the system, then the system is promoting that technological gap, because we're not giving it to them. To me, it's as useful a tool now as some of the other things that we say they need to know when they leave high school.

Courses in computer and Internet technology skills. In addition to the efforts of teachers to include the learning of Internet and computer skills in their subject area courses, the Internet and computers were the focus of some courses in the schools' curricula. Many of these courses were basic computer and Internet literacy courses.

Originally, there was a computer literacy course taught to all ninth graders. I taught one of them, too. Some of it was typing and how to use the Internet and PowerPoint.

Last year I taught a couple classes on computer literacy . . . half the class is basically learning the keyboard and doing typing, and we did spreadsheets, database, Internet, graphics.

Some schools required such a course of all their students, but in several of the schools required computer literacy courses had been moved from the high school to the junior high and middle school levels. One school had an entire department and program area focused on technology, especially computer technology. This school offered courses that helped students learn networking skills, which they could apply toward further study leading to Cisco and Microsoft A+ certification.

We have a really, really good technology course offering. So they have a lot of opportunity [to learn]—*from basic computer skills all the way up to* [networking in the] *Cisco* [class].

The console and two routers, which is another thing that the kids do. . . . It is a console that they're going into to actually configure the routers, and they're also telneting in. So that's how they go in and actually change the configuration.

Then I use it [a department computer lab] *the 4th period of the day for Cisco. . . . the kids will actually go over and move the Ethernet cables to the right ports.*

The Internet was a central source of curriculum for these courses. Courses such as Web design and multimedia design were included in several of the schools' curricula:

There are several computer classes. There's Web page design; there's computer literacy. . . . They get it [the Internet] *several times, and then if they need more, they can get it.*

These courses, along with what individual teachers included in their subject-area courses, gave students a range of curricular opportunities and levels through which to develop their Internet skills and understanding.

Teaching Internet search skills. As reported in Chapter 5, teachers found that many students had limited Internet search skills.

I did give them some instruction at the beginning of the year. They didn't quite know how to reach a search engine.

I teach them how to use certain key words, rather than typing in questions, which they like to do. "What is the capital of ——?" [Instead] *just put "capital"* [as a key word]. *So we teach them, or I do, how to use the Internet effectively, so they don't spent so much time going through all of that excessive information that's out there.*

Teachers across the curriculum indicated that they taught their students Internet search strategies and made them aware of alternative search engines:

In our regular classes, we give specific instruction on how to browse or search.

Teachers had devised several ways to help students learn search strategies. Some teachers located Web sites ahead of time and asked students to retrieve certain information at these sites:

I had them do a scavenger hunt of a Web site, where I went through and . . . this is the information I want them to get. They have to go and find it. I know it's here. I found that was better than just saying "go see what you can find." "This is the specific information, and I want you to learn how to ferret it out." So that's how I like to use resources. "I know what I want you to find, and I want you to gain the skills of finding it."

We talk about searching and the more sophisticated databases. . . . we do scavenger hunts, to start out. And then I insist that they bring in some of their courses that they're checking on line for. And then eventually, we use links that they've found when they develop their own Web sites with content.

Another approach was to help students understand how to use the short descriptions of Web sites resulting from a search in deciding which sites to look at:

What are some shortcuts? We just did a thing with annotated bibliographies, and I said, "Now, let's say you just found 55 sites, things about dreams. You want to be able to eke out whether you want to click on this one, because it's going to take you 40 seconds to load it. And so we gotta look at just the line in the abstract. It'll only give you one line. Do you want to read it from there?" Kids were just clicking on stuff kind of randomly because they weren't taking the time to read.

I take time to teach my students how not to choose things that are irrelevant. At the beginning of the year . . . we would do an Internet project or research project, and students would just click on anything that was blue, that came up under their subject. I'm like "What does that have to do with this?" Simply because it has one of the key words in it, it pulled it up when it had absolutely nothing to do with the topic at hand. So we sat down and we looked at it, and I used the TV screen again to show them, "I can see from the title of this and from the brief summary, that this isn't going to be what I need. I need to look further into my list" . . .

A third method was to help students develop their vocabulary so they had search terms to use:

I had a kid who was doing research on acid rain and was not . . . able to find anything, and I said, "Have you checked an encyclopedia?" and he said, "I hadn't thought of that" . . . "Check out an encyclopedia so you have some place to start from." . . . people forget about print resources when they're using the Internet. So I end up telling them a lot, "If you're struggling with the Internet, stop, check your print resources, ask people, ask *teachers. Then once you have more information and more words to use when you're doing searches, then go back to the Internet." Because you need to have a fairly large vocabulary and knowledge-base to really use the Internet.*

<u>Teaching critical evaluation of information on the Internet.</u> Because of the questionable validity of information on the Internet, and students' tendency to ignore this issue, teachers felt strongly that students should be instructed in the need to evaluate the information they obtained and in how to become critical readers of what they found:

We do three major projects and a minor project that require them to do research. . . . We talk a lot about if it's a credible site or a reliable site for the information.

Of course, then we also run into a lot of problems. I mean, you have to teach the kids how to evaluate sites.

[The Internet] *adds a completely different instructional element to assigned research—the kinds of things you want them to look at before they accept an authority.*

Teachers across the curriculum felt that this instruction was their responsibility, and they described their ways of approaching it:

In classrooms, I use it [the Internet] *a lot to teach kids the difference between a commercial organization, and an organization that is not commercial and no- for-profit. I try to show them the difference between the two, and why this one is telling you all these things, and why this one may not be telling you these things. I think it would be interesting to come up with some good lessons on how to cross-reference the information that you access on the Internet, because a lot of kids think if it was on the Internet, then it's true.*

Kids are so tempted to say, "Well, it's there. 'Must be true." It's really a hard thing to get them to understand, "Well, I'm not going to say it's true or it's not true. But who is writing it? And what impact does that have on the message it's giving you?"

<u>Enhancing students' employment and career opportunities.</u> Teachers reported that teaching students about the Internet and computers enhanced their prospects in the job market:

I think it opens the door to some people for future employment. I think a lot of [students] *start to realize that, "Hey, Internet is kind of cool. Maybe I can go someplace with it or do something." When I taught at ——, I was still in contact with 5 or 10 of my students. And they worked for . . . different companies that are out there. . . . And that would have never been possible if they hadn't had access to Internet and to things like that.*

Some students who had developed sophisticated Internet skills had found employment in Internet-related endeavors during high school or when they graduated:

I know one kid that already has a job working with technology stuff.

We have two kids . . . who graduated last year, who have been hired to do technology stuff in the building.

Teachers tried to help students see potential employment opportunities related to the Internet, and used this as a way of engaging their students' interest in learning to use the Internet:

I am pushing my students. I said, "Listen, this is the future. You have to understand this technology. You'll go out and make that big money. Go out and make $120,000 a year designing software."

More broadly, however, teachers indicated that by integrating the Internet into the curriculum and helping students to develop their technology skills, they were preparing students for many different careers because technology use was a requirement in all kinds of jobs:

It's a tool that students need to learn how to use. That's what I focus on. I have 9th-grade students. I feel they need to be guided in how to use the Internet. I think it is important because I think whatever job they might be looking for in the future, it's going to involve manipulating or using the Internet, and if they don't have the skills, it will bring them down.

This exploration and preparation needed to include not only Internet use, but also Internet design:

We've got some very, very bright kids here. And I really feel that they aren't challenged with a lot of curriculum that we're providing. Our guys don't want to surf the 'Net. They want to design the 'Net.

Teachers acknowledged, however, that simply developing students' technology skills was not the entire answer to preparing students for employment. Helping some students learn about technology was easier than helping them learn to apply themselves in other areas that were also important to career preparation. Some students thought that technology skills were all they needed to have a successful career, and some who had developed good technology skills lacked other important skills:

I was in a parent conference just last week where this little 10th-grader doesn't think it's important that he get his high school degree. He can just kind of slide by, because he knows so much about computers that that's going to be his livelihood.

I have a student who is very good with computers and would be very good in the workplace. 'Knows a lot about computers, but he didn't pass his basic standards. On the other hand, he would be a great worker and he's prepared for the workplace, but he's getting mixed signals, in a sense. Because, on one hand, they're saying this [computer skill] *is what you need to do work in and he is excelling in those areas, but his basic skills of reading and writing are not quite there.*

Teachers described several ways in which they had their students use the Internet in exploring possible careers:

> *They looked for information about careers on the Internet. We found some good sources. Ask Jeeves has good access. It actually has its own database on careers, and has basic information about all sorts of different careers. . . . So that's kind of a good starting point. . . . The Bureau of Labor Statistics was another site that a lot of kids went to.*

> *But we spent 3 or 4 days in the* [computer] *lab researching different careers, and we're using a system called ECOS and bart.com. Our school has subscribed to it and all our students can participate, and I use that as the guide to search out careers. Then I have kids do their research on their own, typing in whatever they felt their career was and seeing what comes up.*

Sometimes Internet-related curricular opportunities that were intended by the schools to be career preparation turned out to be career exploration for some students. For example, many of the students who enrolled in the networking courses offered by one of the schools, with the expectation of eventually becoming employed in the networking side of computer technology, dropped out of the classes, finding that their interests were in other related areas, such as computer programming:

> *The kids enter the course with those expectations* [becoming employed as a network person]. *We lost a lot. We started with 33 kids in the class, and I'm down to 14. . . . They're all boys now.*

> *Most of the kids are planning on going on to school to do some kind of technology thing. . . . Most of them have decided that they don't really like the networking end of it. That it's just way too technical. A lot of them have already had some experience in the programming end, and they like that more.*

Students in interviews corroborated teachers' reports of the Internet-employment connection. Students reported using the Internet in running their own businesses and as a source of information about employment and internship opportunities:

> *I use it for my shop. I made a Web site for my shop. I have a car shop and we made one Web site. Our Web site and word of mouth are the only ways we advertise. We don't advertise in magazines, and we get a lot of hits a month just because we go to a drag race and we're like, "Hit us up on the 'Net, and find whatever you need, and get it for a cheap price."*

> *I built a Web site through friends and family who needed to sell whatever they needed to sell, basic business.*

> *I found a job on the Internet.*

> *I go and search for internships. . . . That's how I use the Internet.*

Subject-Area Curriculum Enrichment

Teachers across subject areas reported ways in which the Internet enriched their curriculum. Many teachers reported that the Internet was a source of excellent material for them in their teaching:

> *With U.S. history, there are on-line college courses, and many of them allow free access to the on-line course. There they either have professors or TAs or education departments or history departments that have tried real hard to put together materials already organized by rather standard curriculums.*

> *Although our media center has been very generous in trying to help me upgrade the quality of some material for college-level schoolwork* [for an advanced placement course]*, you are always looking for the supplements that are important. The Web has virtually put college libraries in our hand. One example is the Avalon project at Yale, which has documents from every century, especially the early documents. So my students are looking at the 'Rights, the Federalist Papers, any of the early treaties. We can look at them. We do a Constitution lesson that takes us in the technology lab and we use several sites, actually, the James Madison University site, and work with some Constitutional issues.*

> *In the Native American studies . . . we'll use it a lot. So they may do a segment on a particular person or place or an event. And it's recorded so you can actually go to their Web site, find that particular package, and it will play it for you. Like we did one here recently about some people who did land run. The Historical Society had recorded that. There was some about Native American code talkers, and so we can actually go back. It's very nice. I wish more of that was out there.*

Teachers described their favorite Web sites with great enthusiasm, remarking about the value of what they were able to find. Their descriptions revealed the scope and breadth of content available on the Internet to teachers. Teachers of career and technical education and academic subjects alike found resources they identified as making important contributions to their curriculum:

> *I go to a lot of graphics sites to look and see what they're doing. . . . I'm interested in starting lessons with my kids on how to build Web sites. I already show them basics for themselves, how to do a Web page. But how to build a Web site for a business. . . . show them how to do links, and that sort of thing. It helps them. . . . I'm on a few sites that will e-mail me as they build a new Web site. . . . There's one site in southern Oregon that builds Web sites for businesses. And when they build a new one, they'll e-mail me and say, "This is on our new Web site. Take a look at it." They build them for hospitals, or whatever, and you can go there and look at it and comment or ask questions.*

> *When they go into a new unit, let's say we're going into shampooing, I give them a couple things I want them to look up. Shampoos, we look at advertisement, we look at pH scale, we look at what the chemical makeup of the shampoo is, and then we look at how they advertise. They can actually get onto the Web sites of a lot of these companies. When*

I'm teaching beginning classes, we use a couple of universities extensively that have dermatology medical slides. We look at ringworm and we look at things like the cocci bacteria and we look at communicable STDs and we look at things the kids might be exposed to by not sanitizing and not doing things the correct way. Nothing is going to show them as quickly that they need to clean their stuff than a hand or face eaten up with herpes or some type of strep bacteria.

We come down [to the computer lab] *to do our course project . . . I had them do an interview, like an oral history interview.* [They get their material from the Web.] *I'd say, "If the person is dead, you will be interviewing them. Then they come to life and they're going to talk." And so we've been doing that. It's been quite successful. Interesting. I had one student do an interview with Queen Elizabeth the First. One did one with Edgar Allan Poe. They did a really good job. It was like the person was alive, speaking in the first person.*

We use it to look up Web sites dealing with law enforcement, crimes. The state puts out a wanted list and they get to see what it is like for wanted posters, how people use the Internet to track down people. So they get a first hands-on dealing with how the police use the Internet currently to track people. We go to the U.S. Secret Service site. We'll go to the state Bureau of Investigation site. We'll go to the local police site, the county police site. We'll go to Alcohol, Tobacco and Firearms sites, which are the federal levels, and look up current laws, change of laws. We'll go to the Attorney General's Web site and look at that.

You can do virtual tours of cities around the world. I've done that sort of thing in my German class too, where they had to research certain cities in Germany or any of the German-speaking countries, and then come up with things.

I found one site, it was called babysitter.com. It has some wonderful information on pregnancy and infants and toddlers. These are things that I lecture on, and I thought how much more meaningful it would be to the students if they could find and do the research themselves. For instance, this is one assignment that I would like them to do on the 9 months of fetal development. Here's a site that discusses the advantages and disadvantages of breastfeeding, which we talk about in class. We talk about amniocentesis and genetic testing, and so there were some very good questions and information I found on that site. So I am trying to infuse it in all the classes.

I'm searching the Web to find animation that would be appropriate for school art. That and finding resources of good paintings. I have found several sites that are just wonderful.

In my economics class we just did this one. You can bring up the Kelley Blue Book. *We talk about buying used cars versus new cars, and car insurance, so they click on kelleybluebook.com, and then they click on used car values, and they put in the car that they're driving or that their parents are driving, and it comes up with resale and trade-in values. . . . So that really centers in on what depreciation in a car value looks like.*

Opportunities to Engage Students in Thinking

Teachers reported that the Internet helped them to engage their students in thinking. They described Internet-based resources they had found helpful in involving their students in critical thinking, decision making, and problem solving, and in organizing, synthesizing, and integrating information.

Critical thinking. The ability of the Internet to provide information from more than one source was reported to give students an opportunity to compare alternative treatments of a subject or topic:

Another thing . . . that the kids are learning is their way of thinking. How to phrase something in a search engine and find it. How to discriminate between what one source is saying and how it is different from what another source is saying. There is a certain cynicism built in to being a teenager. Cynicism is an easy form of sophistication, but it also is teaching some analytical thinking. When I was a kid, my parents bought two newspapers, and so I grew up often reading the same stories written by two different people, which introduced me to the idea that you've got to compare sources. Now it's so easy to do that. I can read The Philadelphia Inquirer *in a couple of mouse clicks now, and so I think that will develop a greater ability of students to think for themselves, and not just believe what they read.*

Teachers alerted students to "about this site" or "about the author" features of Internet sites, where students could find information that helped them assess the credibility of information they found on Web sites:

One of the things that we look at is "about this site" or "about the author" section on there, and just to have them think critically about it. If it's just someone's personal Web site, that means you have to question the information on it more. Whereas, if it's a university site, you can assume usually that the information is more reliable, or if it's a government agency. So it's not any specific tools, but rather just to think.

Part of it is I think you can look past the Internet and just try to teach students how to recognize facts from opinions.

I think there is an evolution because when kids are new to it, they tend to accept everything. With experience, you become skeptical about more stuff. Even stuff that is now in print. . . . You are more skeptical about what is written in print because you know how easy it is to do that because you see how easy it is to pick stuff up on the Internet.

Decision making. Teachers used information available on the Internet to help students learn decision making processes and about the kind of information gathering that supports them:

In my algebra B class, we were doing systems of equations in intersectional line. I went to the AirTouch Web site, and I had them graph three different price plans and determine after how many minutes was it better to switch from plan A to plan B, or plan C, or which plan you should choose based upon your personal usage. They also had to decide if the cell phone is really something they wanted to acquire.

I said . . . "you need to read information from . . . three different perspectives. Then you need to make your own decision. You need to draw your own conclusions."

Problem solving. Several teachers remarked about their use of the Internet to engage students in problem solving:

They have to solve an international crisis on that one [WebQuest].

For the programming class, I teach them programming languages. And then they want to do something. For example, one of the kids wanted to scan a picture in and have it show up as a background. Okay, you can do that. You have to convert it into a bit-map and then store it as a file, then access the file, and then display it on the screen. But I didn't tell them how to do that. I said, "Well, you're gonna have to find out." So he has to go on the Internet and look for Web sites associated with basic programming skills, and there's all kinds of help. There's clubs. There's all sorts of things.

The other day we were looking at a science fair project on welding and porosity, the problem, and so I had to [let] *kids just kind of attack it to see what they could find* [on the Web]. *Well, they found a lot of stuff.*

I try to find on-line tutorials. The most recent one I found . . . is a bunch of different calculators, so you can actually hop on the Web site, and say I'm dealing with circles. If I have a circle and I know the circumference, how can I find the radius? And they ask . . . [you] *questions: What are you trying to find? What information do you have? Then it will show you how you solve that problem. They do that for all levels of math. I try to find things like, that so that I can refer the students to those.*

Organizing, integrating, and synthesizing information. Teachers assigned students work in which the students obtained material from the Internet (e.g., information, illustrations, graphics) and from other sources, and then had to put these pieces together in an organized, coherent way in a presentation, television show, or other multimedia production, or written document:

They got pictures through the Web, and then they got information from the Web, and then they wrote it in their own words.

We do things like a director's project, where I'll have students choose their favorite director. On the video end, they'll need to pull together clips from their director's work. If there's autobiography materials out there, they'll pull some clips from that, interviews with family, whatever; also samples of the work. To buttress the video presentation when it's time to present, they will have gone on line to pull off biographical information . . . so they show the clip and come back and refer to the printed material.

They have to go out and research the weather facts from the National Weather Service and also get the weather maps and things like that. They pull all that information down and then construct a television show. They've got the green screen to stand in front of and do the composites with the map, and things like that. Where we do use the Web, I try to make it, put it in a context of, some kind of multimedia production.

Teaching and Learning Approaches

Teachers reported that the Internet helped them teach in ways that emphasized inquiry and discovery learning, project-based learning, and group learning. Teachers commented that group learning was almost inevitable when the Internet was used in class.

Inquiry-based teaching/discovery learning. In Chapter 6, it was reported that teachers found their use of the Internet was fostering a change in their teaching style—from information-giving to supporting students' self-directed learning. It is not surprising, then, that teachers described using the Internet in inquiry-based approaches to teaching. For example, the Internet was used as a source of data that students could analyze. Students also used it to develop background information for problems they were assigned.

I teach environmental science. There are a number of programs out there that test air pollution and ozone levels, and report it to a central location. They're collecting [these data] *from all over the world. . . . And so they collect the data and then it's graphed for them, and we can use it to do some analyses.*

They were able to go into that Web site and get the data for an earthquake, find the epicenter and manipulate the data like that.

Different aspects that aren't exactly chemistry but all related to that one chemistry company, those that had Web sites. . . . I try to make it multiple focuses now just to get them to think. . . . I asked for financial information so they were supposed to tell me how much that company spends or how much they grossed. I had pollution, what are their biggest byproducts and waste, so environmental concerns. Chemistry, if they could figure out the chemistry of what that company did. It might be Shell Oil, and they had to do a little research on what is oil. I tried to have lots of aspects to it.

We have standards for high school graduation versus just credits, and they have to do certain things. I teach inquiry science and they have to fulfill the inquiry standard. Everyone has to do a science project, and so they specifically need to do background information, which means they have to go find that somewhere. Topics can vary from medical things, biology, physics to gravitation to growing plants. Once again, it's [the

> Internet] *a great means for them to go and dig out that background information because so many people post so many different Web sites with different information on them. That's really what they use it for, is dig out the background. I use it more as a research tool than anything.*

Project-based learning. Project-based learning was another approach to teaching that teachers mentioned frequently in connection with the Internet:

> *We're starting to incorporate the Web. For instance, we do a kiosk assignment in the 9th grade. . . . We built a kiosk on how the movie* Ghostbusters *was created with special effects.*

The Internet was used both for various inputs into students' projects and as a vehicle for presenting their projects:

> *Right now, they're doing a project on a road trip across the country, and they each picked a different state that they wanted to go to. As they travel across the country, they have to stop at different states, and have to access the Internet to find out what type of sightseeing is available there. They are required to visit historical sites as they go across. . . . So they are accessing a lot of different types of sites for the project.*

> *We do a final project at the end of the year. The choice is to create a Web page or do a video biography or some sort of interaction using the Internet, and drawing some source sites and getting things of that nature. So it is like an interactive display.*

> *This year we have done a project using the state legislature. The students have been able to access bills from the Internet, and have done a lot of research as far as the graduation standards. They had to do a report on a current issue and a political action plan, and they also used the Internet to do their research for that.*

Group learning. Teachers described the Internet as facilitating group learning. This group learning seemed to occur spontaneously, as students in a classroom or computer lab used the Internet:

> *In a classroom, maybe the separation of the desks and the arrangement of the rows, students tend to work independently unless you organize them in groups. I've noticed in the* [computer] *lab, however, even when they're looking at text on a page, they tend to spontaneously comment with one another.*

If the class wasn't too large, the entire classroom of students became engaged in learning together.

> *Once I got involved in bringing the Internet in, the class became more universal as a group. My class only has anywhere from 12 to 9 students in computer science. They function more as a total group, totally sharing all the things because of the use of the Internet. Everybody wants to see what the other person is looking at, so they all get*

involved. When they have time to talk, they're kind of talking as a whole group more than in small groups.

If they get on an interesting Web site, the others around will migrate to that computer screen, and they will talk about it and they'll get into a kids' [student-student] *conversation.*

Teachers reported that certain kinds of Internet-based assignments, such as building a Web page, lent themselves to group learning because several roles were required in order to accomplish the assignment. Within a group, each student assumed one of the roles:

Most of the time, I try to group them in groups of three, 'cause . . . just with the different jobs that it takes in making the Web page, building the problems, or taking pictures.

Impact on Traditional Teaching Materials and Activities

Teachers reported that the Internet was changing their use of teaching materials and activities by providing substitutes for and supplements to traditional materials. Most notably, the place of books in instruction was reported to be shifting. In addition, the Internet provided teaching props and demonstrations, and made virtual laboratories and laboratory equipment available. These allowed teachers to provide more adequate learning experiences for students when the school laboratory equipment was inadequate, and allowed students to make up missed laboratories.

Replacing books. Teachers reported that they used the Internet in place of books as an information source and for student learning assignments:

We're working on weather problems right now, just trying to learn what they're showing. When I pop up that weather map with the isobars, what does all that mean? I didn't give them a book, didn't have them look it up in a book. I just told them to go to weather.com.

Sometimes this was because there wasn't a textbook or other print material available:

I've used the Internet in some of the other courses that I didn't have books for.

We just finished up galaxies, and we're pulling pictures and information that definitely augment what I'm doing lecture-wise, or any kind of worksheets that I make out. That's probably the class that uses the Internet the most, because we do not have a textbook.

I've had classes that I've had to teach with very little notice where there has been no textbook. It's happened to me a lot of times. . . . It's challenging. . . . You think of the ways you can get information from the Internet, and then you go that route.

Teachers in some schools indicated that their school's library resources were sparse. These teachers used the Internet to substitute for books and other resources not available in their school's library:

> *Our library media center has very few paper sources, so when my kids need additional information, this* [the Internet] *is really the only place we're going to be able to get it.*

> *With our library facilities, we don't have a lot of hard copies of things.*

Teachers also reported that students tended to use the Internet form of reference books, rather than the print form that was available to them in the library:

> *Many of them used the Internet encyclopedia source, as opposed to just an encyclopedia book.*

One school had discontinued updating some of its library reference books, such as dictionaries, and encouraged teachers and students to use the dictionaries available on the Internet:

> *I'd made a request for dictionaries when we first got here, and it was made clear that we need to use the dictionary source that's on the Web. Because the money has been spent for this product . . . that's when I realized that we need to use this all the time.*

Supplementing books. Teachers and students reported using the Internet to supplement books. In some cases, this was because a textbook that teachers were using had a corresponding Web site. These sites often provided students with interactive and other activities related to textbook content:

> *And the textbook that we order has supplements to every chapter that are on line.*

> *Then we have our textbook. It's* Paso a Paso. *And there's a Paso a Paso site, too, where you can find some additional materials to supplement what the textbook has in it . . . I've used that and our department members have used that.*

Teachers intentionally used the Internet along with books as a way to augment the information in books:

> *It's also interesting for the kids to have the Internet and the textbook. With the textbook, they are kind of limited as to what they show.* [With the Internet] *they can look at the pictures and movies about whales and dolphins. It is a lot of information. To me, it is more exciting to look at sometimes than reading a book. I have mixed it up so that they use a book, they use Internet.*

> *With every assignment, I have some kind of Internet-based segment to add to whatever is available in their textbook, because there is not adequate information* [in the textbook] *. . . and there are so many sites now.*

Teachers continued to use books along with the Internet because they felt the information in books was more tested, reliable, and valid:

> *When we do research, we use it because we have more resources available on the Internet than there are in the library. I also make them go to the library to do their search. You have to have the hard copies, the periodical, in hand, too. You need to be able to read the articles, but it has to be a blending of both. I just like to have a combination. Libraries are great . . . on the Internet, anybody's knowledge could be there.*

For some teachers, the Internet was one of several resources they required their students to use:

> *When I did the research projects with the kids, they had to have an encyclopedia source, a book source, and an Internet source.*

Students also commented on the supplemental role they saw the Internet playing in relation to books. They reported using the Internet as a starting place, but relying on books for in-depth material:

> *I found the Internet was a good jumping-off point, just to get the basic facts, but if you wanted anything in depth, you have to go to the books.*

Props and demonstrations. Teachers found sites and material on the Internet that provided them with otherwise unaffordable or unavailable props, or that improved upon demonstrations they had been doing by allowing better visualization and observation opportunities for students. Phenomena that are difficult to describe or observe were easily demonstrated on the Internet:

> *And then with my AP* [advanced placement] *classes, we use the Internet. There are several really good sites. They have some three-dimensional physical chemistry things on there that it's hard for us to show in three dimensions, that you can pull up, and it's very good. There are a lot of good materials.*

> *I got an entomology team training on bug education, and for me to go out and get a big collection would be costly and time-consuming, and I can get all that right off the Internet.*

Replacing or augmenting hands-on labs. The Internet provided resources that could be substituted, at least some of the time, for costly labs and lab equipment. In some cases, when teachers did not have expensive lab equipment or a sufficient number of items needed for a lab exercise, the Internet made a virtual lab experience possible for students:

> *Some of these physlets I mentioned have almost lab-type information on them, where you plug in a set of numbers and it gives you the results. So if there is a piece of equipment I don't have, or if I don't have enough equipment for the whole class, they can actually do a lab on line.*

> *The only problem, though, for this class one pipette costs $500. It's expensive. . . . I just downloaded sites last week where the kids can go on and use pipettes on the computer. . . . For titration, micropipettes, like for bacterial cultures.*

Some teachers allowed students to make up a missed laboratory by doing a virtual lab on the Internet:

> *For example, if students miss a dissection lab and* [ask] *"What do I do to make it up?," I say, "You go on the Internet and you find a virtual dissection."*

Other teachers allowed students who were uncomfortable doing dissection an alternative way to complete such an assignment:

> *With biology class, we do some of the on-line dissection programs that we use for those* [students] *who don't want to do the actual dissection. They can go into one of the places that will have an on-line dissection.*

A virtual lab could also be much more convenient than the real thing:

> *One thing that I've done on line was the virtual flies . . . when you do a project in biology where you do fruitflies. You can do that now on line. You don't buy the flies, but they do all the classes on line. And it's actually so much better because they're not dealing with killing the flies and getting them to mate, and the flies in the room.*

One student, however, who had taken on-line courses, cautioned that the Internet could not completely replace all in-school experiences, especially certain laboratory experiences:

> *We have some classes, Internet classes, now offered. Courses where we don't have to come to school. We just take 'em on line, see all the virtual stuff. . . . I think that's a good idea in some ways, but I don't want it to end up where you're just at home doing everything on the computer, 'cause it's not the same as when you're actually in a class—I mean for labs and stuff like chemistry or some things. It can't replace everything.*

Impact of Internet Use on the Management of Teaching

The Internet gave teachers and students helpful resources and more options. Sometimes the added options, however, required teachers to spend more time managing, and thus added to their work. Often this was because the Internet added new options without subtracting old ones (either because replacement was not feasible, or because it was not desirable), so that teachers did things the new way while still continuing to do them the old way. Opportunities the Internet provided also created new tasks for teachers, or added new components to their responsibilities. Adding a computer activity as a learning station among other learning stations, for example, expanded the range of simultaneous activities the teacher needed to supervise. Finding Web sites for students to use and creating Web sites on which assignments could be posted were examples of new tasks. Taking a class to the computer lab meant scheduling a lab ahead of time, and added the need to develop a contingency plan if the lab wasn't available or the Web site(s) or systems were down.

Teachers had to learn new tasks, develop new awareness, and pay attention to new problems. For example, when students filed their assignments in their folders on the school's server, teachers had to know how to go into the folders to get and review the assignments. Teachers needed to be aware of legal restrictions on the use of Internet material. And when they structured learning experiences, they needed to pay attention to new issues—to minimizing distractions and opportunities for students to access inappropriate sites.

<u>Planning and Preparation</u>

The Internet provided teachers with helpful resources in their curriculum planning and lesson preparation. Teachers saw the advantages in being able to access Internet-based resources either at home or at school, and to send them back and forth. At the same time, the volume of information the Internet made available to teachers made planning more complex. Teachers said that using the Internet required a good deal of advance planning. The changeable nature of Web sites meant that they had to keep rechecking Web sites ahead of class. In addition, teachers who incorporated Web sites into their curriculum knew it was possible that needed Web sites would not be available if there was a server or network problem. In addition to having to have an alternative plan in reserve, many kept multiple copies of their work, which meant that if they made any changes, they had to update all of the stored backup files. If teachers needed a computer lab during their classes, they had to schedule the lab, which was often challenging because of the heavy demand for computer lab time in their schools.

<u>Planning ahead.</u> Use of the Internet had not lessened teachers' need to plan. Teachers still needed to think carefully about their goals and be familiar with the resources they introduced to students, including resources that were Internet-based:

> *Internet use in the classroom, for me, has to be extremely well organized. It is not just a "search on your own" type of thing.*

Some teachers had been taught a model for Internet-based lesson development that involved presenting a well-structured, preplanned, organized task with clear guidelines for students to follow, and preselected Web sites for them to go to. Other teachers had learned through their own experience the kind of structuring that Internet-based lessons needed:

> *Sometimes I'll go through and find Web sites that are applicable to what I want to talk about, and then I have them go to those sites. I'll make questions that go along with what's there.*

> *I've* [indicated] *specific sites for what I want them to learn and given some structure to questions, so they know exactly what I want them to pull out of there.*

> *The teacher should be finding some very good sites, creating the links to those sites, and then maybe providing 15 different sites the kids can look at. Then they can click to those and find the information.*

Developing Web pages with links to sites that teachers wanted students to explore was a frequent tactic for organizing and providing easy access to Web sites that teachers had preselected for their students. Teachers had found that identifying sites ahead of time made students' time spent using the Internet more productive and more goal-oriented:

> *I have a* [Web] *page, and a colleague I helped has a page. Both of us have pages that guide them to certain Web sites that can help them find what research they need to do.*
>
> *I have to find Web sites that fit in for what I want my students to research. I spend a lot of time researching for sites that would be beneficial to my students so that they don't have to spend all the time doing that.*

<u>Curriculum planning resources.</u> Internet resources were helpful to teachers in their curriculum planning and lesson preparation.

> *TrackStar is an Internet site that allows teachers to choose ahead of time the Web sites they want students to go to, and gives the instructions that they want students to do on those particular Web pages. It's basically a database. So teachers go to that one single address. It has only one-frame call-up of all the different links. Then it has, across the top, the bar that gives the instruction for the students. One Web page can do this.*
>
> *And without the Internet and the e-mail, I would never have found it. It's a virtual library now. I very seldom use the county library anymore. I get what I need right off the Internet.*
>
> *I now know a lot. I've been teaching it now for like 4 years, so now I know a lot of links that stay up, that aren't necessarily up 1 week and then down the next, that I can keep going back to it and say, "Okay, try this link." I've had time to explore the links and I can tell them, "Okay kids, try it. Now you're going to move to this link." And I can actually put together a worksheet to say, "Okay, here's step-by-step how we're going to do it," so that it is a very objective-based, content-driven assignment.*
>
> *Whereas in the past, I sat down, wrote those, typed them up, xeroxed them off, and gave them to my students; I don't have to do that. They've got it* [on the Paso a Paso site] *in another way, in another explanation, in another format.*
>
> *So technology really has helped a lot in helping teachers get resources. That's very valuable to us. It would take me 11 times as long to get some information. Now I can just go home and get in the Web and get it quite fast.*

Planning at multiple locations. Teachers who had Internet access at both home and school liked being able to access Web-based curriculum resources both places. They could do their curriculum planning conveniently at either location, and e-mail the material they found or developed back and forth:

I'll do Internet searches for various topics, especially either German or history, some in ESL too, at home, find a site that I find interesting and kind of experiment there at home. . . . Then I e-mail the addresses to school so that I create my list that way.

I do my lesson plans at home and I e-mail myself at school, or I e-mail my lesson from school back to home so that I can revise it.

I also will write up tests or reports or things I'm working on at home and then just e-mail them here, print them out here on the nice printer, and have them for class. So I tend to take more work home. I work more at home on school stuff because it's easy to send it back and forth. That has been a big help.

Volume of material. Teachers found so many resources on the Internet, it was a challenge to glean the best sites to use in their classes:

Another thing that I guess is a problem with Internet use is that of selecting information. . . . What was I looking up the other day, I got 92,000 and some hundred hits.

Scanning sites and discriminating between useful and irrelevant resources was essential:

I think the Internet is really great. In fact, there's so much out there, it's almost overwhelming at times when I go to search for things. You have to learn to really narrow it down and sort out what you're going to use and what you're not.

Some teachers longed for a directory of Web sites that could help them in this process and save them time:

One disadvantage I feel with the Internet— there's not a menu that you can look up something. You just kind of have to keep looking. One site, then take it to another. You can spend a lot of time. . . . I wish I could look on page 14 for certain things that I want. It's so vast.

I spend a lot of time looking at sites and figuring out sites and book marking what's worth keeping. That takes a lot of time. If I had a ready reference, that would be helpful.

Backing up in case of equipment failure. In their planning, teachers needed to take into account the possibility of equipment failure. If they were dependent on using Internet materials in their classroom, they were at risk of not being able to teach in the event of an equipment failure. Protecting themselves against this possibility required backing up their files. Some teachers followed intricate backup routines:

I have my material in four places. That teacher computer sitting right there is the one that's hooked to the TV. All of my Web sites and everything are right there on that teacher computer. The way my links are made on the Web site, everything's in-house. The links will work whether it's sitting on that computer or whether it's sitting on that Compaq laptop that's over there or wherever it's sitting, the links will work. So every day when I turn that computer on right there, all of the in-house stuff is being read off of that computer. Now, if the Web server goes down, then the only thing that affects me is none of the links out-of-house work. But I've still got all of my in-house materials available to me. So . . . when the server goes down, I can't get out of the house (and that is a problem), but it's not like I can't access anything.

The backup of that computer is our network G: drive. It's another computer. So everything to that computer is backed up to that network drive, and then that Compaq laptop over there, it's hooked to the network, so . . . when I make changes on the teacher computer, I transfer it to the network, and then immediately transfer it from the network to the laptop. So, what's on the laptop, what's on that computer, what's on the network. All three of those are exactly alike.

New legal issues and questions. Teachers commented on the need to be informed and careful regarding legal issues in using Internet material:

You have to know the legal aspects, and that's a biggie. The big aspect with legality in Virtual High School is making sure that you're very careful about copyright law. We did a whole week on copyright issues.

There are very strict laws about Internet use. You have to be aware of what they are. That part is kind of scary.

Making and distributing paper copies of material from the Internet, using others' Web sites as links in one's own Web site, and making electronic backup copies of Internet material were legal issues that concerned teachers:

I don't have any qualms at all about downloading something from the Internet if I'm going to use it on my PowerPoint in class. Now, there's a lot of people that probably think I shouldn't do that. . . . But then, when you put it on the Web server (take it from somewhere else and put it on my Web page), now that gets a little more shaky. . . . So, I've got a lot of pictures on my PowerPoint stuff that aren't on the Web pages. On the introduction page on my Web site, I put there that I don't claim any copyright. Anybody can use anything as long as they're doing it for noncommercial [purposes]. . . . *If I've got something on the Web page that somebody else made somewhere and it shows up on my*

> *Web page, well, I still don't think I'm, you know, pushing too much. It's not something that's making me money. Now, if I burned it into a CD and started trying to sell the CDs, then that would be a different deal.*

Checking, updating, and refining plans. Using the Internet in their lessons required teachers to continually check for changes in Web sites and edit their lessons accordingly:

> *I don't have to think about what I'm going to do tomorrow. I know. I can walk in tomorrow and turn that computer on, and it's all right there . . . the only real preparation that I'll have to do is stay ahead, checking the Web sites. If a Web site that I use . . . disappears and I can't find it, then I've got to find another Web site. . . . By the time school starts next year, that'll be the only preparation that I have to do, because the rest of it's all right there.*

> *The second you burn it into a CD, it's out of date. Because the Web sites change, I always have to work a week or two ahead, making sure the Web sites are still there, and all that stuff. And so it's so fluid.*

> *I have a Web page here at school, so I update it all the time. I post assignments on it. I have three classes, and I update them every 2 or 3 weeks.*

Some teachers noted that having their lessons on the Web made editing them and changing them easier:

> *I'd like to get all of mine* [lessons] *on there so that the students have access to them, and also so that they're easier for me to edit. 'Cause I've really gotten into editing them at home. I can work on them at home, and just pop them on the server, and it's done. And I like the fact that it's easy to modify, make the changes.*

More resources to coordinate. Using the rich resources the Internet offered in tandem with other teaching-learning resources increased the complexity of coordination for teachers:

> *When I started looking at the new edition of* [the textbook]*, well, there are some minor things. They've finally gone to five kingdoms of living things, and my Web site is still set up with four. And that sort of thing. So, to update . . . I know that this summer I'm going to spend however many weeks it takes to go back and tweak all of those* [Web pages]*, to get them to fit the new textbook.*

> *One of the sites at University of Wisconsin has a video component, and it is on the TV, the TV lecture notes are on the Web, and then photos that we have used in class.*

> *I subscribe to an international volcano watch, and they send me messages every day on what's happening in Pompeii or . . . The Philippines . . . 'Cause there's something happening every day somewhere in the world about volcanoes. . . . I bring it to my classes when there's something significant and when we're studying volcanoes, earth science. Then it's something that's very, very relevant.*

Scheduling computers or computer labs. Teachers who wanted their entire classroom of students to have access to a computer, either as individuals or in small groups, had to schedule a computer lab:

> *You have to sign up for using the labs. So you have to plan ahead.*

This task may seem parallel to scheduling videotape players and televisions or other equipment shared among teachers in a department or school-wide. Using a computer lab, however, required moving students to the lab and was more difficult because of intense demand for the labs:

> *The problem's trying to schedule time and get the kids there. I mean logistics, which is every teacher's nightmare, anyway.*

> *Right now, although we could support a lot of Internet use, it becomes a little bit of a management problem, because we have the one lab up there and the one traveling lab that are used campus-wide. There's more and more of us using these. So it becomes a difficult thing to manage.*

> *There is a lot of demand for lab time, especially towards the ends of semesters and quarters, and it's hard to get in there.*

To get a turn, teachers needed to schedule their classes into the labs far in advance:

> *You work out your plans and then you go to sign up in the lab, and someone else is in there and signed up for the lab. Or you go because you know you want to use the media center, and three other classes are already in there and there's no space for you.*

> *We have 22 teachers in our department. So you have to sign up early to get lab time because it is used widely.*

> *And then there is the hassle of signing up. . . . Some people . . . run down there Monday morning and sign in on the big board for Internet use. If you don't get there in time, you're out of luck.*

> *We have another lab with about 22 computers, but you have to sign up early in the semester.* Very *early in the semester, to guarantee the days that you want.*

Assigning, Collecting, and Grading Students' Work

The Internet provided new ways for teachers to communicate with students about assignments and grades. E-mail, Web pages, and messenger features of the Internet were used by teachers in assigning, collecting, and responding to students' work and in communicating grades. The new alternatives were convenient and appreciated, but did not necessarily replace more traditional ways of performing these tasks, because not all students had the access to the Internet that was needed to use the new ways.

<u>New alternatives for communicating assignments and grades to students and parents.</u> Teachers used Web sites or e-mail to inform students and their parents about assignments, grades, and tests:

> *Pretty much, it's used for just kind of a communication tool, like what homework is due. So parents can access the Web site and see when a test is coming up.*

> *I have a personal Web page, and I also have a Web page for the school for myself where students can access grades. They, as well as parents, can access assignments. . . . One of the biggest things that I find is students sometimes forget to tell mom and dad things. And when mom and dad find out, they get upset. So, I have this for parents.*

> *I created a little* [e-mail] *group, and I could send out assignments or notes or comments or say, "Look this up."*

> *When the kids log in, they're at the media center page and one of their options is "teacher assignment." Then they open the teacher assignment folder, and it's under* [my name].

> *They* [students] *automatically go to the high school site. And then on there they have links to mine* [my Web site] *and their assignments. . . . right now, they're working on their leaf collection and there's the instructions, there's their rubric.*

Student grades that teachers posted on line were password-protected and allowed students to check on their record of completed assignments:

> *I have everything published on the Web. All my lessons. The grades are published on the Web and with a password. They can look at their grades and see what they are missing.*

While teachers used e-mail and Web pages for sharing assignment information with their students, they also realized that students who did not have Internet access at home needed to get this information at school:

> *Because we have some students who do not have Internet access at home, it's always two-pronged. They* [all students] *get the assignments on their e-mail and at school.*

Students also mentioned obtaining assignment and grade information on the Internet:

> *When she gives us an assignment, she puts* [up] *the Web pages so we can make notes and she gives out the Web pages so we can go at home or where we have a computer. We can go and take notes from there and we can check our grades, too.*

<u>New avenues for submitting, collecting, reviewing, and responding to student work.</u> A few teachers used electronic work boxes as a way for students to submit their work and for teachers to retrieve it. One school had institutionalized this practice across the school, and all teachers were expected to use it. Each student had an on-line electronic folder into which they placed their assignment work. Teachers then opened, read, and commented on the assignments on-line:

We have a [student] *work folder on the server here.*

They [students] *create it* [their assignment] *and put it in their folder.*

In the other schools, it was more common for students to submit their work as an e-mail attachment sent to the teacher:

E-mail, kids use it every day to send me their stuff.

They send me work on the e-mail.

Whichever approach for electronic submission of assignments was used, a number of teachers graded and returned students' work—and provided feedback regarding it—on line:

In literature class and composition class. . . . e-mail's the only means that they can send me an early copy, a rough draft. So, it forces them to get into that technology. And they use it. I've opened my e-mail account and there's been 45 papers on. It's nice because then I don't get bad papers. I get much better quality papers, but it also creates more work. It's easy enough to paste it onto a word processor, you know, show them the changes, and then send it right back to them.

Rethinking standards and criteria for student work. Teachers reported that the Internet had introduced new challenges and complexities for them regarding their expectations for and judgments about student work. Some teachers required Internet sources or a mixture of Internet and non-Internet resources in student papers:

It was an out-of-class assignment. Most of the kids wanted to do all of their research on the Internet, which I wouldn't allow.

Some teachers also asked students to document sources used and even to verify that they had actually visited Web sites they cited:

That is why I require the printout—because [then] *I can tell they actually went to a site.*

Beyond these changes, however, were nagging questions for teachers. For example, how does one evaluate multimedia products in a way that judges them fairly alongside written papers?

I think there [are] *issues with how we do research and how students report that research, and then judging the quality of students' work. That's more complicated than maybe it was before. The kind of reports they turn in, in terms of what they look like, and I don't mean only paper, because they can do multimedia reports, as well.*

Should a teacher have the same expectations for students who are having their first computer experiences in the class as for students who are computer pros?

> *Some kids . . . were still a little scared of sticking the disk in by the time the week with that project was over. They weren't good at the computer before, and I was kind of making them use it and there was no way out for them, so they knew they had to do something. And they were still the same way at the end of the week. So how do I hold every kid to the same grading scale when some kids walk in the door and know how to do all the things I'm going to ask them to do?*

Publishing students' work on the Internet. The Internet made publishing student work feasible from a cost standpoint, but was one more thing for teachers to do and make decisions about:

> *I ran the computer lab* [at the university where I got my master's]. *I use the ties that I made there for publishing on line the good work of my students. It's a thing called KidReach, where kids can publish their own work. . . . I helped develop that, so I get my kids' work and we'll publish it to that. . . . I try to use it as much as I can. It creates more work sometimes, because if someone finds out that you're interested enough in their kids, then they'll send you more work. So they're, "Here, I've got something you can help me look at." That's fine. That's the whole point of why you're here.*

Classroom Management

Teachers found that managing the classroom was more complex because of opportunities or requirements the Internet introduced, and that use of the Internet and computers encouraged student behaviors that made classroom supervision more challenging. Because the Internet created more opportunities to individualize student learning, teachers often had to manage a complex array of simultaneous activities in the classroom. Taking students to a computer lab to use the Internet took time away from class; or moving computers into the classroom took extra teacher preparation time. The power of the Internet to distract students, the possibility of students gaining access to inappropriate Web sites, the opportunities that the Internet created for students to cheat, and the temptation that school computer systems presented for mischief by students all contributed to the need for extra vigilance by teachers.

Individualized learning. Teachers found that use of the Internet allowed students to be doing different things at the same time or to proceed at their own pace. This tailoring of learning to students' individual interests and patterns was seen by teachers as helpful to students:

> *I think the Internet allows us to do that as teachers, to do more individualized instruction and gear things to the kids' interests.*

> *So that kind of shifted the way the classroom operated. Instead of having everybody working at the same time on the same thing, then students were able to work at their own pace. If somebody was able to finish something quickly, then it was easier for them to go on, while some others were struggling to finish up. It let the quicker students do*

> *something other than just sit around and wait for everybody else to finish what they already knew.*

> *I think they feel that they have a little bit of freedom, can move at their own pace, but yet they still have to stay on my page, and either they have a little more time or they have a little bit more independence than looking in the book.*

While this made schoolwork more appealing to students, it meant that teachers had to oversee many different activities going on at the same time:

> *I break the class up. I have five students, one per computer, and then the rest of the class does something else. Then rotate around.*

> *What I do is present opportunities for them and they work at the same time. Some of them are very book-oriented and they like to outline a chapter. Others have more savvy on the PowerPoint. Other students like dissecting. . . . In addition to that, the other center that I usually will set up will be the one for Internet research. When we were doing the dissecting, I broke them up into those five centers.*

Classroom setup and time management. Moving students to a lab during a class period took time from students' actual work time. One of the schools that had block scheduling every day allowed teachers to sign up for a computer lab for only half a period, which gave a class about 40 minutes in the lab. Although one teacher at this school said that this amount of time was sufficient, most teachers said that by the time students got to the lab, logged on, and worked through any problems in this process, they had very little time left for working on the Internet:

> *They only schedule you for half of the class period. They won't schedule you for the whole one. Sometimes, because it takes so long for them* [students] *to get to where they need to be, or so much problem solving, a lot of the time it's not worth it. By the time everyone gets on and gets to where they need to be, it's almost time to go, so they can't really do the questions you ask them to do or do any really detailed searches.*

Some schools had traveling computer labs. The computers were moved to the teacher's classroom on a cart. If the computers were wireless, students could remove them from the cart and use them immediately; if they were not wireless, however, they had to be hooked up to electrical and Internet wiring, a logistical task that discouraged teachers from using these traveling computers. In addition, the wear and tear on the computers from being moved took its toll on their dependability:

> *We get moved all around. We sign up for them* [computers on carts] *if we want them. If you're lucky, you may get all 10 at one time, or you may get only 4. Quite frankly, it's more trouble than it's worth a lot of times. When they're moved around like that, you get them in there and start hooking them up, and one doesn't work.*

Student behaviors. In Chapter 6 it was reported that because many students enjoyed working on the Internet, they were better behaved and more engaged in learning. On the other hand, it was reported in Chapter 5 that students were easily distracted from the task at hand when it involved working on the Internet. Many teachers reported that students' distractibility when working on the Internet presented a supervision challenge for them:

Sometimes it can cause a lot of extra work, trying to lasso in the students to stay on task.

It gives us, as classroom teachers, a much larger burden of responsibility in terms of maintaining that the kids are on task.

One thing that we have to be careful of is these kids who want to use the computer, and you think they are doing their work, and all of a sudden they've brought up a game and they're just playing. So there again, we've got to really monitor our students' usage.

It really is kind of a problem when you start letting them get free hand to the Internet. They want to go see what is available at the Gap, to go shopping. They know how to get to all these sites. . . . I've had to get students off of some of this stuff. They'll get on it before you know it.

I had them go up to the lab one day when I was out because, instead of just doing a worksheet, I had one of the other teachers speak to them. And the sub that was there with that teacher said he was busy the whole time going around making them stop playing solitaire. They are so sharp at it, they just flip into that stuff easily, and you're constantly trying to control that.

Students acknowledged the distracting power of the Internet in their interview comments and admitted that the appeal of the Internet lured them away from their schoolwork both at school and at home:

A lot of times it distracts you from what you are supposed to be doing.

I've been in that journalism room, and it's hard to sit there and do work when you can just go on the Internet and do whatever—check the sports scores.

Sometimes, when you're going on [the Internet] *to do schoolwork, and you start chatting, and then you forget about it and before you know it, it's midnight.*

Sometimes it does shock you when you get on to look for something and you do something else, or sometimes when you have to do something for homework and you decide to get on for a minute, and then it is an hour.

More serious student behavior issues involving the Internet included students going to inappropriate sites, cheating, and creating problems with the school's computer and software systems. Teachers reported that these issues made their classroom supervisory responsibilities more challenging and complex, and that they had to learn and develop ways of dealing with these issues. Constant supervision on their part was required. Some teachers felt they had to continually monitor students' computer screens during class:

> *As a teacher, I have to be constantly walking the rows if the kids have the computers, just checking that they are not someplace they're not supposed to be and wasting their time, and then saying "we didn't have time to get this done."*

Arranging the computers in the room in a circle or U shape with the screens all facing toward the center facilitated this approach:

> *I've got a view of all the screens, so I know where they're at and we talk about it. It's kind of like a horseshoe and I'm in the middle, so I can look at all the screens.*

Some teachers limited students to specific, preselected sites:

> *I'll have them go to the Web site and explore beyond what the textbook had, based on the references the textbook gives. I pretty much keep them funneled into that area where they're exploring different links coming from the author of the textbook.*

> *And what I do is, I go there first. I don't ever send them someplace I haven't been myself. Now, sometimes, they'll find places to link to, but usually that's okay because it comes from the first address.*

These strategies also helped minimize the distraction problem noted above. Some teachers used the school's individual student password sign-in and sign-out procedure, and the computer's site history record, to monitor the Internet locations that students visited:

> *I control the Internet access by their sign-on. We start off and they do their own work, and then once we've done that and we've discussed it, then I allow them to re-sign in with Internet access and then explore.*

> *Generally, every day I have several students asking me if they can use the computer lab for one purpose or another, and it is pretty supervised. The teachers will go in and check and see what is going on in there. We can always pull up a site they've been to with the student number, so we know who has been where.*

As noted earlier, teachers reported that the Internet made plagiarism easy for students. Students had ready access to papers on the Internet on topics they were assigned to write about for classes. Some teachers reported that high-achieving students were especially likely to engage in plagiarism:

> *Another concern is how much easier it is for students to cheat with sites like cheaters.com and other places where people can buy essays. It's making the teaching of AP particularly harder because those are the kind of kids who generally have the access . . . there seems to be a high correlation between the kids who are pushing themselves at that*

level and the willingness to use full possibilities of cheating available on the 'Net. It's pretty scary now.

Although the potential for students to turn in another's work as their own has always been present and of concern to teachers, teachers reported that the Internet raised the potential for this form of cheating to an unprecedented scale. Some teachers had devised ways of creating unique assignments for which students would be less able to find a ready-made product:

In my case, the classes I teach allow me to make up pretty strange assignments so that nobody else is going to write about the same thing.

If you want them to do documents, they're often tempted to plagiarize, rather than doing their own thinking. . . . Oftentimes that means that you structure your assignments so that they must include some of their own thoughts.

Teachers also adopted this strategy of carefully designed assignments to limit students' distractibility when working on the Internet:

There's so much out there on the Internet that they tend to stray off on things that may not be really educational or maybe even beneficial to them, and so whenever I plan the project, I try to keep it really focused on education or have it relate back to math or science or social studies or something like that, because I don't want to get them off doing something that's pretty useless.

That's the next challenge. How to design things so that they don't get distracted.

Teachers also reported incidents of unintended damage and deliberate misuse of the schools' computer systems by students. Although teachers said that very few students engaged in deliberate misbehavior, those who had highly developed computer skills sometimes caused serious problems. Teachers felt responsible for preventing abuse of the hardware and software, and this added new burdens to their supervisory tasks.

I have a lot of students in my classes who are capable of circumventing and bypassing security measures and things like that. Every year you always get kids who are really good. . . . we had a programming class and . . . [a kid] *designed a program that would capture kids' passwords. It mimicked the DOS startup format and then would capture their passwords, store them in a file, and he'd come back later, download the files, and then he'd have their passwords. Because of the telnet, he'd go through the systems and open up their files, or change things, or whatever.*

Students get on there who don't know what they're doing, or they mess something up inadvertently, or they're really hacking the computer but they don't realize it. I may be at the other end of the room. The other day a student was using the A drive and the little metal thing came off and got into the A drive. I fixed the A drive, but now the computer won't work.

We have kids who are so sophisticated. . . . Personally, in [the] *lab, I'm afraid to turn my back on a couple of those kids because they could be doing something bad and I would never know. They know how to do things like hack into computers and change software.*

Impact of Internet Use on Resources

As already reported, teachers indicated that computers in their schools were heavily used. As more teachers became users of the Internet, demands for its availability and for resources that supported its use escalated. Teachers described additional technology they felt they needed or would like to have in order to follow through with their curricular plans. They were looking beyond the initial acquisition of equipment and networks, and realizing that meeting ongoing resource demands was a continual challenge. These ongoing resource needs included updating and upgrading equipment and networks, finding adequate space for housing and using computer equipment, hiring staff to help them learn and adapt their curricula, and making time for learning to use new technologies and for doing curricular integration.

Demand for More Technology

Teachers in all of the schools reported that their schools' computers were heavily used. As much technology as some of the schools had, some teachers felt that the gap between the number of computers available and the demand for them was wide. This made it a challenge to gain access to the Internet and created demand for more computers:

Access to computers . . . you look at all this, and you're like, "Gosh, how could anybody say we don't have enough?" Well, the other piece is that there isn't one teacher who says we don't use computers. You have technology-savvy teachers. . . . So you do have actually a little more competition [for computer labs] *than you would at other schools.*

As many computers as there are here, there are still sign-up times, and the labs here are filled quite a bit of the time. If there were more labs here, it would be easier.

We used to have a lab across from my room that was accessible just to our area, but now the school has opened it up to everybody. So we can't get in there much, and I have to sign up down here at the library.

Teachers reported that computers and telecommunication were being used on a daily basis in their classes, and that their curricular plans increasingly incorporated the Internet. This increasing dependence on the Internet meant that teachers felt they needed more equipment:

I certainly plan on expanding our use of it. At this point, every computer that is Internet-capable is on line. I'm hoping to get more computers. In fact, when they were installing the lines, I was really unhappy because I got about half of the number of lines I wanted. My goal in the short term is, within the next year, I hope to have about a dozen Internet stations here.

Teachers indicated a desire to have more computers and more network capacity in their classrooms, or to have a computer lab for their subject area:

> *That's the intention. There's not a whole lot there now, it's just all text, but the intention is to show off the multimedia stuff. Now, this room doesn't have fiber* [optic cable hook-up]*, so we can't show off too much. We've done some experiments. We've done some streaming video up here and basically just experimental stuff. Just until the fiber gets here some day. . . . Whatever we do, we'll bog down the rest of the world. So the whole idea is to have a server. That's why I invested the money; to have a server so that we could put on there whatever we pleased. So that we could set up the multimedia part of it without disrupting the school site or the district site. So we can put whatever extensions or plug-ins, whatever we want on there. . . . and not destroy existing systems.*

> *It would be helpful to have something* [beyond the one computer] *in my own classroom. I would use it a lot if it were in my room, or if I had my own lab for my subject area.*

> *In my ideal classroom, instead of having the study labs someplace else, I would have a larger classroom with maybe eight computers in the classroom for the students to use while they're in class, so I wouldn't have to go anyplace* [else]. *That would make it quicker and nicer. Actually, I could use 10 computers. Ten computers in the classroom, and I couldn't ask for more.*

> *We just don't have the equipment for the art department that is adequate for us. . . . There is some pretty specific stuff that we need for artwork . . . . We need a better screen, a more high-resolution screen, scanners, and really good printers.*

Some were taking action in the form of proposal writing to bring this about:

> *Right now, I'm putting together a proposal because we need our own computers here. . . . I'm asking for 10* [computers]. *. . . I have to try to get these computers, and I was told who to contact and to write a proposal and, you know, go for it that way. We certainly need them in this facility. . . . I'm going to go for the proposal and see if we can get them for our own department.*

Keeping Up With Changing Technology

Teachers said that the constant need to upgrade computer hardware, software, and infrastructure presented a never-ending challenge:

> *Things are always getting faster. I know they're slowly replacing things, but it's hard to keep up.*

> *The technology improves so rapidly that it makes it real difficult to keep up and to keep your machines in line with what's out there. Computers need upgrading. The ones we have downstairs are probably 2 1/2 years old, and it's expensive to go and keep adding and upgrading and putting in new processors and increasing speed and those types of things.*

The county is trying, as well as the lottery system in the state is trying, to get us on line. They're trying with the Internet hookup and we've got the fiber-optic, and we've got all this stuff. The problem is, it's not coming fast enough. The discrepancy is getting broader . . . we're not keeping up with what is going on out there, by far.

Even when new computers were added, their capabilities were soon out of date:

And I think where my concern is here at the school is to make sure that machines get upgraded, 'cause we had all this nice new equipment 4 years ago, but stuff gets outdated quickly.

Teachers also noted that much of the demand for memory, speed, and other capacity was driven by the Internet itself, or by other forces outside the school that the school had little control over, if it wanted to make the Internet available to students in school.

We try to upgrade as many computers as we can, and it seems like it's basically just upgrading the memory for the graphics. . . . If you're doing Internet study and you try to download some data off the Internet into a spreadsheet, you can't do it because of the amount of graphics that was in the Internet package. So even though you only want to download the data, you've got all this other junk that comes along.

I think now it's to the point where it's taken on a life of its own. Companies live by this, so because they do, we need to.

Despite the amount of new technology the schools had been able to acquire, some teachers observed that their level of technology was far below that being used in many students' homes:

The biggest difficulty of all is becoming the discrepancies. We have so many: the ages of the equipment, the types of the equipment, the amounts of the equipment. . . . I was telling you about the dad at home with the ultimate computer. He had to spend over a half hour here just to put it [a software program] *in our "outmoded" machine—and it wasn't that outmoded! He was frustrated. That's what we run up against now. You have two worlds colliding* [what students have at home and what they have at school].

<u>Space and Layout Adjustments</u>

Finding the space that computers required was difficult in many of the classrooms that were built before the age of computers:

Depending upon our financing and our space available, I would love to have more computers in my classroom, but two is all I can fit. If you would come down to my room, you would understand why.

In several of the schools, classrooms had to have enough desks and other objects to accommodate large classes of students, which left little room for computers:

> *Classrooms are very small here as far as space. . . . We have to put 37 desks in, plus a teacher's desk, plus computers that people want. There is just not enough room in a lot of these rooms. . . . It is tough to say, "Here are four to five computers students can use," and where do you put them? That's part of the problem.*

> *I have to have 37 desks in my room. And by the time you add computers in there, I also have the TV that's on a cart, I have an overhead projector, and I have my desk. I also have a counter, and then I have bookshelves and I have file cabinets. So, you squeeze all that into a small room. And I have to have those computers along one wall, which really means it isn't convenient to have two to three kids at one computer. I can't cluster them the way I'd like.*

Some rooms had layout and electrical capacity problems, such as space-eating counters, or too few electrical outlets, or outlets that were inappropriately located, that either constrained the physical arrangement of computers or necessitated expensive remodeling:

> *In the chemistry rooms, that's not a problem. We have a lot of electrical outlets there, and those rooms are generally big enough to accommodate the computers. But in the biology room, I couldn't get more than two computers in there.*

The electrical load created by computers sometimes required costly rewiring projects.

Staffing Needs

Teachers indicated that using the Internet introduced ongoing staffing needs that required the school to add staff positions and find budget funds to support them. The introduction of the Internet into a school required additional staff in the computer labs and to assist teachers in learning and using the Internet:

> *The more technology you have, the more you need somebody. We need somebody who is designated; all they do is technology.*

> *We need the manpower there, someone to run the lab on a regular basis.*

> *We have all these new iMacs in there* [the computer lab]*, and you have to have a teacher or somebody in there to help.*

> *I'm one of those who likes to mess with it, but then I need to be able to ask somebody, "Okay, show me how this really works."*

> *I would not have been able to pick it up just by myself.*

It was important for support staff to be located nearby so that they could help with technology setup and be on the scene quickly to help teachers if a problem arose in the middle of a class:

> *When I run my Web class, ——— comes in and starts up the SMART Board. You have to have somebody who does those things.*

> *What we need is a technological aide in the classroom to assist the teacher. I would probably use it* [the Internet and other technology] *more.*

<u>Paid Time for Learning and Doing Curricular Integration</u>

As reported in Chapter 5, teachers had much to say about time as a barrier to their use of the Internet. They needed time to learn to use the Internet and to do the redesign work necessary to incorporate it in their curriculum and teaching practice. Teachers said that paid time during the school day or the summer was important for them to accomplish these tasks:

> *It would really make a difference if somehow during the school day there could be some time provided, not only for additional trainings, but also for extra classes on what we've been introduced to in the training, so that it can become a part of what we do with our teaching. We take those courses obviously because we want to be able to access information that way. We want to be able to utilize it, but it doesn't become part of what we can actually do if we're not provided with adequate time to practice so that it becomes part of teaching.*

> *What would get it there . . . giving us as a staff a workday that is a normal workday, but without students. . . . Not adding a Saturday or not adding after-school time, but an actual day that's already scheduled. So my day care would be covered. . . . And then, probably, having it somewhat of a requirement of that day that you show how you decided how you're going to use the Internet differently, and what you've done. You have to write a short paragraph to turn in to the principal, or whatever, just to make sure that that's how I spent my time. I think I would do that even without it, but I know that I would if that* [a staff workday] *were* [available].

> *Realizing that whatever* [learning and technology integration] *you do is outside your normal day, if there were one thing, one wish I would have right now, it's that they just say, "Okay, you've got 3 months. Here's the computer. Here's the Internet. Here's your regular pay. Go to it. Come back in August." It would really take something like that . . . to really get all these things done.*

Finally, teachers spoke about the need to have the kind of time to approach the curriculum integration task in a relaxed and playful manner to allow them to be creative in this process:

> *When you're trying to teach six or five classes and everything else, you don't have time to play. And it takes playing. I think it takes a playful attitude, too.*

Finding Funding

The demands identified above required funding that exceeded what was available within normal school budgets. As a consequence, teachers reported that they and their schools were always searching for funds to support technology:

If you use technology, you've got to expect it to cost.

But, technology money is limited, you know, just like anywhere else.

We're always looking for funding.

Wherever you go: Is there money available for computers and networking and systems managers? Are there funds so we can have these . . . in our schools?

Impact of Internet Use on Roles, Relationships, and Values

The teaching-learning system, as a social system, encompasses roles and relationships, social arrangements, communication patterns and processes, and the values and priorities underlying these (Blanton et al., 1998). Teachers and students reported changes in their roles and relationships brought about by computers and the Internet. Teachers were learning about technology from students, and students were teaching other students about technology, as well. Technology skills had become a basis for social status and acceptance among teachers and students. Teachers and students reported that the Internet helped them to maintain relationships and social networks, and to form new ones.

Students as Teachers, and Teachers as Learners

Teachers' need for information and assistance with the Internet and other computer technologies placed teachers and their students in new roles vis-à-vis each other. Teachers found themselves learning from their students, who knew more than they did about technology and willingly shared their knowledge. For the most part, teachers seemed comfortable with the turnabout in roles they were experiencing:

I learn from them, as well as them learning from me.

They help me out a lot, instead of my helping them out.

I think it's good for us as teachers, and it's good for them as students, to know that, "Hey, you do know some things I don't know, and I'm not afraid to let you know that you just taught me that." We can teach each other things.

I think it makes a good thing. [Students realize] *"Hey, they don't know everything," and "Hey, I know something they don't!" So it kind of gives you a better perspective with your students. And of course, I always thank them and tell them how much they know and I'm still learning.*

They've been real good. When something goes wrong, I finally have learned to swallow my pride and ask them, and they'll tell you.

Both the quantitative data reported in Chapter 5 and the teacher and student interview data reported here suggest that students played a significant role as teachers and trainers regarding the Internet. Table 15 in Chapter 5 indicated that 40% of the teachers and 45% of the students who completed the survey questionnaire said they sought help regarding the Internet from students.

Students were good sources of help for teachers because they were knowledgeable and they were available in the classroom. Teachers reported that some or even many of their students knew more about the Internet and computers than they did—and students agreed. Teachers reported giving students assignments using the Internet that they, themselves, did not know how to do, and students reported the same kinds of occurrences. Students' knowledge about the technology was the primary basis for the shift in roles whereby students became teachers and teachers became learners. Students with the technical know-how willingly pursued the assignments given them and taught teachers and other students what they knew. Students were often more available when teachers needed help than technical personnel were, because students were right there in the classroom.

Teachers indicated that these shifts in their own and students' roles led both them and students to new perspectives about their respective roles and the teacher-student relationship. Teachers differed in their reactions to the shift in roles: Some found learning from their students a more difficult role to accept, while others embraced this new opportunity for learning and relating to students in new ways.

Students who excelled in using the Internet and computers also experienced a change in their peer group status. These students—often ones who had not been strong students or peer group leaders in the past—were recognized and appreciated by their peers for their expertise.

Students' superior knowledge. The difference in students' and teachers' knowledge levels was the key element in the shifting relationships with their students that teachers described. Teachers indicated that some or many of their students knew much more about the Internet and computers than they did:

> *They know more than we do. That's the way it should be. If you don't embrace their knowledge and let them take you along with them, then you are going to be left in the dark ages. The kids know a ton.*
>
> *I have some students who are pretty sharp. . . . And so, if I have a student who's working on something in my room, and I don't know what to do totally to help them, then I have kids who probably know more than most people at the school do about computers come up, and I'll say, "Hey, look. We can't get to this. Do you know how to do that?" "Oh, yeah, let me show you."*
>
> *Certain students are just wonderful. They know a lot more than I'll ever know.*
>
> *Are there students who have better skills on the computer than myself? Yes. And I will certainly go to them and ask them to help if I have a problem.*

Sometimes I'll ask my students just to fix something I've messed up. That's probably the most frequent, because I don't mind admitting to them that I'm not as far on the scale as they are.

They know how to create the Web site. I don't.

Students conveyed in interviews that they were aware that their knowledge about the Internet and computers exceeded that of their teachers:

Last year for biology we had to set up the whole SMART Board presentation for our class. The teacher didn't know how to work it and relied on us to set it up.

What he knows is not anything that we don't know. So it's already outdated—his knowledge.

Student availability. Another factor in the degree to which teachers relied on students' knowledge and expertise regarding the Internet and computers was the availability of students in the classroom, and the time and inclination that students had to work on the computer. Students were right there in the classroom, and when something went wrong, they could often fix the problem:

Now I'm more likely to go to the students, 'cause they're in the room with me and . . . you find out pretty fast who is the real whiz, and that's who you go to.

Students also had the time and the opportunity to "play" with features of the Internet, something that teachers said they, themselves, so often lacked, as reported earlier:

The kids always seem to have a lot more time to experiment with the machines because they're not worrying about getting grades done in the computer or preparing for the next day's lesson.

Consequently, teachers could turn to competent students when technological problems arose:

The students are a great resource. That's a secret resource, probably not too secret to teachers. You get the serious students and put them on a task and they get it figured out in no time at all. You just find the time and let them go . . . it's hard for me to make time, . . . so students are definitely a resource you can rely on. And all the way through, from my very first bulletin board to the first Web site at the school here, all that was student-produced. It wasn't done by me or someone here at the school.

Students teaching teachers. Teachers saw themselves as learners of the Internet. Teachers were very clear and emphatic about how much they depended on students' help and learned from them:

I do have a lot of students who will show me how to do new things that I hadn't even thought of, or help push me in a different direction with ideas of things.

We use Macs here and I use an IBM. Students can help me out because they know Macs really well, and they can tell me how to do this.

Teachers reported that they actively sought students' help, and that students knew a lot about resources available on the Internet:

The students are wonderful. If you ask them where would you find puzzles and you have something in mind, they can tell you which sites have good crossword puzzles, this one has good mind puzzles, this one has quotes for the day. The kids know this.

Some students come and they have more information . . . and I'm not afraid to ask them either, "Hey, how'd you do that?"

I now get to go to the kids and say, "Show me where you got that, that's great." And I have kids bringing articles in to me all the time . . . so I've learned a lot from them in terms of the things they can find.

Students teaching each other. Peer teaching is not a new concept or phenomenon in education, but new dimensions of it have been spurred by use of computers and the Internet in schools. The wide range in students' levels of expertise in using the Internet (see Chapter 5) encouraged peer teaching in the classroom regarding the Internet. Teachers reported frequently that students assumed a teaching role with their peers, helping other students who had less experience or expertise. A common theme expressed by teachers was that students seemed to be not only willing, but also eager, to teach each other what they knew about computers and the Internet:

When I'm helping this one, the other kid over there is needing help, and I usually can plan on another student to come and help while I help this one.

In addition, students often shared their "finds," such as useful Web sites, with each other:

They learn so much from each other. The students who have used it more are wonderful teachers in telling them, "Oh look at this, this site will have it."

Teachers mentioned the effectiveness of the help that students gave each other:

Even those students who don't have an opportunity to use it at home because maybe they don't have a computer at home, they quickly pick [it] *up. The other students are able to show them, to share, and they learn from one another.*

Some teachers reported encouraging peer teaching regarding the Internet, and even explicitly asking more capable students to help other students:

When we're working on a project, if another student has finished their research or has gotten into that site, I let them coach each other. I find children learn wonderfully from one another . . . I actually ask, "Would you please go over and help so-and-so?"

There are some [students] *who are very savvy when it comes to working the Internet. And I always have them help those who are new or not accustomed to* [it]. *Peer tutoring—they love that. I think that's a great way for them to learn as well—when they're teaching other students.*

Teachers' relaxed expectations regarding the classroom atmosphere, noise level, and physical structure were important in encouraging peer teaching:

I don't have the time to spend with all of them, but if all the students kind of help each other, that's what does it. And they know to ask. They'll say, "Shawna or Jennifer, I don't know how to do this." Right away they pick out the students who are the leaders to come and help them. They share information. So you can't have a very structured, quiet classroom. It's got to be free-moving and easy for these kids to feel comfortable with each other.

One student reported that he was teaching in a formal tutoring arrangement through a state-sponsored organization:

I'm teaching people how to use PowerPoint, how to like use Microsoft Access, Excel, like all those . . . [through] *our state's Scholarship Federation. It's part of a tutoring program. I only tutor four of the classes here—Internet use, Internet-related problems, or like computer-related problems. I help other people.*

Valuation of Technical Skills

Teachers' comments reflected the value that was placed on technology skills by students and staff. These skills were admired, and those who possessed them were sought out by students and teachers. Teachers indicated that this had led to changes in roles and status among students.

Enhanced student status among peers. Students with good computer skills were sometimes not those who had been the usual leaders, academically. As a result, students who had received help from their peers in the past now gave help, and found this an entree into their peer group or to enhanced status within it:

When we first got the network, there was a student who was attending learning disability classes, except for my class. Every other class that kid had was with special ed teachers. But they had mainstreamed this kid in the subject I teach. Well, when we started using the computer, this kid's mind understood that computer. And when I started giving students . . . a problem and they were to use the computer, then I saw "A" students struggling, and this kid working away. All of a sudden the "A" students were going to this kid. The kid was a freshman [or] *sophomore, . . . early in his high school career. . . . by the time he was a senior, he was as much a part of the in-group as any other senior.*

It isn't always the most academically successful student who is gifted with technical skills. Use of the Internet in school has given some students the opportunity to show off their talents in new ways, to build their self-esteem, and win the admiration of peers.

So now they're excited because they're the experts and they're helping somebody else. And in some cases, as academic pecking order in school [goes]*, sometimes it is the ones who are considered on the lower end who* [are] *helping that straight-*A *student, and that's a big ego trip.*

Admiration of teachers with technology expertise. Some teachers indicated that they were sought out to help others with technology, and that they had assumed such a role in their departments, classrooms, and the school:

We are, I think, a viable resource for some of the other teachers who haven't been around it [technology] *all that much. So they use us pretty readily. . . . she and I both pretty much do the upkeep of the lab, so whenever they have problems with their own computers, they come and find us, and we pretty much help them with whatever it is they're doing. I would say they probably come to us more than any other person.*

They do [ask me for help] *because I have had some experience with . . . figuring the machinations of how to get files opened up, and how to get sites. People will come to me and ask.*

If somebody's Mac doesn't work, they tend to come to me because I'm a little more available, and I'm a little gentler than other people are in explaining what is wrong with the computer.

They commented on the respect this earned them from others:

And I think that's one of the reasons they still respect me, too, is because of the types of things that I can do with computers.

Their confidence and pride in their ability to provide such help to others was also reflected in their comments:

A lot of kids ask me to help them, and I'm able to do that.

For grading, we have to get on the Internet for the grade standards, and I learned how to do that early on. As other people now have to get on and get their answers, they'll ask me about that just because I've been on and have done it, and know how it works.

Relationships and Social Networks

Teachers' comments revealed the degree to which the Internet helped them maintain relationships they had already established at school and to form new ones that aided learning. Teachers used the Internet to keep in touch with students, parents, and colleagues. In some instances, the social networks teachers forged and maintained were international, and were part of students' and their own learning experiences. The ability of the Internet to span distances and to facilitate communication through e-mail, listservs, and Web sites made it a valuable avenue for keeping relationships alive. In some cases, the Internet provided a high-tech mode of carrying out familiar activities, such as corresponding with a "pen" pal. Students indicated that the

Internet expanded their circle of friends, helping them form a new network of "Internet friends" that functioned as an outlet for them to express themselves more freely than they felt they could with their "real life" friends.

Developing relationships with teachers and students in other countries. Students used e-mail to develop and maintain a correspondence relationship with students in other countries:

> *They are connected with e-mail pals in Germany.*

A Fulbright grant through which a teacher had met teachers from schools in another country had led to cooperative development of Web sites with those teachers. A summer meeting was planned in the United States to foster continued cooperative work on the Web sites:

> *We had a Fulbright grant summer, and I spent 2 weeks in Estonia. And we have teams, so there are five schools in our state and five Estonia sites. We all have our Web sites up now, and we have a master site that links to all of that, and so we have been putting information on our sites about our schools and exchange of information. This summer, one from each of the Estonian schools is coming over and one each either from the Czech Republic or Romania as we expand the thing, and we will have 2 weeks at our state university, and then we'll . . . continue to be working on our Web sites.*

Students also mentioned the value of the Internet in maintaining relationships with students in other countries:

> *My friend is an exchange student from Germany, and when he goes back, I can still be able to talk to him.*

Keeping in touch with former students. A considerable number of teachers mentioned the ties they maintained with their former students:

> *Well, the e-mail. I stay in constant touch with students who graduated. Many of my students who are in the world of work and business, kids who are in college. Students whom I have this year will be e-mailing me next year. I have kids now that are 1st-, 2nd-, 3rd-year students in college . . . and they e-mail me to tell me what they're doing. Sometimes they e-mail me questions that have to be answered for projects they're doing in college.*

> *I always remind the seniors of my e-mail address and say, "When you get where you're going, let me know where you are and what your address is, and we'll keep in touch," and we do it. And what's really fun is, like yesterday, three girls popped in . . . they're home for the summer and we just reminded each other, "let's keep corresponding." It's nice to keep track of the kids. We have such great kids here.*

> *At home, one of the pleasures of using e-mail is keeping in contact with students who have moved on and are in college. Out and about. So I use that often.*

Teachers whose former students were abroad could still keep in touch with them:

> *I have a lot of former students who live all over the country as well as the globe, so we e-mail back and forth.*

> *This is mostly former students. I have a huge address book of students that I've had for the last several years and . . . daily, things come from students all over the world.*

Students also reported using the Internet to stay in touch with students who had graduated ahead of them:

> *I find it really useful for like friends that graduated last year, and they are in different places now, and you can just e-mail them and they can e-mail you back. It's useful because you can keep in touch really easily. A telephone call is expensive, and writing a letter is slow.*

Connections with parents. Teachers reported that parents contacted them through e-mail regarding their children's progress:

> *This is e-mail again. More and more parents are sending us messages asking how kids are doing, or having concerns or questions, and we answer those.*

> [Parents are] *. . . checking up on kids, yes . . . I'd say more and more. I mean, each year you're seeing more. So you'll get the parents who are really concerned . . . saying, "Oh, I just wanted to check. Is little Jack doing okay?" And then I can check and go, "Oh, he's missing two assignments." And right away I can send back.*

Teachers used e-mail to help parents stay informed about their children's schoolwork:

> *I have several kids who are at risk and I send . . . weekly reports to their parents as part of their IEP or 504 plan.*

Collegial networks. Teachers used e-mail, including listservs, to stay in touch with colleagues and mentors within and beyond their school and school district:

> *It helps me contact other teachers I know.*

> *Yes, and people who are in my groups when we do projects related to my courses there. I keep in touch with my professors primarily through . . . e-mail.*

Students' social networks. Student interviews revealed an aspect of Internet social interaction that was not mentioned by teachers. Students said that because of the anonymity and distance the Internet allowed communicators, expressing themselves freely was safer on the Internet than in face-to-face communication. Because the Internet did not require one's identity to be known, one could say things in e-mails and chat rooms that one would not otherwise say. These comments provided insight into why chat rooms are so popular with students (chat rooms were the third most frequently reported Internet-based technology used by students; see Table 7 in Chapter 3). Students could express themselves more authentically to “Internet-only” friends without the editing and inhibition they saw as necessary in communicating with their “real life” friends, or the repercussions they feared in communicating freely with those they faced in person every day. Students’ perceptions of their “two worlds”—an Internet world and a real world—provide a sense of how adolescents see their world of friends, an important aspect of life for most adolescents. Students’ comments also reflected an awareness of the potential risks in communicating with strangers over the Internet.

> *You’ve got two separate lives. You’ve got Internet friends, and you have friends in the real world. Friends in the real world actually take care of you. Friends on the Internet are just to talk to. It gives you the feeling of being able to express yourself because you don’t know who they are and they don’t know who you are—if you’re playing it safe and just talking to them. . . . If you have your own beliefs, like personal stuff . . . and you don’t want anybody to know . . . you can just talk to somebody off the Internet and you don’t know who they are. In real life, you talk to somebody and they find out stuff, they might tell somebody you know, and you don’t want that to happen.*

> *It’s people who can understand you and listen to your opinion . . . they are your friends, but they’re not like the friends you see in school every day. They are easier to talk to than your friends. If you say something confidential, they won’t tell the person because they don’t know who the person is. It’s easier to talk to them and tell them what you need.*

> *I guess the Internet brings that out of you with your social life, because the people you talk to aren’t necessarily like people you ever meet or anything. But you can be weird, act free, don’t care what you say, that sort of thing.*

> *It can make it easier for you to tell people what you want to tell them about when you don’t want to do it to their face. I do that a lot.*

Discussion

The Internet had four major kinds of impact on the teaching-learning systems in the five schools. The first was its *effect on curriculum*. Teachers reported that the Internet enriched their subject-area curriculum and gave them new resources that allowed them to enhance experiences they provided for students. The need to help students learn to use the Internet resulted in the development of technology-focused courses and teaching of technology skills throughout the school curriculum. The teaching of technology skills that was infused in subject-area courses emphasized Internet search skills and helping students learn to evaluate the credibility and validity of information obtained from the Internet. Many teachers saw technology-focused teaching as career education. Teachers saw the Internet (and computer technology in general) as a new area of employment and career opportunity for students. Teachers and schools had adapted their curriculum to help students explore and prepare for these possibilities, and were encouraging their students to consider these opportunities. The line between career exploration and preparation became blurred when students chose a career-preparation technology course and found that their interests lay elsewhere. It was clear that teachers understood that their efforts to prepare students for the new technology-based opportunities did not mean that students could neglect other aspects of schooling, or that schools and teachers could relax their efforts to help students develop their basic literacy skills.

Teachers found the Internet useful in creating learning experiences to promote students' thinking capacities, and in inquiry-oriented and project-based approaches to teaching. Teachers found that use of the Internet led to group-oriented learning of necessity, or because of the nature of what students found on the Internet and their reactions to it. This is an especially interesting finding in light of concerns often expressed that computers and the Internet are socially isolating.

Teaching materials were also affected by the Internet. In some cases, Internet resources replaced the use of books by students and teachers, especially when the availability of textbooks and other print materials was limited. In other cases, the Internet was used to supplement books, such as when textbook publishers maintained Web sites to accompany textbooks. The Internet also provided props that teachers could use to enhance learning. Some Internet-based props provided an opportunity for students to have experiences not otherwise accessible because of the cost of laboratory equipment. In other cases, the Internet provided opportunities for manipulations that made abstract principles easier to understand. Virtual laboratory sites on the Internet gave students who were absent on lab days a chance to make up the missed labs, which was a great convenience for both the student and the teacher. Such sites also provided students who were squeamish about dissecting specimens an alternative.

The second major impact of the Internet on the teaching-learning system evident in the interview data was that it *provided new opportunities and challenges that made the management of teaching more complex*. Teachers had an array of new Internet-based resources potentially at their disposal, but found that sorting through them consumed a good deal of their lesson- and curriculum-planning time. Moreover, having Internet resources available did not lessen the need for teachers to plan and structure their lessons carefully. Most teachers had been taught, or had discovered for themselves from experience, that pre-selecting and previewing sites they wanted their students to go to resulted in more productive use of student time than simply having students find informative Web sites on their own. The Internet had the advantage of being available to teachers at both home and school, so that their planning could conveniently take place at either location—or wherever they had an Internet-capable and connected computer available. But if their plans involved Internet use during class time, they also had to take into account the possibility of equipment or system failure, which in some cases meant following elaborate backup procedures. Copyright and other legal issues surrounding the use of Internet materials were of concern to teachers. They also needed to check for Web-site changes when preparing to reuse already formulated Internet-based lesson plans. Teachers needed to coordinate the timing and content of Internet resources with other resources they used in their teaching. Having to schedule a computer lab introduced other complications, such as needing to know far in advance when it would be needed.

The Internet provided new avenues for teachers to communicate assignment information and student grades to both students and parents, and to collect student work, evaluate it, and provide feedback regarding it. These new alternatives made information and teachers accessible to students beyond school hours, and reduced the need for students and teachers to be in physical proximity in order to deal with assignments. They expanded teachers' availability to students and parents. Since many teachers used both the new Internet-based alternatives and traditional verbal and written communication about assignments during class (because not all students had home Internet access), the new Internet alternatives added to teachers' work and increased the complexity of managing teaching. Teachers also found that they needed new standards and criteria for evaluating students' work that included Web sites and multimedia products, and for comparing these with traditional paper-based assignments. The ability to publish students' high-quality work on line was an opportunity for students, but created extra work for teachers.

Classroom management was also made more challenging by use of the Internet. The Internet made it more possible for students to pursue highly varied projects tailored to their interests, and to work at their own pace. This created a classroom with students at varying points in a process, and diverse activities being pursued simultaneously. Teachers felt that the benefits for students were worth the added complexity of their own guidance and supervision tasks. Teachers without multiple computers in their classroom found the additional logistics involved in taking their class to a computer lab or moving computers into their room ate up class time and made their preparations more complex. Finally, students' distractibility when working on the Internet created challenging classroom supervision tasks for teachers, as did the possibility that students might gain access to inappropriate sites. Students' propensity to turn in Internet material as their own work or misuse computer equipment and systems complicated teachers' monitoring and supervision responsibilities, requiring them to be continually alert to potential problems when designing assignments and conducting classes.

The third major area of impact of the Internet on the teaching-learning system was the *resource demands* that use of the Internet and computers led to. As teachers became more familiar with the possibilities of the Internet, they wanted more and better equipment. Forces outside the school, including the Internet itself (which continually demanded more memory and infrastructure) and the state-of-the-art technology in some students' homes, placed even more pressure on teachers to seek more and better equipment. Adding computers to classrooms and adding computer laboratories required space and electrical capacity. Teachers needed support staff to provide ongoing technical and curricular support, and they indicated the need for paid time to undertake the learning and curriculum work that integrating the Internet in their teaching required. Teachers and their schools were constantly in need of funding to help meet the multiplicity of resource demands associated with use of the Internet.

The fourth major area of impact of the Internet on the teaching-learning system was its *implications for student-teacher relationships, collegial relationships, and relationship networks*. Most notable was the shift in student-teacher relationships. Students with technological expertise helped their teachers and other students learn to use the Internet. As noted in Chapter 3, one of the schools was working toward formalizing this teaching and mentoring role for students under the Generation WHY program. In all of the schools, however, students were assuming this role informally. Teachers felt they were benefiting from what they were learning from students, and were incorporating students' expertise into their classroom processes. Because teachers required technical support in using the Internet, individuals with Internet-related expertise were in high demand, and consequently, not always available at a moment's notice. Teachers reported that they frequently relied on students to fill the gaps in availability of technical support staff and in their own expertise. Table 17 in Chapter 5 suggests why this was a reasonable thing for them to do: A higher proportion of student respondents than teacher respondents to the survey questionnaire reported high comfort levels in using Internet technologies. In every school, a higher proportion of students than teachers reported comfort in using Internet-based technology.

Teachers with technological expertise were sought after and respected by other teachers, and technological expertise was reported to be a source of status within student peer groups. The Internet helped both teachers and students develop and maintain social networks that furthered learning. It also helped teachers maintain connections with present and former students, their colleagues, and their students' parents. The Internet added a new social dimension to students' lives—that of Internet friends, to whom they could express themselves freely without the risks that such expression might entail in their relationships with their "real" friends.

Conclusions, Implications, and Recommendations

Conclusions

- Overall, the data in this chapter reveal that the Internet makes some things easier for teachers, and adds a number of new dimensions that enrich curriculum and provide alternative ways of handling student work and grades.

- These new dimensions, however, also make teachers' planning and the management of teaching more complex.

  - Sometimes the complexity is introduced simply because the Internet adds new alternatives for accomplishing certain tasks, or providing certain opportunities, and the old ways cannot be discontinued.

  - Complexity is also introduced by new tasks that are necessary in order to use the Internet, such as moving students to a lab, or moving and connecting computers.

  - The threat of unreliability forces teachers to make contingency plans, back up their work, and constantly check Web-site availability and continuity.

  - Students' tendencies to go off to sites on their own and to misuse computer equipment and systems add to the complexity of teachers' classroom supervision responsibilities.

- Like most new technology, Internet use creates additional resource demands that originate both inside and outside the school, and that continue over time. The decision to add Internet capability to a school system is likely to engender continuing demands for technology-related resources, many of which are driven by forces beyond the school's control.

- Changes the Internet sets in motion in schools' teaching-learning systems range from enhancing and complicating existing arrangements and practices to fundamentally shifting roles.
  - It is clear that teachers perceive the Internet to enrich their curriculum. Experiences that were not feasible before are possible via the Internet. Some changes were not so much in curriculum content as in the richness of students' experiences with it.
  - New dimensions in curriculum content, however, seem to be reflected in the focus of courses and curricular components on the technology itself. Students were instructed in how to use computer technology, search effectively for information, critically evaluate information obtained, and design Internet-based products (such as Web pages).
  - Some effects of the Internet on the teaching-learning system appear to involve doing the same things, but with a different medium or tool. For example, curriculum planning, and assigning, collecting, and grading student assignments go on as before, but teachers have new resources and tools for accomplishing these tasks. Even the new technology-focused content area reflects the teaching of long-taught skills (searching effectively for information, critically evaluating information obtained) in a new context.
  - A decline in the use of books may be an area of more fundamental change. The Internet's capacity for displaying text, images, graphics, and streaming video, for reproducing sound, and for up-to-the-minute updating make it a serious alternative to books, but questions about validity and depth appear to constrain its replacing books altogether.
  - A change in typical room arrangement is evident in classrooms with multiple desktop computers. Traditionally, teachers have preferred having students face them. The need to monitor students' computer screens, however, has led some teachers to arrange their rooms so that they can see students' computer screens from a central point, which means that teachers face students' backs. When laptop computers are used, teachers must walk among students to monitor their screens.
- An area of fundamental change is in student-teacher relationships, where a true shift in power and new roles for both teachers and learners were evident. In Chapter 6 it was pointed out that teaching styles were changing in response to the power shift also reflected in the data presented in this chapter—students are taking on more responsibility and teachers are sharing some of their responsibilities for directing learning with students.
  - The fact that students know more about technology than teachers, and that teachers need to learn and use the technology is driving this shift.

- It is clear from the data presented both in Chapter 6 and here that some teachers are changing (or at least questioning) their perspectives about what their role is, what students' roles are and can be, what teaching means, and what is required of teachers and students.

- Because technological know-how is valued, it plays a role in social status among peers for both teachers and students, and represents a new route to peer acceptance. The Internet and technology in general seem to be new arenas in which students can excel. Students who excel in this arena include some who have not excelled in traditional arenas of achievement in school (academics, sports, and other extracurricular activities). Teachers and students alike are being sought out by their peers because of their technological expertise.

- Internet friends represent a new social category for teens—one with specific and unique characteristics that meet teens' needs for exploration and self-expression. Teens view these friendships as a safe way for them to meet these needs, are aware of potential risks such friendships may pose, and believe they are taking precautions to reduce those risks.

Implications

- The data presented in this chapter continue to show the mixed, paradoxical patterns that have been noted in prior chapters as associated with Internet use in schools. The Internet makes some things possible, easier, and better, and it also introduces new challenges and problems. Because it offers new alternatives, it is not surprising that it makes some aspects of teachers' work more complex. Over time, if the new alternatives replace current ones, some of this complexity may lessen.

- The Internet seems to require a new dimension in the curriculum across school subjects that focuses on using Internet and computer technology. The time needed to cover technology as a curricular component implies that some other curricular material will be cut or condensed. While some may regret this curriculum cost, others will see it as an appropriate move because they believe that technological expertise is vital to students' futures. Some aspects of this new curricular dimension may also help students develop certain other basic capacities. For example, learning to question the validity and credibility of Internet material should aid students' critical thinking capacities. This would be consistent with Blanton et al.'s (1998) observation that the mandate to help students learn technology skills also "stresses the development of higher order thinking and problem-solving skills necessary for the appropriate use of these new computer technologies" (p. 236).

- It is clear that use of and learning about technology in high schools is no longer an emphasis unique to career and technical education and science. The Internet and computers were part of the teaching-learning system and curriculum in all or almost all subject areas in all of the schools studied.

- The tendency of students to spontaneously begin communicating with one another when using the Internet is an interesting observation in light of concerns often heard that the use of computers reduces children's opportunities for social interaction and leads to antisocial tendencies and to reinforcing individualism. In this respect, use of the Internet differs from the use of a software program on a computer. The Internet provides a discovery element, which may awaken an urge to share one's findings with others, and its communication elements promote and expand opportunities for communicating with others.

- The data discussed in this chapter, and in Chapter 5, suggest that as schools move toward increasing accessibility to the Internet within the school, resource demands are likely to escalate. Internet usage demands a certain level of equipment and network capacity in order to accommodate its graphics orientation. As Internet graphics and plug-in requirements become more and more elaborate, they require more and more computer memory and telecommunications capacity. Equipment quickly becomes outdated or obsolete, and has to be replaced or upgraded.

  - Thus, schools are likely to face spiraling costs over which their control is limited, because some of the demands originate outside the school system.

  - To the extent that schools use Internet resources to replace textbooks and other print materials, some of these costs may be offset. Schools may also feel compelled to replace textbooks with Internet resources in order to compensate for their investments in technology.

- Implications of the shift in the nature of student-teacher relationships could be far-reaching if teachers' and students' perspectives toward their roles are fundamentally affected. The reported shift in relationships likely both reflects and encourages changes in teachers' and students' roles.

  - Since it is the discrepancy between students' and teachers' technological knowledge that is driving the shift, it is likely to continue as long as the discrepancy persists.

  - To the extent that students' and teachers' views of their roles are changed in a deep way, the shift in teacher-student relationships is likely to be a more permanent change and to spread to other arenas beyond technology.

- Students who have experienced academic and social marginalization in the past, and who have computer and Internet expertise, may find themselves more accepted.

  - Consequently, technology may provide opportunities for students who have had difficulty making a connection to school find a meaningful niche.

  - To the extent that school is a place where students gain social status linked to their technological accomplishments, their persistence in and enjoyment of school may be enhanced.

Recommendations

- The impact of Internet implementation on school curriculum should be examined in research studies that monitor curriculum over time, so that changes can be observed as they progress.

- Student follow-up studies should be done in schools that offer technology career preparation courses (e.g., Cisco and Microsoft A+ networking courses) to examine the value of these courses, both in terms of students' intended career preparation goals, and also in terms of other kinds of career development value such courses may have.

- Longitudinal and time series studies should be done in schools that are in the process of Internet implementation to determine how the impact on the teaching-learning system evolves over time. Such studies could reveal whether the added complexity teachers have to deal with initially, because they must do tasks both the old way and the Internet way, is temporary.

  - Ways to support teachers in dealing with increased complexity should also be identified.

  - Evolution of teacher-student relationships, and resource demands, are other aspects of such studies that would deepen understanding of the Internet's impact on the teaching-learning system.

- Student interaction that occurs when students are using the Internet should be studied within different kinds of Internet-based tasks.

  - Such studies could shed light on an important area of potential impact of the Internet on both learning and social experience.

  - The impact of students' technological expertise on their social status and experience in school, and the potential links between students' social status and social experience and their social development and persistence in school should also be examined.

- Support from students that is helping to fill the gap between teachers' need for technical support and what they have available should be recognized and encouraged. Southeast Suburban's plan to implement the Generation WHY program developed through the Olympia School District Consortium's Technology Innovation Challenge grant (Olympia School District, n.d.) may be a step other schools would also find helpful. Students are an important resource, and should be recognized as such and given opportunities to learn from helping others with technology. Schools can support students' development in this regard by helping them develop their technology expertise, connecting students who have developed expertise with those who need their help, and providing students with training regarding teaching others.

CHAPTER 8: IMPACT OF SCHOOL TEACHING-LEARNING SYSTEMS AND CONTEXTS ON USE OF THE INTERNET

Chapters 6 and 7 examined the impact of Internet use on teachers, students, and schools' teaching-learning systems. Conversely, this chapter looks at the impact of the schools' teaching-learning systems and of their community, state, and national contexts, on their use of the Internet. Teachers' sense of the role that the educational, physical, financial, and social environment had played in their experience with Internet integration in their schools is reported, along with comments from interviews with other school staff, as well.

Commitment to and Support for Technology Integration

Teachers commented that the degree of commitment of the school and school district to technology integration was an important aspect of their school's favorable view of the Internet, and the encouragement and challenge to use the Internet that they experienced.

Other districts could do what we've done. But they have chosen swimming pools instead.

Teachers and other school staff noted that the commitment to technology integration that they felt and observed contributed in important ways to their abilities, efforts, and wherewithal to integrate the Internet into their teaching and students' learning:

Our school site council has made it a priority to get computers into every room so, at least we have the access to them if we need to for parent-school communication on e-mail or doing our own programming, writing up tests and so forth. Funding that for us. That's been very good.

It's having qualified people on the staff, and people who are willing to learn. If you ask for a single ingredient in any site, that's it. You can buy everything and still it becomes an expensive paperweight. But if you have learning going on and a commitment to professional development, it makes this whole transition a lot easier. . . . And so it has been a total commitment of this school to that. It's come from everybody here.

So the commitment is one of having a vision of what this community needs and being willing to provide that. We went from a school that had virtually no technology to a school that is immersed in technology in a 4-year period. And that's why. It is the personnel that's here. The understanding that the people here have about the needs of the students in this community. And the willingness for a lot of people to learn new strategies. There's an adventure that's manifest in a lot of our staff that helps to make this occur. They are excited. They transfer that excitement to the kids. . . . There is a commitment and a competitiveness that focuses on excellence. And that helps when you have teachers who really want to do better. Who really want to know more. And they take the time to get there. That's probably the greatest asset that we have.

It started in the science department because there were a couple of teachers there who were interested in doing that, and it just kind of expanded from there. And we have, as a school, put a lot of money into technology. 'Cause you have to do that. It's an expensive proposition with all the. . . . computers, to put in that wiring and the infrastructure, so we had a pretty good base before . . . [the state funds] *came along. But that has only really enhanced and upgraded our abilities. So I guess I would say it's the vision, and then it's the follow-through and then it's the commitment of money that has moved us along. And then, the encouragement. There's always been encouragement, administratively. I would just say that we have that vision, and we're moving down that road, and we've committed resources in a lot of different ways.*

The school has been committed to that; I'm well pleased. I think as an institution and as a system, we're very highly committed to technology in the schools. I believe that. I think that every effort is being made by parent groups and the board. And everybody involved recognizes the importance, the need, and we're pressing as hard as we can to make that happen.

Behind the commitment to technology integration at these schools was the belief that technological expertise would help their students be successful in their lives beyond high school. Teachers viewed their students as being ahead of students from other schools in the technological expertise they were developing, and believed that this would give students a competitive edge in finding employment and other opportunities:

I think the school's responsible for teaching them, and that's one of those things they need in order to be successful.

By allowing them and actually encouraging them to use the Internet, we are teaching them to be more successful.

Everything is for our kids; we're doing what we're doing for them because we want their lives to be better. Technology is the world of the future in a global society.

A kid from a different school, even though they might be the brighter kid, smarter kid, they might eventually catch up. But our kids will be ahead if it's in a technological situation.

I think our kids are a step above, like they put their stuff out there so other people can use it. They create research material instead of just researching.

Administrative Commitment

Administrators in some of the schools were described as supportive of and committed to technology integration. Administrators' commitment was expressed, according to teachers, by willingness to support teachers in trying new technology-based directions and possibilities, including the Internet, and in the expectations communicated to teachers about using technology:

> *If you're looking at how that's facilitated, I think you have to look at administration and the attitudes there, because if you don't get support there you're, just beating your head against the wall. And that's . . . even more easy to do with this principal, because she'll go for anything. If it's out there, she'll try.*
>
> *So the fact is, we have the hardware and we have the administration that says "use it." That's got to be the two major things that you've* [got to] *have.*
>
> *We're motivated by the administration here to use the Internet and the technology of the school as much as possible, to integrate learning.*

Teachers described their sense of the expectation for them and their students to use technology, and to integrate the Internet into teaching and learning processes and activities:

> *We're just expected to use it as much as we can because it's here, because it's available.*
>
> *If you don't use it, they kind of frown at you, so they want you to use it.*
>
> *It's a big encouragement . . . around here, you know: "We are technology-driven, and we want you to use it and incorporate it anywhere and everywhere you can."*

Teacher Commitment

Teachers described belief in the value of technology as a significant part of the culture at their school, the importance of teachers' having that perspective, and their agreement with it:

> *You have to believe that students need to be able to use the technology, that teaching them to use the technology is just as important as teaching them the parts of a cell. It's part of their educational process.*
>
> *You couldn't just drop anybody in the middle of this school and have them survive. You have to at least partially believe in the technology, or this place will drive you nuts. So, most of the people here have at least some grasp of the importance of the technology. We have very few people who say, "I've been teaching this way 20 years, and I'm going to continue to teach this way." There are a lot of those people around, but we don't have very many of those here.*
>
> *We're encouraged to use technology first of all, so to me, that's not really an issue, because I want to use it. To me it's ridiculous to let it sit there and not use it when there are so many resources available.*
>
> *We are encouraged to use it. However, I really don't think that's a factor to me. And I would say that's true of anyone who actually uses it all the time. It's not because someone says you need to use this. It's because you really understand how effective it is.*

In this atmosphere, some teachers reported feeling some pressure to use the Internet and computers in their classroom:

Once in a while I feel pressure, like I have to get there, I have to do this, I have to do that, but not very often.

I noticed that in most classrooms, it's kind of like an unwritten rule that teachers are trying to implement not just Internet, but computer usage, in the classroom, which eventually leads to Internet usage.

Teachers who were committed to using the Internet and other technology in their teaching also understood that this emphasis could go too far and become something altogether different:

We've been approached as a school and as some teachers within the school by an outfit that thinks that education will be, you'll have teachers at one place and you'll have students all over the world. And this company was trying to do that right now. And I listened to them for an hour and a half, and walked out. 'Cause what they were talking about was literally a diploma mill.

Although they thought technology was really important, they did not believe in exclusively Internet-based approaches to education:

I doubt we'll really get to the point where . . . you never leave the house, you can do the whole thing on the Internet. I don't really see that happening.

It still comes down to the relationship between the teacher and the student. Even though it looks like the whole thing's right there on the Web and you don't even have to come to school, there's still something about teachers and students working together.

Teachers were asked in the survey questionnaire how important Internet access at school was to them. These data are graphed in Figure 5. The overwhelming majority (over 90%) of teachers in all of the schools thought that Internet access in school was either essential or important. At Midwest Rural, 85% of the teachers indicated that Internet access in school was essential, a higher proportion than in any other school. In the other schools, 60–70% of the teacher respondents said that Internet access in school was essential. The high proportion of teachers at Midwest Rural who responded that Internet access was essential may reflect this school's long-term Internet integration across the curriculum. Computer access was well distributed throughout this school so that both teachers and students had ready access to the Internet, teachers had received more training than in any of the other schools, and teachers were strongly encouraged to use technology and were required to use e-mail. In addition, Midwest Rural's emphasis on technology likely attracted teachers who already felt that Internet access in school was essential.

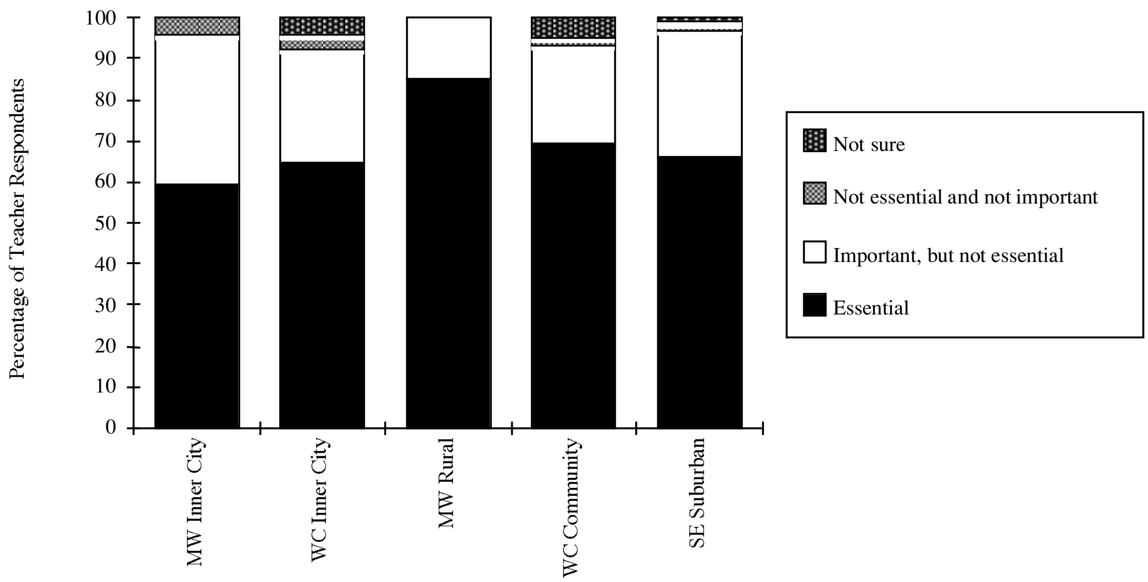

Figure 5. Value placed on Internet access at school by teacher respondents.

State Support

Teachers' interview comments reflected variation among the states in which the schools were located regarding commitment to technology integration. One state in which lottery funds were designated for education allocated a portion of these funds for the purchase of technology equipment in schools.

> *The state has a lottery, and the first thing the governor did was demand that when the lottery program went in, the schools get a large portion or all of the lottery money. That makes a big difference, too, because very specifically, those lottery funds we've* [our state has] *designated for technology.*

This state also included professional development units in technology as one of the requirements for teacher certification renewal. This state also allowed stipends to be paid to teachers through the school district for their participation in professional development workshops and courses.

> *There is a huge push as part of our requirements for recertification to get the 5 hours* [of technology training].

Teachers in other schools painted a different picture of state support for and commitment to technology integration, one in which shared responsibility between the local and state levels for encouraging technology integration was less evident.

Now we can keep up here, but other schools . . . don't have a clue. They have no idea. I went to a conference yesterday . . . to give a presentation, and they're asking me questions. And you know as soon as they ask you a question, it's a loaded question. I don't apologize for this stuff we have here. I'm sorry you don't have something in your room. I'm sorry you have to schedule with the librarian to make this happen. And that's sad. It's unfortunate. I think it's just flat-out wrong. It goes back to your legislature and everything else. The dollars need to be there. It would make it fair and equal for everybody.

States also influenced technology integration in less direct ways than providing or not providing equipment. Teachers indicated that state requirements for education influenced the flexibility and time they had in their curriculum to add new dimensions, such as Internet-based lessons. Teachers seemed to assume that they could either meet the state curriculum requirements or infuse the Internet in their teaching. They did not convey the sense that the Internet might be used in meeting some of the state requirements:

The state said that I had to cover a certain amount of topic in a certain period of time. And for me to deviate at all, I have to, in essence, cut . . . I can do this project, this Internet assignment, or I do that. I have to cut away from this material. In terms of the content that we are required to keep or cover, it is not 100% feasible at this time to do Internet study in a math class. Maybe another class like English, history, I can see a great use for that. But I have to spend 175 or 182 days covering and testing. That doesn't leave me with a lot of time.

And we lose more and more days with the state testing . . . and the AP testing. We figure that we lose 12 days in our second semester that are mandated from somewhere else. It's real hard to get through the course of study. . . . What day can I give up to go do this [use the Internet]*?*

Community Support

Teacher interviews indicated considerable variation among the communities in which the schools were situated in the degree of support for technology integration teachers observed. In some schools, community members donated computer equipment to the school. Community representatives were active in some schools in supporting decisions to approve expenditures for computers:

We have a community that has seen this as something that's valuable, and willing to commit to it, as well.

In other communities, especially those with high poverty levels and many people struggling to meet basic needs, technology was not a high priority:

And they come from some hard backgrounds and some hard things, and so, having . . . a phone line in the house is not necessarily a priority in anybody's house.

But economics was not the only factor in a community's interest in and support for technology-based experiences for students. In most of the schools, teachers indicated that some of their students' parents were skeptical about the value for their child in using the Internet:

> *The supposition that every student is hooked up to the Internet, no they're not there yet and they use it here at the high school. Part of it is economics. Some of them, their parents don't think it is important to them.*

Some parents were anxious about their child's use of the Internet and refused permission for their child to use the Internet at school:

> *From time to time, I have parents who refuse to allow their students to work on it.*

> *I want all my students to be able to have a pen pal from a different country and be able to get the technology experience, but also their language experience. I tried it last year but all my students are minors, so parents were kind of complaining* [about] *how secure it is or how do we know who they are. So I had to back off a little bit on the project.*

> *We went 5 days in the lab doing Internet research for their multimedia project, and I had three parents who wrote me notes saying, "We don't want our child using the Internet."*

This refusal meant that teachers needed to make sure that these students did not participate in Internet-based activities, and that teachers could not make Internet-based assignments or Internet use a requirement for all their students.

Support From Higher Education

Higher education appeared to play a role in all of the schools' technology integration efforts, but the extensiveness of that role varied considerably. In addition to offering Internet-focused teacher training, colleges and universities provided schools with network access, computer processing time, access to their computer facilities and faculty, and Internet-based resources:

> *We spent two summers learning how to communicate over the Internet in a variety of ways. There's a program up at* [the University] . . . *where you render 3-D animations. If you constructed them in your classroom, you'd have to call up over the modem, get signed up there, actually have the supercomputer center . . . render your animation, and then a couple days later you went and downloaded it. It was all telnet stuff.*

> *We have a very good connection with the local colleges here. It's quite a deal, and I don't think many high schools have a similar arrangement.*

> *You have to be a subscriber or have a password, that's what the kids go into. You can get one, it just costs you $30 a year. It's free to schools from . . .* [the University]. *You just need to e-mail them that you are a teacher to get a password.*

Some of these supportive efforts were stimulated by federal grants to the higher education institution or to the school. Some schools had decade-long relationships with higher education institutions in which a variety of these kinds of support had been provided.

> *I started . . . in the early '90s, I started with a program out at the University, which was just before the Web. We did Gopher and telnet and all that business.*

One university provided training to the school district's teachers regarding an Internet-based curricular-design model a professor had developed. This training provided support for teachers' curriculum development that incorporated the Internet.

Teachers also reported being exposed to Internet-based experiences in graduate classes that had given them ideas of ways to use the Internet and other technology in their own teaching:

> *One thing that I would really like to be able to do . . . is to set up a bulletin board. . . . I used a bulletin board in a class I had at the U, . . . and the classroom bulletin board was a great place to be in contact with the teacher and to have conversations with other students, and to get questions answered, and to bring up issues. So a classroom bulletin board that's password-protected.*

> *I was taking some classes at the University. . . .* [In] *one of the classes that I took, a professor had almost all of his lecture notes, at least in outline form, and little diagrams and whatnot, on a Web site that you could call up. He had practice questions—you had the interactive question-and-answer. You could pose a question; it would answer it, or somebody would answer it, and kind of a discussion line. As he lectured, he also put the material through the projector onto the big screen in the lecture hall, which kind of spurred me on to my idea that I'm going to try and do some of this for next year.*

> *Another huge facilitator was the educational technology class that I had to take. It's part of my master's, my master's of ed. It's part of my license. . . . Boy, that was a great class and . . . I think he showed us some great things. . . . We did some things with HyperStudio. . . . One of my friends did a HyperStudio program, and she connected it to a Web site where they did an activity on the Web site that started from the HyperStudio. . . . He didn't have us do a Web site, but he showed us some of the basics of doing a Web site. One thing that was really great was he showed us how to make up a folder of Web sites that you would have the kids go to, a folder of bookmarks. Just like brief descriptions of the bookmarks that you could put on a server. This is something that I would want to do eventually, and I haven't had a chance to do it. Ways to use technology in education. That really helped.*

Leadership

A number of teachers pointed to leadership as a key factor in their school's Internet integration. Leadership came from different places—administrators, technology coordinators, and teachers in the school and from contexts outside the school, such as higher education.

> *We have department meetings* [where] *we talk about what we're* [going to] *do with the Internet. There are a few scary issues that we saw and covered in detail, but for the most part, we want to be one of the leaders at the school. That's kind of my goal in our department. We want to be the people who set the tone. We set the pace* [for] *what's going on.*

> *We did have access to the facilities at the University, which was a nice lab. It's big enough for maybe 25 teachers at a time to go. So, we set up staff development days and the staff would go up there. And we did that for 2 years, at least, and maybe more, in addition to training that we would do here* [at school]. *I remember during that time we had a technology fair, and the other teacher and I held different sessions during that time on the types of things we were working on.*

Leaders had provided vision and experience, and had mobilized goal-focused action.

> *We're lucky. —— busted his head over a wall . . . which he didn't have to do. He didn't have to spend all his extra time on it, but he was determined. He had a vision for this school.* [He should have been] *working someplace else, you know, making six figures a year somewhere. But, he did it and now we have, all of us, have at least some type of access to technology.*

> *—— had a lot of visions for what was going to happen in schools. So he had a lot of self-motivation or push to get teachers involved.*

Funding

The schools differed in their budgets for technology, and this was reflected in teachers' and other staff's interview comments on what the funding levels meant for them in the technology they had available to use. One of the schools was eligible for federal E-rate program funds (described in Chapter 2), which helped libraries, schools, and other public facilities with telecommunications connections:

> *We've tapped into the E-rate money. We've bought, through E-rate, . . . gigabyte backbone in this school . . . for access.*

> *E-rate, it's a federal program that . . . basically was designed to provide all schools with Internet connection.*

Teachers in one of the schools that was in a favorable position regarding available revenues, and had emphasized technology integration for more than a decade, described what their funding for technology meant in comparison to other schools that had not had similar financial support:

> *You go and visit with other schools and other places, and it's* [the Internet] *not accessible. And that is a crime. You know, the commercial on television where they're having the Senate hearings and the company's giving away free Internet. I don't know what it is, but they give it away free. And it really is, particularly in the schools, it's a crime that every school is not wired. . . . There should be dollars donated out there.*

> *What we have here just puts that place to shame. Especially for all grades. I mean at my son's elementary school, their computer got thrown out a couple years ago, and so I mean all their stuff just got old. They did what they could, and finally the stuff just got so old and worn-out that that was it. It took a bond issue this last fall to finally get the money, and they are just now getting it ordered, so by the time my son hits 2nd grade next year, they'll finally have a computer lab again. Whereas here, oh my gosh.*

Teachers in another school pointed out the advantage they had in being designated as a magnet school, because this gave them extra funds they had been able to use for technology acquisition:

> *But we have some benefits here being an industrial ed magnet, and some schools don't. 'Cause we do get some money.*

Teachers and other staff in the school that was officially designated as a high-tech school, and that was the most recently constructed facility, indicated that insufficient attention had been paid to budgetary planning for keeping the equipment upgraded and replacing it:

> *It's also a mismatch in the planning. If you're planning a school to be one of the top in technology, you have to somehow budget for not just having the computer, but having the upkeep. I don't think we have that budget, or that program, or that design in the planning of the building.*

As a result, they reported that this school lacked the needed funds to do the equipment replacement and upgrading that was necessary for teachers and students to use the technology as fully as they hoped to:

> *It was part of the design. When we built this school, it was one that was technologically advanced, and we tried to apply technology to the curriculum. We've been doing that okay to some extent, but there are so many glitches that we run into. For example, I'm doing this astronomy class where we use software, but our computer can't support the software because the software requires so much disk space and memory that many of the illustrations and pictures just can't be opened. So there are pros and cons to the technology that we have.*

> *I think maybe our technology is too broad and not high up, so we have lots of computers but they're all really outdated, instead of having maybe half the amount of computers but consistently upgrading to the right level of technology.*

The School's Characteristics and Nature

Advantages Compared to Other Schools

As is evident in several comments reported above, teachers in these schools saw a gap between the technology their school had and what they saw available to teachers and students in other schools.

> *When I first started here. . . . It really made me realize in a very graphic sense this thing they call the "digital divide." Here we've always got something to challenge us to try and learn new.*

Teachers and other staff saw themselves and their school as technologically ahead of other schools within their districts and states:

> *This school is pretty good, really, with computer resources compared to most of the high schools in this district.*

> *The biggest factor is that I'm at this school. Because if you're familiar with this state and just other schools in general, we have more than enough* [technology].

> *Comparatively, this school is in the vanguard of technological upgrade. Just to have* [the special] *designation* [we have] *means that you've made a quantum leap into commitment and technology. There are only a handful of schools in . . .* [the city] *that have that, and that in combination with . . .* [the federal technology projects we're involved in] *puts us light years ahead.*

Student Population Served

As noted earlier, the five schools differed in the kinds of students they served. The student population influenced the approaches teachers took, and felt they were able to take, in integrating the Internet. The majority of the schools served a significant segment of students described by teachers as having many needs:

> *You've got different groups of people from all over the world* [that] *have these special needs.*

The Internet could not be used by students who could not read, so learning to read was a prerequisite. In one of the schools, teachers said that the combination of students with many special needs, and large class size, made it difficult for them to manage use of the Internet by their students during class:

> *So many of them . . .* [have special needs]. *We're now getting more help. But we still have classes that are too big. They could be anywhere from 30 to 40.*

<u>Students' home access to the Internet.</u> Some schools served a student population whose families for the most part had the economic means to provide computer and Internet access at home. In these schools, teachers knew they could give Internet assignments without worrying that many of the students would have trouble finding the access they needed to the Internet.

> *Our kids are coming from an upper socioeconomic area. The kids have access to stuff.*

> *There's access if their parents have it, if they have friends who use it. So, there's peer pressure. Money. If they can afford it.*

But in most of the schools, teachers said that many or most of their students did not have home Internet access:

> *Many of our students come from inner-city, lower economic backgrounds, and do not have computers at home.*

> *I wouldn't call it rare* [having a computer at home]*, but I won't say "most" either, because a lot of kids around here are just flat-out poor.*

It was clear that lack of home access among their students discouraged teachers from requiring use of the Internet in assignments:

> *Now when there's a need for an assignment, you know, we haven't gotten to the point where every student has a computer at home.*

A number of teachers felt that requiring students to use the Internet exacerbated what they saw as the many inequities affecting students without home Internet access. These teachers shied away from assigning Internet-based work.

Unavailability of the Internet in students' homes reduced the effectiveness of posting assignment information on the Web for students who were absent:

> *I had two absent yesterday* [who] *were supposed to show up today with everything. They were supposed to be on track because everything is out there on the Web, but they couldn't access the Web. They didn't have a computer* [at home].

<u>English Language Learners.</u> Large immigrant populations in the community resulted in student bodies in two schools with students who had never before been in school:

> *Some of them are completely illiterate.*

Basic skills and English Language Learning were high priorities for teachers of these students:

> *Roughly 35% are second-language learners.*

As a result, teachers used the Internet where they felt it was reasonable to do so, but in order to use the Internet, students needed to be able to read. Teachers in one of these schools felt that helping students learn English and develop their reading skills took priority, and was necessary before use of the Internet was feasible.

Erratic attendance patterns. Some schools experienced high student absenteeism. This made it difficult for teachers to accurately plan equipment needs for classes in which they used computers and the Internet.

> *But then what happens is, because we have so many high-risk kids, they don't show. And what will happen is one day you might have 25, the next day you might have 35. One day you may have 20. And what happens is if you're planning* [computer] *labs . . . it is so confusing.*

School-wide planning was also difficult in this situation. If the school provided enough computers for all students in a class, many might go unused on any given day. On the other hand, providing fewer computers than the number of students in a class on the expectation that some students would be absent meant that on days when most students were present, some did not have a computer to use. In some classes, this happened more often than anticipated:

> *When I taught computer literacy, I had 33 kids in a classroom with 22 computers and 26 seats. So I had to bring extra seats in. And they said, "Don't worry, we'll get the class size down to where it's the same"* [as the number of computers]. *And then I came back a week later and it's, "Well, aren't a lot of the kids absent?" "No, not a whole lot." "Well, there's enough absences each day that you should have a kid to a computer." "No, no, no, this is not what's happening."*

Attitudes Regarding Who Should Have Access to Technology in School

Different views were expressed about whom technology was able to help, whom was ready for it, and whom could benefit from it. Teachers' comments reflected who in their school received the most powerful computers, the newest and the best technology, and the most advanced technological instruction. In some of the schools, all students and teachers were seen as needing to learn about and use technology:

> *Even our severe-profound kids use the computer. They've got the touch screen. And they can do the little counting programs with those. The moderate kids, they're learning things like, "Let's type our names." . . . They just got an iMac down in the moderate lab, so the kids are going to start doing some Internet activities, because there are some really good activities out there for kids who are low functioning. . . . Our learning-disabled self-contained rooms have two or three* [computers]*, the same as all the behavior disorder rooms. Almost all of our special-ed rooms have at least two, if not three, in them. And that way, if you have a class of six, you can have half of them working on the computers, and swap out the next day or do partners. . . . One year, our behavior disorders group did a special ed newsletter for the moderate group.*

The view was expressed that it didn't take especially talented teachers or students to use technology in ways that take learning and teaching beyond the ordinary; instead, it required having the tools available to do it:

> *I'm an average classroom teacher. I don't claim to be anything else. I'm an average classroom teacher. I just happen to be in a position where I've got some tools that an awful lot of other teachers don't have. But I really think of myself as, it's just, this is average. And I'm serious. We might be out there on the cutting edge, but what you see in my classroom, in 20 years or less, this will be just what every teacher does. The only reason why mine is cutting edge is 'cause I happen to have the tools, and an administration that says, "Figure out how to do this."*

> *There are individual programs in my subject that do a lot wilder things than we do. But overall, putting it together with technology, then ours starts looking pretty special. But it's what an average classroom ought to be. . . . This is not really that bang-up special. You don't have to be a brilliant kid. Every student that I have fits right in. It's not like it's gifted students . . . and all that, just average classes. It's just that I've got tools that a lot of others don't.*

In one school, gifted students were among the first to have access to the Internet in school, and were exposed to a more sophisticated level of technology-focused instruction across their curriculum than students in other curricula. These students were also reported to have computer technology available at home:

> *In the gifted department, we teach the kids to help develop projects, how to do Web pages. They can all write to code. They can also use a Web page editor. So we've tried to incorporate the* [computer] *lab into every aspect of our curriculum. And any one of our classes involves some kind of technology. We've written it into all of our curriculums in the gifted program. So that through the day, the kids either go into our lab or, of course, all of them are on line at home. So they're able to develop things that they can use on their computers at home by accessing the Web pages we designed in Internet class.*

Diverse perspectives regarding who should have access to the Internet and computers at school were also apparent among teachers within a school. Teachers from one of the schools that served a large portion of students from high-poverty backgrounds disagreed about the value for those students of learning about the Internet and computers:

> *Inner-city kids who don't have the computers at home are the ones who need them* [computers] *at school. They need to be forced to use them.*

> *Having access to the computer is invaluable, especially for our kids here, for the inner city kids. . . . You learn some really good skills there on how to look for information, how to ask questions, and how to use the information that you gather. I feel like it's really important for everybody, not just people who can afford to have computers in their homes. . . . I get on a soap box about this . . . everybody needs to have these skills, not just the kids whose parents can afford to buy a computer at home, and not just the kids*

who are wily enough to figure out where they can go and gain access to computers. These kids may not realize it, but they're going to be entering the marketplace with that one extra skill.

You should also look at who you are trying to educate. Not to be negative, but we're teaching at an inner-city school, and the percentage of the kids actually going on to become researchers or scientists and doctors using computers on an everyday basis is going to be a lot less than the kids out in, say, a technical school. Most of our students aren't going to go into the field of science, so how many computers do we want for the kids? Do we want every kid to be using the Internet?

Instead of spending a lot of money on all these computers for the kids who go into vocational jobs, instead of spending on these PCs, it might be better to spend on the drafting computers so they know how to draft, and on a software program that talks about construction guidelines and rules so they know how to build a house or a deck, where there's more relevancy to the use of technology.

Identity and Character as a High-Tech School

The two newest schools had reputations as high-tech schools, although both were also comprehensive high schools. One of these was officially designated within its district as a high-tech school. One school had developed its technology gradually; the other had been built to be a high-tech school and was fully equipped when it opened. The high-tech identity and reputation of these schools influenced the amount of technology teachers had to work with, who came to teach in the school, and assumptions about technology use in the school.

Technology-rich environment. Many teachers in these schools stated that access to technology had never been an issue for them:

The number of computers is not an issue for this school.

I feel like it's been real accessible for me. I have my computer in my office and so it's real accessible, so I don't feel like that's been an issue. I feel like if I wanted to, it's been there for me.

We've had it [the Internet] *from the first day. . . . We had e-mail right away.*

It [the computer] *came with the job.* [My predecessor] *got the notebook because when they started, people got a notebook. It was here when I came.*

Teachers could gain access to the Internet on multiple computers in multiple locations in the school:

I have one computer in my classroom that we use for attendance, and then in my office I have a computer on my desk so that during my prep I can use it. . . . I am pretty sure I use computers because I have so many access points.

Each area of the building, a group of about six classrooms, has either a small computer lab or a small study lab. Our area has computers in it, so it has an additional eight computers, I believe. And all the computers are Internet-connected.

Teachers who want to use technology. Many teachers had originally been attracted to these schools because of their emphasis on technology:

I came here to this school because of the technology.

I came over here . . . this building having all of that technical stuff, because I think that is the future. . . . I really think it's the education of the future.

One of the reasons I came to this particular school is I saw technology everywhere.

Assumptions about use of technology. Using technology was expected, and was taken for granted as a way of operating within a high-tech school. The teachers expected to use technology to a considerable extent:

What happens is, you have to get on there. Oh, when we first came to this school, we knew that we'd better know how to work the computer . . . because of the technology [focus at this school].

Where I came from . . . we didn't have access to all of this. That's why I didn't have to learn anything [there]. *But being we're here, it's like you want to use it, so I use it.*

You have technology-savvy teachers. So, more and more teachers are like, "Well, I have to use it." I see a need to require my kids to word-process all their papers or to use Internet as a means for research.

I guess I plan to keep using it because I'm here.

Design of Physical Space and Curriculum

Interviews with teachers indicated that a school's physical and curricular design can influence what technology in the school they are aware of, and therefore what technology they use. The official high-tech school was uniquely designed to wed curriculum and physical space. Some teachers in this school thought the building design aided their use of the Internet:

Just the physical structure of the building facilitates the use of that [the Internet].

Others said that they remained in their part of the building, having few reasons or opportunities to venture into other spaces. As a result, they felt isolated and ill-informed about the technology available for use in the school outside their own immediate area:

There were quite a few labs. They're on the second floor, I believe. I should know that. But I don't even know myself, because I don't get out of here. It's hard for me to get out of this department.

I don't know about the digital lab. . . . I don't know anything about that, and I should. . . . You'll hear a lot of things talked about highly that we all should know about, and I don't know anything about it.

I'm disappointed because there is so much stuff available here that nobody knows about.

Availability of Technical and Curricular Support

Although, as reported in Chapters 5 and 7, teachers felt they needed more technical and curricular support, teachers in all of the schools were clear that their school, and in some instances their school district as well, provided a rich array of technical and curricular support to them that was both deep and wide. This support was generally close at hand, knowledgeable, accessible, and helpful—attributes that teachers indicated were important to their being able to use it and benefit from it. A wide range of people provided it, including technical personnel, media specialists, and other teachers. Different personnel were available to teachers for different kinds of problems and questions. In addition to what the school and school district provided, teachers had networks beyond the school through which they could also obtain technical and curricular support, including groups or individuals who taught the same subject, other teachers who had taken technology-focused courses with them, and family members with technological expertise. As a result of the variety of qualified, accessible technical and curricular support resources available to them, teachers did not feel that they were on their own in their efforts to integrate the Internet into their teaching, but rather that there were people around them who were ready and willing to help.

Resources Within the School

A network of technical and curricular support resources was available to teachers in every school. This network included both persons in formally identified technical and curricular support positions (e.g., technology coordinators, media specialists, and specially assigned teachers) and technologically knowledgeable teachers who provided informal assistance to their colleagues. Characteristics of support persons that made them helpful to teachers included close physical proximity, breadth and depth of knowledge, presence when needed, and patience. As a result, teachers were confident that these persons could help them, and weren't afraid to approach them. These support networks were deep enough to provide the assistance teachers needed for a variety of problems:

Absolutely; there're enough individuals within our department to handle our problems.

If I don't have an answer, I go to some of the technology integration leaders. . . . I go to another teacher, the technology staff development coordinator. Usually [I go to] *my department head because right now, during my prep period, I know where he is, and I go there. If not, I go to the system administrator.*

Just local teachers first—"Have you tried this? Have you tried that?" . . . My department head and the technology staff-development coordinator if I have a computer problem. Then, as you branch out, the systems administrator.

Proximity. Technical and curricular support resources in all of the schools were physically distributed throughout the school because more than one person provided technical and curricular support. As a result, teachers in all of the schools reported having technical and curricular support resources nearby—an office mate, department colleague, technical/staff person—located at the next desk, next door, across the hall, or in their department:

I'm sharing an office with a guy who is very good with computer work, and he helps me a lot if I need help.

So when I [have] *a question, I usually go ask him. He's right here next door to me. He's probably one of the first ones I go to and ask, just basic, well, I could ask him anything, 'cause he knows. . . . And then —— has been very good. She's on the other side.*

Basically, I go to whomever is close. Our department head is right next door to me. So when I get stuck on something, I'll go there.

The proximity of these resources made it easy for teachers to contact them and get prompt assistance:

One thing that helps is when you have a problem and they're right next door, you can pretty much get immediate help. So you don't lose your train of thought. That I can get to —— within the next 40 minutes, and I can take care of it immediately. That's what's really helped me.

I could call on the phone, or I could e-mail him, or I could say, . . . "Help! I need this. What's the matter?" And he'll say, "See you after class." But . . . the proximity is real important.

Knowledge. The technical and curricular support persons that teachers had available to them in all of the schools had considerable expertise in areas relevant to technical problems and to curriculum integration questions:

Like to download pictures, I asked her how to do that. She helped me insert them, she helped me find them on the Web and any suggestions for that. Basically anything that I have done . . . she has helped me. She's wonderful.

But he knew Macs, and so when we started getting the Macs, I went to him and . . . he showed me a lot about using the Mac.

Not too long ago, I changed my desktop home page and downloaded a higher browser. Well, I got the browser in, but it wasn't on the home page, so I asked the media specialist, who is our resident expert, how to go about changing my home page on the desktop, and she helped me.

I get [help] *from different sources, but if I really need something, I contact the media center. They are very learned. They are able to say, "Try this," so that's been my best support.*

My technology-integration leader just got his master's in technology in the classroom. He is very knowledgeable. It's his hobby, so he knows more than most.

As a result, when teachers sought help, the results were satisfactory. The problem was resolved or the question answered in a short amount of time:

He . . . fixes it. It just seems like, zip, zip, you know? Or if the whole thing has shut down and there's even a problem with the plug, he can find it, whatever it is. It hasn't been anything serious but, oh, maybe three times this year, he's come by just because I'll be having some little problem. He can just straighten me out in about 2 minutes.

Choice of responders. The depth in the support resources that teachers had available to them in their schools gave them choices in whom to seek out for various kinds of problems and questions. Consequently, it was not surprising that teachers had learned to be strategic in seeking help, to go to different sources for different needs:

It depends on what the problem is. If it's a little bitty problem . . . then I go to ——(he's right across the hall). And then if it's a bigger thing, like my computer's messed up, it's broken, it won't come on, then I go to ——. And then if it's how do I create a Wave file on this PowerPoint presentation, something like that, then I go to ——. So, very specifically, according to what it is. It just depends.

People within our own department . . . if I know specifically what I want. But if it's something general that affects the school, I'll go to ——, always.

I've gone to them [the technology staff]*, especially ——, when I had a real technical problem with my computer. He's helped me with it. Curriculum kinds of things would be my department members and other teachers.*

If it's a peripheral problem, it goes to the guy in my office. And if it's a problem with the network, like my access and my needs for technology, I go to my tech person.

I would go there [to people in the information-technology area] *. . . more for curriculum-related* [issues]. *When my computer crashes, I go to the building techies.*

Accessibility. Teachers described technical support resources as accessible to them—present and available when needed:

There are several people on staff whom I feel comfortable asking, and they're all very available and ready to be there.

> *There is always somebody here to help you. That's not been a problem whatsoever. That's been wonderful. Even the people from other departments. In fact, we just had ——— from the ——— department come down and help us out on his lunch hour.*

Teachers could get in touch with these resources easily, and the response to teachers' calls for help was prompt:

> *He always comes, usually always, the day that I ask him, which I just think is so nice.*

> *There're now more technology integration leaders, and we know who they are, and they're accessible whether it's before school, after school . . . sometimes it's immediate.*

> *She'll come usually within 24 hours.*

Helpfulness and patience. Teachers appreciated the helpful attitudes of their sources of technical support, especially the patience shown them when they felt like novices:

> *The media specialists are very, very helpful at the school. If I have a problem or I don't understand something, they are real up to date, and they are real helpful in coming to my lab and just answering my questions.*

> *We have so many experts on campus who are willing to stop and help, and come and give you whatever help you need. Our two technology integration leaders, just about any time we have questions they just are right there to help us out.*

> *He is our tech person. He is wonderful. He is very good at explaining things, very patient about things the first time around.*

> *There are actually a couple people on staff now that not only welcome questions, but have patience and have time to answer.*

> *She has infinite patience and is willing to help me with my stupid little technical questions.*

Resources Within the District

Some schools were able to call upon additional support resources at the district level if a problem could not be solved in-house, or involved a part of the district's network. These district resources amplified the technical and curricular resources available to the schools:

> *If there is a real major problem, then we have the ability for the district to come in, and if it's a breakdown, the district will come in for us. The support is there. I can't complain about the support. It is there.*

> *We also have the district you can call. And you can get information from them, too.*

> *We get a lot of support from the people at the district center.*

Teachers also reported having a network of teachers in their district from whom they could get help:

> *I also go out to the other moderate* [special education] *teachers at the other high schools or middle schools, and we feed back and forth at staff development classes.*

Resources Beyond the School and District

In addition to the resources that were available to teachers in their schools and school districts, some teachers had technical and curricular support resources available to them at home and through other groups of colleagues. These sources of support were highly specific to the individual teacher. Some teachers who had these outside networks were highly advanced in their use of technology, and some were just beginning to use Internet technology. These personal networks gave beginners a sense of having resources they could call on and helped them venture into using the Internet even though they felt intimidated by it.

One teacher reported participating in a group that had been meeting for about a decade. This group was formed in the days of the National Science Foundation supercomputer grants that were given to higher education institutions for the purpose of supporting math, science, and technology teachers' use of computers. The grant had ended several years ago, but because the group had been useful to its members, they had continued meeting on an informal basis:

> *It's just an organized informal gathering. Basically . . . we invite everybody who has something new to talk about, something that's happened at their school, or a new lesson they're doing, or some new technology. It's usually always something about some aspect of HTML or its variations. Somebody will present some lessons that they've done, or perhaps receive recognition for that type of thing. So it's just a sharing.*

Some teachers who had taken instructional-technology courses had met other teachers in the class with whom they had formed a bond in the process of learning together, and these teachers informally continued to support each other's efforts:

> *We all went through the same program together. . . . So we're all kind of in this together. We kind of, in terms of just clarifying sites that are good or how to get to certain sites. Those are the individuals I usually might ask.*

Still other teachers were part of subject-area teacher networks located within a geographic area. Members of these groups kept each other informed and were resources for each other when members needed ideas, had questions, or ran into problems:

> *With me, most of it is if I'm doing something over here and I've got colleagues in the area that I can access through the e-mail and, "What are you doing over at your place on this particular project?" We share that way, and that's a big plus for me to just be able to find someone to see how they are doing.*

Some teachers had family members who were knowledgeable about computers, software, and the Internet, and who could help them when questions and problems arose:

Just about anything I encounter, I can just call my dad.

My wife is very good with computers, some particular programs. She's a CPA and she's very good at Excel. She'll know more than I ever do. I will call her up because she knows the way my brain works, and she easily walks me through these dummy questions.

My daughter . . . has even given classes . . . on the use of the Internet. . . . So she'll get to give her mother some classes. I'll have two built-in coaches. One living with me, and my son stops by quite often.

At home, my husband, because he is an engineer, he knows a lot more about computers than I do. . . . [He] *helps me figure out what is going on, and even hooked the computer here up and put the printers in.*

Availability of Relevant and Supportive Training

The five schools differed considerably in how and to what extent they provided technology training. Some schools provided their own training. Some focused on having colleges bring credit-based, technology-focused courses and programs to their school to make it convenient for teachers to enroll. Some schools required participation in training that was offered, others did not. Technology coordinators, media specialists, and technologically knowledgeable teachers typically provided school-sponsored training. Teachers in all of the schools, however, indicated that some form of training was available to them in their school and that some or all of it had been relevant to their needs. In addition, some teachers reported having training available to them through their school district.

There constantly are in-service classes offered.

The media specialist has been very helpful that way. He's given a lot of workshops and courses since we opened our doors; even before that.

As indicated in Chapter 5, however, with some exceptions, most teachers felt they needed more training than they had received.

Regular Training

The most striking example of regular training provided by a school was the school that excused classes every Friday afternoon for the purpose of providing teacher training. As mentioned in Chapter 2, the school had obtained a variance from the state to release school at noon on Fridays for this purpose. Teachers reported that these training sessions were very helpful to them:

We do have a lot of support from computer central and from our district, as far as training us in the software applications. Every Friday afternoon, we have training time set aside to help with the technical end because there's just so much.

We have a fantastic setup with the half-day Fridays, so that Friday afternoon we have a chance for training. So our school, because of that half-day thing, really does work on giving the training that the teachers need to use the technology.

Usually the technology personnel provided these sessions, but occasionally a teacher who had used a particular technology would lead the instruction:

Sometimes teachers will do [the training]*, like if they know a particular program, they might do the workshop.*

Some school districts offered district-level training that supplemented or reinforced the technology-focused training provided to teachers at their school:

The county offers . . . 2-day workshops that your school can send you to in Word and PowerPoint and Internet searching.

The district has a district technology center here where they do offer ongoing classes.

We get a lot of support from the people at the district center, whom we have known for the last couple of years through the . . . courses [we've had with the federal project]. . . . *some of the district coordinators for* [the federal project] *are over there. That's where we go to do our . . .* [school's] *training.*

Required Training

Schools also differed in whether or not the training provided to teachers was required. In some cases, policies requiring training were set at the district level:

Those are required by the district. We have four or five mandatory in-service sessions, nowadays it seems, all technological based.

Other schools had computer acquisition grants that required training:

It's required by the . . . [grant] *so yes, it does happen. It's not even a volunteer basis—it's required because we have these funds to follow through on this.*

Every teacher on campus had computer training this year—6 days.

There were six sessions, and each session was a typical workday, 7 to 8 hours.

Whether training was required or not appeared to have considerable impact on participation. Schools that required teachers to participate in technology training had better participation rates than those that did not. Evidence presented in Chapter 7 regarding the resource demands that the Internet leads to suggested that teachers are concerned about being asked to participate in training that goes beyond their workday or consumes their weekends without being paid. Schools that required participation by teachers in training may have had high participation rates partly because the training took place during the school day and teachers were released from teaching responsibilities in order to participate, which also meant that they were being paid for their participation time. The importance of these factors to teachers is supported by evidence presented in the next section.

Economic and Social Incentives to Participate in Training

Teachers indicated that the incentives provided to them to participate in training were an important factor in their involvement. Training took time, and being paid for this time was a key factor:

> *What was nice about that program is that they gave us time. They forced us. I mean, we chose to be involved, but there was structure to that time, and there was support driving that time, and it was paid time. It wasn't a lot, but it was a stipend that helped.*

Receiving equipment was also an inducement:

> *There was a lot of incentive, and a lot of it was monetary, for equipment.*

The social side of the training situation was also a draw for teachers. They saw others successfully using the Internet in their teaching, saw people whom they respected participating in training, and wanted to keep up with their colleagues:

> *But once I got that little push from ——, and there were people that I respected who were new on campus that were going to try it, and the incentives were nice. Produce a project, get a computer. Like, "Wow, okay, we'll do that!"*

> *And then the incentive was to produce, because your peers and your colleagues are producing. So that became an incentive.*

> *The projects are very involved and take a lot of time* [but] . . . *if you always do this lesson, yet somebody's doing it in a computer interactive way, well, why not do it like that?*

Relevance to Teachers' Needs

An important aspect of the training teachers received was the degree to which it met their needs and was immediately usable in their teaching:

> *Well, she, a lot of times will do it by elementary, middle school, high school, because obviously we have different needs.*

> *The county also has hired an English teacher to basically focus on helping English teachers use and develop Web sites and assignments.*

> *She likes for it to be hands-on, which is the best way. It's the way I learn.*

> [That federal project] *was, to me, the project that had a great philosophy, great training, very applicable to the classroom, very user-friendly for the teacher. . . . I got a lot of training, a lot of nurturing. It really is something that's very well done. Very well done.*

In addition to relevance, another feature of training that encouraged teachers to integrate the new skills they were learning was being given time to practice under guidance:

> *I think one of the things that was especially helpful to me, and I heard other people say the same thing, is that we had time to practice. I've been to training sessions . . .* [and] *if you teach someone a new skill, you have to have guided practice and . . . practice independently, also. . . . It was wonderful because we could experiment a little bit and say, "Why did this happen?"*

Interdisciplinary Efforts and Mentoring Skills

Training helped teachers get acquainted with their colleagues from other disciplines, and see what other teachers were doing:

> *The other part with the other teachers is when we get time to present. That's when you get to see what other teachers are doing and have a chance to have dialogue. So even teachers who are not in your discipline, it's really a wonderful program to get people together from different disciplines.*

This exposure expanded their sense of what was possible with the Internet, and also led to collaboration among teachers regarding interdisciplinary Internet-based instructional projects.

Some districts provided opportunities for technologically knowledgeable teachers to learn mentoring skills, which helped them provide assistance to other teachers in their schools and districts:

> *I mentored last year for the . . . summer workshops. I took the summer training, refresher training, and learned new stuff, and then mentored other workshops for teachers in other parts of the district who came to the workshop that I was a mentor for. I mentored a couple of times where there have been technology workshops here on campus because of staff development days.*

Technology coordinators also provided mentoring opportunities to technologically advanced teachers during workshops the technology coordinator offered for the school's teachers:

> *He had —— and me in that class as sort of assistants so that . . . we could rotate around and help everyone else.*

> *It was a lot of information that I already knew, so I would . . . mentor some of the classes with him.*

This kind of teacher training helped to expand and strengthen the technical and curricular support and training resources available within the schools.

Climate of Helping, Sharing, and Collaboration

Teachers indicated that the relationships among the professional staff at their school were characterized by mutual assistance and sharing of resources. This collaborative social climate facilitated the diffusion of information and expertise among the staff, and helped teachers feel they were supported and connected to a network, instead of isolated and on their own. Teachers and other professional staff shared ideas and resources, and helped each other solve problems and gain access to computers. Their spirit of giving led to their working together and collaborating in integrating the Internet in their teaching and curriculum.

Solving Problems

Teachers reported that a social climate of mutual assistance and helpfulness in their school or department made it easy to ask for and receive help:

> *If one of the teachers* [is] *there* [in the department office] *when I'm getting stuck on something, then I* [go there]. *We're a very close department, and anybody's willing to help anybody, so it works out great. Others might know.*

> *We've had a lot of people around who have a lot of knowledge. . . . You just* [ask] *whomever you know knows how to do what you want to do, and everyone is more than willing to help each other out.*

Teachers who helped others reported that they enjoyed doing so and were willing to go to other areas of the school to help someone in need:

> *I love finding information, so helping people do that is fun.*

> *I really like it because everybody knows how to ask if they have any questions, as far as using the e-mail or downloading, and they just come to me.*

> *I get questions around the office. I have pointed people to Web sites. I've hiked down to the other end of the building and worked on computers for people.*

Sharing Equipment

When teachers found they needed more computers than they had available, or when they needed a computer lab and couldn't schedule an all-school lab, in most of the schools, their colleagues were willing to help them out by sharing equipment and working out schedules so that everyone's needs could be accommodated:

> *He is willing to take my kids to work in his classroom, so if they are working on a project and I don't have the equipment, he helps them.*

> *I usually have 30 to 35 students. I had over 50 last year, 52. So with absences, you know, I'd get maybe 45. But I'd bring them down and be in the larger* [computer] *lab, and then there'd be a spillover into the smaller one* [computer lab], *and teachers are very, very acceptable to . . . can we use a couple terminals in your lab?*

Teachers who had multiple computers in their classroom or department willingly shared their computers with other teachers in their own and other departments when they could:

> *We don't have problems sharing. If I know a social studies teacher really needs to have three computers one day and can't get them, if she wants to borrow ours, I don't care. Come down, get 'em, wheel 'em up, just bring them right back. It's not like we're really territorial or anything.*

> *And if I know that there's a small English class that needs a lab to write in, they can use mine, if I'm not using it. And social studies is the same way. If you need ours, come in and use it if we're not using it, because we want them to be used to the fullest capacities.*

Sharing Ideas and Resources

Sharing helpful Internet resources they had discovered had become a habit for teachers in several of the schools:

> *If one of us hears something, we're a very collaborative group of people, so if we find something, "Oh gosh, you've got to go look this up," and plus . . . we'll e-mail, and then we just send it to everybody in the department. So we help each other out a lot.*

Teachers reported receiving ideas, materials, and Web site addresses from other teachers, and reciprocating when they found or developed something that worked well. This sharing occurred school-wide, as well as within departments:

> *In my department, especially, there's a whole complete community of sharing of ideas and materials and sites. Anything we want to do we share together. . . . If I find something good, I'm going to share it with you so you can look it up for your students.*

> *We share a lot, within the department and across the school, both. Yeah, very informal. . . . I found something that you might be interested in; I pulled something up that . . . . The other Spanish teachers will all share all our materials.*

In one school, Internet-based lessons that teachers developed were made available in an on-line database so that other teachers, both at the school and beyond, could have access to them:

> *I love the WebQuest idea. . . . I think you can come up with a number of lessons, and lots of people can use them, and that's what we're here for, I think. To share things that we have learned work, and they can work for someone else, particularly newer educators. You know, it's hard to come out, and the first year's your tough year. Even when you change schools, the resources that are there and available may be quite different than you had where you were.*

> *I see* [the Internet] *as being a way to get information out for other people. When you're a teacher and you have a good lesson, you want everyone to know about it: "This is a great one; you should do this."*

The media specialists in most of the schools saw the sharing of helpful Internet sites with teachers and students as one of their roles and functions:

Our librarian showed me what she had done, and it was most helpful. And she's made out a list of all the different Web sites they can go to for Shakespeare, and she's going to give them a handout. It's going to be very nice.

Then if there's something that we've heard about and we don't have time to go look for it, they'll go look for it. If they see something that comes across their desks, things that we might be interested in, they'll drop us a note and let us know.

Collaborating on Projects

Teachers went beyond simply sharing good Web sites and the Internet-based lessons they had developed. They also did joint projects, and worked together in developing new lessons and curriculum that incorporated the Internet:

Right now I'm doing a joint project with —— , who is the desktop-publishing teacher.

He is a part of our global-affairs institute. . . . They were trying to create something with School-to-Career, and I thought this might be a wave of the future, and there are a lot of possibilities for my field. I put together a number of projects and we worked together on that, and then we have just continued over the years to build that kind of stuff in there. We do planning over the summer. I use him as a resource.

I have friends in the English department who integrate the computers into the classroom, and I see them on a daily basis, so I know I can talk to them about it.

Discussion

It should not be surprising that the characteristics of school, community, and state contexts, and of federal programs that are discussed in this chapter as influencing teachers' Internet use are reflected in the descriptions of the schools outlined in Chapter 2. Links between aspects of the schools' teaching-learning systems and their contexts reported here, and factors reported in Chapter 5 are also apparent.

One context factor that stood out in teachers' comments across all of the schools was the commitment to and support for technology integration that was embedded in the school itself and in the broader federal, state, and community contexts. This commitment came from different sources in each school, but was present somewhere in all of the schools. The rationale behind this commitment was expressed as a belief that developing students' technological expertise would aid students in their future endeavors and give students from that school a competitive advantage. Commitment within schools to technology integration came from the administrative staff, technology staff, and teaching staff. Beyond the school, commitment to technology integration was reported to come from the state, the community, and higher education institutions. Teachers in schools that experienced commitment and support from multiple contexts were more positive about their Internet-related efforts and accomplishments than were teachers in the one school that experienced commitment and support that was limited for the most part to their school. Teachers in this school expressed more dissatisfaction with their Internet-related efforts than did teachers in all of the other schools.

Another context factor that was clearly evident in teachers' comments was leadership. In some schools, a committed administrator or administrative team provided leadership. In other schools, leadership for technology integration came from technology staff, individual teachers, a group of teachers, or an entire department of teaching staff. Higher education institutions were also identified by teachers as providing facilities for those who assumed leadership in demonstrating their work and training their colleagues.

Funding followed commitment and leadership. Those who were committed to technology integration and took leadership for it found the funds to bring it about. Often these funding opportunities were federal or state grant initiatives. Some schools had funds within their district they could tap for purchasing computer equipment and the infrastructure needed for Internet access. In one school where budget planning had not addressed the need for upgrading and replacement of computers as they became outdated, teachers identified the gap in funding as a serious limitation on the school's technology capabilities.

The schools' characteristics and nature also had an impact on the degree to which technology integration was being achieved. Teachers from all of the schools saw their school as advantaged in the technology resources it had, relative to other schools. Teachers in schools where students had computer and Internet technology at home felt freer to require use of the Internet in assignments than did teachers in schools where many or most students did not have access to the Internet at home. Lack of student home access also limited the effectiveness of Web-posting of assignments for students who were absent. Students' limited English skills in some of the schools and lack of literacy in general discouraged teachers from using the Internet. Planning for Internet use by students (and the necessary computer availability) was challenging for teachers in schools where student attendance patterns varied widely from day to day; moreover, the school came to count on high absentee rates, and provided computers accordingly.

School culture and teachers' perspectives also influenced teachers' use of the Internet with various students. In some schools, the perspective prevailed that all students needed to have access and opportunity to use Internet technologies that were as equal as possible. In other schools, academically talented students and those in particular curricula were seen as groups to be given priority in learning Internet technologies, especially those that involved creating Internet resources.

Two of the schools were identified as high-tech schools, one formally and one informally. Teachers in these schools reported that access to technology was not a problem for them. Furthermore, these schools attracted teachers who wanted to learn about and use technology. An aspect of the culture in these schools was that use of technology was assumed. Consequently, teachers in these schools felt obligated to use technology, and many wanted to do so because of their technology-rich environment. In one of these schools, teachers expressed a feeling of isolation and lack of awareness of technology available throughout the school due to the unique curricular and physical design of the school that featured smaller, self-contained units within a large school.

Teachers in all of the schools praised the technology-support personnel who helped them participate in Internet use. These resource people were conveniently close by, knowledgeable in a wide range of areas, accessible when needed, and helpful and patient. A critical mass of technology-support resources in each of the schools gave teachers options and alternatives in seeking help, and was able to address most problems that teachers encountered. All schools had these resources available within the school, but teachers also had access to resources beyond the school, including district-wide technology personnel, informal networks of technology-using teachers, subject-area colleague networks, geographic networks of teachers, and their families. Teachers knew that if they ventured into new territory with the Internet and something didn’t go as planned, there was someone who could help them figure out why and what to do about it. Technical- and curricular-support people who were helpful and patient in answering teachers’ questions and in working with teachers to solve their problems encouraged teachers to feel that they could learn to use the technology, and reduced teachers’ fear in asking for help.

Teachers who received regular training were especially appreciative of their school’s efforts to help them learn to use the Internet. In schools where technology training was required of teachers and was part of their school day, teachers were paid for their participation. Additional incentives that encouraged teacher participation in training included receiving equipment and the social incentive of seeing colleagues develop interesting lessons and resources that they wanted to emulate. Teachers also cited the relevance of the training to their needs as an important motive for participation. Training that exposed teachers to colleagues in other disciplines broadened their horizons and encouraged cooperative, interdisciplinary efforts. Training that taught teachers how to mentor the development of other teachers’ technology capacities provided the schools with additional training and support resources.

Teachers in all of the schools reported a climate of helping, sharing, and collaboration. The reports of teachers from some of the schools indicated that this kind of climate was especially well developed and important to their attempts to use technology and their opportunities for doing so. In these schools especially, teachers shared equipment, resources, and ideas, and a spirit of willingness to help and working together pervaded their department and school.

Conclusions, Implications, and Recommendations

Conclusions

- Commitment and leadership appear to be central factors from which funding and other resources supportive of Internet use in schools flow. With commitment and leadership, funding is likely to be developed. With funding comes access to technology. With access to technology comes experience and learning, and with experience and learning comes technology integration. Although commitment and leadership are central, they are not sufficient. Rather, a number of elements need to be in place in order for technology integration to take root, thrive, and flourish.

- Adequate technical and curricular support and training are important aspects of Internet experience and learning. Participation by teachers in training can be enhanced by providing training during school hours, requiring participation, paying teachers for participating if training is offered outside of school hours or in the summer, matching the training to teachers' technology skill levels, and making training relevant to teachers' subject-area teaching responsibilities.

- Communities, states, higher education, and the federal government have an important role to play in supporting technology integration in schools. The data presented here and in the description of the schools in Chapter 2 clearly show that all of these entities made important contributions (including funds, equipment and services, and teacher training) that helped schools integrate technology.

- Data reported here (and in Chapters 5 and 7) suggest that when some students in school do not have Internet access at home, teachers are reluctant to require Internet-based work of their students. This suggests that the digital divide affects all students, not only those without Internet access at home. The major reason teachers reported for their reluctance was uncertainty that students who were dependent on school Internet access had sufficient access there to complete their work. Parental refusal to allow their children to use the Internet in school is another factor that affects teachers' ability to require Internet-based assignments of all their students. This refusal suggests that even if students had unlimited access to the Internet in school, teachers would still need to have alternative assignments that did not require Internet use for some students.

- Teachers' attitudes and school-wide perspectives regarding who should have access to and learn about technology affect students' opportunities to learn about technology. Attitudes and perspectives that see technology as something all students need to learn about and all students can learn to use are likely to be the most supportive of all students having opportunities to learn to use as well as create Internet resources.

- A supportive school climate creates a context in which teachers are willing to take the risks necessary to learn something new. Such a climate helps teachers overcome challenges they will inevitably face along the road to accomplishing technology integration.

Implications

- The essential ingredients for accomplishing technology integration—commitment, leadership, funding, technical and curricular support, teacher training, and a collegial school climate—are outlined here. Schools seeking to accomplish technology integration will find guidance in this chapter for creating a context conducive to achieving that goal. Communities, states, higher education, and the federal government will also find in this chapter (and in Chapter 9) ways of supporting schools toward that goal, and schools will find guidance in the kinds of supports to ask for from these entities.

Recommendations

- Simplistic solutions to integrating technology in schools should be avoided, for they are not likely to be successful. A one-time allocation of funds for equipment, for example, is unlikely to produce sustained technology integration if the school system itself is not helped at the same time to develop the essential characteristics and capacities, and teachers are not trained. On the other hand, schools that possess many of the essential characteristics, but lack one or two, could be significantly boosted in their technology integration efforts by help in attaining the missing elements. Consequently, when those providing equipment and infrastructure to help schools develop their technology integration cannot help all schools and must decide which schools to select, schools in which many of the key ingredients are already present (e.g., commitment, leadership supportive of technology integration, mutually supportive social climate) are likely to be the most promising targets.

- Support resources available to teachers need to be of several kinds, ranging from the highly technical to those that are more curriculum-oriented. Mentor training should be considered for teachers who have developed considerable technology skills, as a way of expanding technical and curricular support resources in schools. Ways to enable such teachers to aid their colleagues without overburdening them need to be put in place.

- Development of mutually beneficial relationships that support schools' technology development should be encouraged among schools and higher education institutions and community entities. The National Science Foundation's Supercomputer Program for Educators was a good example of what can happen when these relationships are forged.

  - Higher education should provide support to secondary schools through cooperative projects that facilitate Internet access for high school students and staff, explore and test models for integrating the Internet into curriculum, and develop Web sites useful to high school teachers and students.

  - Higher education faculty can help teachers see possibilities for integrating the Internet by using the Internet in classes high school teachers take, and can spur their own learning by giving high school teachers opportunities to share their Internet-based work.

  - Teachers and higher education faculty working together to create research and development projects focused on use of the Internet in high schools could help answer questions raised in Chapter 6 regarding the impact of the Internet on student learning and clarify the Internet's impact on school teaching-learning systems.

- Teacher education programs should assume responsibility for providing explicit instruction regarding use of the Internet in teaching and developing future teachers' technology skills.

CHAPTER 9: INTERPRETATION OF FINDINGS IN LIGHT OF EDUCATIONAL CHANGE THEORIES

Theories of educational change, innovation, and reform provide lenses for interpreting the study findings in ways that deepen understanding of them and offer guidance for action. Louis (1992) points to four aspects of educational change that influence its course and character: characteristics of the change, the change process itself, the internal context of the school, and the external context of the school. Fullan (1992) points to similar factors. These theorists suggest that implementation of change depends on a combination of these factors, rather than on any one of them alone. This chapter interprets the study findings in relation to these four factors and to theory regarding stages of change (Adelman, 1997).

Characteristics of the Change

This factor has several dimensions: Centrality and quality of the change, scope and complexity of the change, quality and practicality of curriculum materials, and fit between the planned change and the organization's way of operating and values (Louis, 1992).

Centrality and Quality of the Change

A change that is tied to central agendas of the school, and is perceived as effective in moving these forward is more likely to be implemented than a change that is more peripheral (Louis, 1992). *In three of the schools, technology integration was central to the schools' primary agendas.*

Midwest Inner City, despite its official identification as a high-tech high school, had what it saw as more pressing agendas than technology integration. Raising its students' basic skills scores, implementing the state graduation standards, figuring out its unique curriculum, and smoothing its operation as a newly opened school were its central goals. Technology integration was not a central aspect of any of these objectives and was seen by a number of teachers as a deterrent to raising students' basic skills scores. Although teachers had to use computers and the Internet in implementing the graduation standards, this use did not require that they teach with the Internet. This school and West Coast Community provided the least amount of teacher technology training of all the schools, the expressed attitudes of teachers toward technology integration were the most mixed, and the frustration with problems accompanying technology integration was the highest.

West Coast Inner City's curriculum was technologically oriented. This school's magnet career and technical education programs were recognized within the district as strong, and its teachers in these programs, and in the school's science programs, had been trying to foster technology integration in the school for a decade. Technology integration was consistent with the school's central goals of maintaining a strong magnet program and being a technology leader in its district. Recent opportunities to expand its technological capability were consistent with that goal and role.

At Midwest Rural, technology integration was embraced as a way to address student achievement problems the school faced in the late 1980s and to help its student body break an ingrained cycle of poverty. Moreover, the community needed to solve the first problem in order to save its school—an extremely central agenda for a rural community. The school's student-achievement problems had abated since technology integration had been implemented, and a number of students had found technology-focused jobs that paid well.

Whether or not these occurrences were evidence that technology integration had solved the problems the school faced was less clear than the belief among community residents and school personnel that this was the case. For example, a new superintendent had made a number of changes in the school, one of which was technology integration, and several new teaching staff were hired at about the same time. It is possible that any of these changes, or their combination, had affected student achievement. Whether or not experience with technology had changed the cycle of poverty for a large portion of the school's students was also not clear, although anecdotal evidence was shared regarding a few students who had changed their economic situation markedly by entering technology jobs. The most compelling data supporting the hypothesis of improved economic opportunity was the dramatic increase in the proportion of the school's graduates (from 33% to 95% over 10 years) who pursued postsecondary education. School staff pointed out that use of the Internet had exposed students to aspects of colleges beyond their sports teams and to the world outside the community. The deepest impact on students' economic opportunities may be changed aspirations based on wider horizons that technology revealed. The school was planning a follow-up study of its graduates to learn more about their situations following graduation.

At West Coast Community and Midwest Inner City, technology integration was less strongly attached to core school goals. At West Coast Community, college preparation, being an excellent school, and maintaining these traditions were central goals. Student academic achievement, not technology integration, was considered the sign of an excellent school. Since this school's students had a very high achievement ranking in the state before technology integration became an agenda, school personnel did not see themselves as dependent on technology integration to achieve these central goals. One of the goals in this school's technology plan reflects the technology staff's desire for a closer link between technology integration and the school's orientation: *"Change the tone of our institutional culture from being tentative in its regard of technology to one where technology is integral."*

Southeast Suburban was focused on being an excellent school. Staff in this school saw technology as the wave of the future and believed that an excellent school would prepare its students as well as possible for the future. Consequently, technology integration was closely tied to a central goal. Recognition this school had received from its state and nationally for its technology integration confirmed school personnel's belief that technology integration was a route to excellence, to being recognized as excellent. (Moreover, academic achievement as measured in student SAT scores had risen in this school over a 7-year period.)

Scope and Complexity of the Change

The scope and complexity of educational change concern how pervasive it is in terms of staff involved and the degree of modification it imposes (Louis, 1992). Pervasive change is more likely to make a difference, but is also more difficult to implement. *In all of the schools, the technology integration being attempted was school-wide, so in all cases the change was large in scope.* To some extent, however, teachers used the Internet as a tool to accomplish in a different way what they would normally have done, thus reducing the magnitude of the change. For example, instead of using a textbook to complete a worksheet, students used the Internet. Teachers used the Internet to illustrate points in a lecture instead of referring students to illustrations in textbooks or drawing diagrams on the blackboard. *The ways in which the different schools managed the change affected how difficult the change was to implement for teachers.* Schools that were able to minimize the difficulties for teachers achieved greater technology integration, and did so more smoothly, than schools that were not able to affect the difficulties.

Midwest Rural and Southeast Suburban had been most effective in minimizing difficulties. At Midwest Rural, an ample number of computers made access to a computer a nonissue for students and most teachers. Consequently, to a large degree, teachers did not have to consider computer access as a factor in their plans—they could assume access. Scheduling a computer lab was not necessary much of the time, and was easy to do when needed. Ample teacher training at this school reduced teacher anxiety and made technology integration easier for teachers to accomplish. Likewise, at Southeast Suburban, several computer labs throughout the school, and the willingness of teachers to readily share these labs with each other, reduced teacher anxiety about computer access in class, and the prevalence of computers in the community eased teachers' worries about students' computer access outside of school. Teachers did have to schedule labs, however, which added logistical complexity to their teaching tasks. The school facilitated a variety of training opportunities that made technology integration easier for teachers to accomplish.

In contrast, at the other three schools, computer access was uneven across departments and teachers, making technology integration more focused in some areas than others. At West Coast Inner City, because computer access beyond teachers' classrooms was limited and many students did not have computer access at home, teachers hesitated to require Internet-based assignments. This school's one computer lab served 1,600 students and 92 teachers, and was closed much of the time due to lack of support staff. West Coast Community had several computer labs, but only the one school-wide lab was available for scheduling by teachers, which was a challenge with the more than 2,000 students and 93 teachers at this school. The age of the computers in some teachers' classrooms also made Internet use difficult or impossible. At Midwest Inner City, school-wide labs were more numerous and available, but the distribution of smaller labs and classroom computers was not even across the school, leaving some teachers feeling that they lacked needed access to computers in this high-tech school. Extremely large classes at this school also created computer-access problems. Low levels of language skills and other basic skills at West Coast Inner City and Midwest Inner City made Internet use by students more challenging for teachers. At Midwest Inner City and West Coast Community, lack of training made integrating technology difficult for teachers.

Quality and Practicality of Curriculum Materials

Teachers' sense of the quality and usefulness of Internet-based curriculum materials was a factor in their willingness to use the Internet in their teaching. Teachers at all of the schools found what was available to them on the Internet useful in their teaching. This was apparent in their descriptions of what they used and their purposes for using the Internet reported in Chapter 3, their reasons for using the Internet discussed in Chapter 4, and the impact that they perceived the Internet to have on curriculum reported in Chapter 7. In no school, however, did all teachers agree that the Internet was useful, and teachers varied in their enthusiasm for what they obtained from the Internet. Teachers in all schools were concerned about a lack of validation processes for material published on the Internet similar to those for books and journals, and the need for students to do their own critical evaluation of Internet material. As noted in Chapter 6, teachers reported that the Internet motivated students and engaged them in learning, but they also indicated that the Internet distracted students from learning tasks, as reported in Chapters 5 and 7. Teachers also gave mixed reviews to the impact of Internet use on students' learning achievement, as reported in Chapter 6. In addition to these themes common to teachers from all of the schools, different perspectives on Internet materials were evident by school.

At Midwest Rural and Southeast Suburban, many teachers had found resources on the Internet that they viewed as useful, of high quality, and of benefit to student learning. As a result of West Coast Inner City's curricular orientation to use of the Internet, teachers there had developed a considerable amount of Internet-based curricular material that met certain standards. Southeast Suburban and West Coast Inner City were both involved in curricular efforts that exposed teachers to on-line repositories of curricular materials that they knew had satisfied certain standards to be included in the repository. In contrast, teachers at West Coast Community and Midwest Inner City expressed very mixed views regarding the educational value of what the Internet had to offer. The commercial orientation of much Internet material, and what they perceived as a lack of depth concerned them. These teachers appeared to be unaware of the lesson repositories with which teachers at Southeast Suburban and West Coast Inner City were familiar. Although concerns about the quality of Internet material were expressed at all five schools, they were most vehement and widespread at West Coast Community and Midwest Inner City.

Consistency of the Planned Change With the Organization's Way of Operating and Values

Technology integration was compatible with the modus operandi and the underlying values of all of the schools to some extent. The extent to which this was the case throughout the school, the intensity of the value placed on technology integration, and the number of competing agendas and priorities varied among the schools. Midwest Rural wanted to be a technology-integrated school because this was how they saw themselves as best able to help their students learn. Southeast Suburban valued being up to date and being known as an excellent school, and saw technology integration as a central feature of both attributes. As a new high-tech school, Midwest Inner City was designed and built to showcase technology integration. West Coast Inner City had a history of valuing technology integration, and strong advocates in sectors of the school had been helping the school move in that direction. West Coast Community also had a long history of interest in and valuing of technology in sectors of the school.

All of the schools used technology in their daily operations. E-mail was used for staff communication. Grading and attendance systems were computerized in most schools. All five schools had Web sites that were used to inform parents and students, and that provided instructional resources to teachers and students. Technology-focused groups were part of the decision processes in most of the schools. As Figure 5 in Chapter 8 illustrates, almost all teacher questionnaire respondents in all of the schools thought that Internet access in school was either essential or important.

The Change Process

Several scholars have identified elements of the change process that appear to play a role in educational change efforts that are successful. These elements include planning, participation, leadership, and assistance and support (Firestone & Corbett, 1987; Fullan, 1991; Louis, 1992; McLaughlin, 1990). These elements have also been identified as facilitating implementation of educational technology innovations (Ely, 1990).

Planning

Combining well-developed knowledge of how to plan for and cope with change with practical knowledge relevant to the unique change situation is thought to be an effective route to bringing about change (Fullan, 1991). *Knowledge of how to plan for and cope with change was most clearly reflected in the two schools in which a strategic approach to technology integration was articulated, but was evident in two other schools as well.* Midwest Rural's leadership was very clear about its strategy: (a) provide access to technology, (b) provide a reason to use it, (c) provide training, and (d) reward participation. Likewise, Southeast Suburban's leadership consciously formulated similar strategies for bringing about technology integration: (a) require teachers to use certain technologies in their day-to-day work, (b) make training a priority and encourage participation in it by bringing it into the school, (c) employ a colleague to teach it to provide evidence that teachers can learn to use technology, (d) make training relevant to teachers' subject areas, (e) identify and support development of key leaders, (f) request planning for technology integration at the departmental level, and (g) support teachers' requests to attend staff development opportunities outside the school.

One school, Midwest Inner City, had not developed a plan for bringing about technology integration. To some extent, this school seemed to reflect Fullan's (1991) point that how accurately those who seek to bring about change understand the situations of those who will implement change is a predictor of the success of change initiatives. The planners of this school seemed to have assumed that because many computers would be available in the school, and because teachers interested in using technology would constitute the school's faculty, technology integration would be automatic. Unforeseen changes in the student body's characteristics, large classes, a challenging curriculum development task, the state's requirement to implement graduation standards, and barriers to upgrading equipment had combined to create a situation that was quite different from the one anticipated. Realizing that it needed a systemic plan for technology integration, this school had begun to develop one, but it was not yet sufficiently formulated for its specific strategies to be articulated. Requiring training for teachers and including technology competencies in criteria for new teacher evaluation were being considered.

West Coast Inner City also had clearly identified technology integration strategies that were articulated by the technology personnel providing leadership and staffing for technology integration in the school: (a) coordinate and combine opportunities, grants, and other resources so that new ones build upon and extend what has already been accomplished through previous ones; (b) focus smaller efforts on aspects of a major target to make a larger impact; (c) make training a requirement for all teachers, but beyond that encourage teachers' efforts and try to help them change their mind-sets to see possibilities rather than mandating what they must do; (d) use training as an opportunity to build staff relationships; (e) give teachers time to practice and integrate new learning; and (f) use technology integration to achieve broader educational reforms such as curricular and teaching style changes.

West Coast Community also explicitly expressed some strategies designed to promote technology integration. Some of these came from administrators and some from technology staff. As an initial step, this school had created a teacher lunchroom with two networked computer stations to allow teachers to explore the technology and observe colleagues using it. Staff at this school saw obtaining teacher "buy in" to technology integration in the curriculum—via encouragement—as the only reasonable strategy for getting faculty involved. They had made e-mail and a grading program available as encouragements and pointed out ways in which teachers could do what they wanted to do better with the Internet or other computer technologies. Technology staff tried to provide teachers with a vision of possibilities that looked doable. They required teachers to submit proposals for curriculum projects in order to get new equipment, and asked departments to include technology plans and goals in their overall curricular plans and goals. One strategy for encouraging teachers to integrate technology into their curriculum was to keep the models, the examples, simple and straightforward. Technology planning at this school was integrated into overall school planning. Technology staff thought other strategies should be adopted as well, including providing incentives, compensation, and time and space in teachers' schedules, and giving other rewards to teachers who integrated technology, but they did not feel they had access to resources that permitted the use of these approaches.

Two of these four schools indicated that hiring teachers with interest and expertise in technology was a strategy they used, and all of them concentrated their efforts on teachers who used the equipment and training they were given. These teachers were more likely to receive new equipment in all of the schools than were teachers who did not use the technology they had. These schools were moving toward including technology competencies as criteria for teacher evaluation, and one state required teachers to pass a technology skills test in order to renew their teaching certificate. Two of the schools clearly indicated that they tried to develop teachers' self-sufficiency regarding computer use so teachers would feel comfortable using computers and the Internet, and therefore be more likely to use them.

Participation

Firestone and Corbett (1987) suggest that an important part of the change process is determining the nature and extent of participation necessary to produce the desired change. Because teacher involvement requires their time, it is difficult to obtain teachers' participation, given their daily responsibilities. At the same time, teachers want to be involved in plans that will affect their day-to-day activities. When teachers do participate, their input needs to be used. Finally, to adopt an innovation, teachers need sufficient guidance and support.

Teacher time and responsibilities. One of the most dominant themes in the teacher interview data reported in Chapter 5 was their concern about the time technology-integration required, and how little time they had to devote to it. *Time to practice, time to integrate new learning, and time to develop Internet-infused curriculum were needs teachers felt were unmet.* Time as a barrier to school reform has been recognized by educational change researchers as a pervasive issue (Adelman, Walking Eagle, & Hargreaves, 1997). The Internet itself clearly contributed to teachers feeling overwhelmed by lack of time because of the quantity of material on the Internet and the need teachers felt to evaluate it carefully. It was clear in teachers' comments that time was not the only type of pressure they were feeling. *Their multiple responsibilities gave teachers a sense of having a "full plate," one on which there was little room for new additions.* At Midwest Inner City, for example, teachers reported feeling exhausted by the end of a day and week, with large classes of students with many needs.

Teacher input. Teachers took their involvement on technology committees seriously and felt listened to, particularly in Southeast Suburban, where site-based management had placed teachers in decision making roles regarding technology acquisition and use, and teacher training. In no other school was it as clear that teachers participated in central decisions regarding technology development in their school. In all of the other schools, a core group of teachers helped to make decisions about technology, but the membership of these groups did not seem to change much over time or allow many different teachers to participate the way they did at Southeast Suburban. Consequently, in most of the schools, *some teachers felt they had a voice and were heard, but the vast majority of teachers saw themselves as simply users of technology, not decision makers about the directions in which the school was moving*. In these four schools, the administration and/or the technology coordinators had central roles in setting technology policies and directions for the school. At Southeast Suburban, school leadership made it clear that technology integration was important and would be supported, but turned the decisions about what it would look like over to the technology committee; the technology coordinator was a member of this committee and had one vote, the same as any teacher member.

Guidance and support. *The guidance and support teachers received in adopting use of the Internet in their teaching and curriculum varied enormously among the schools.* Midwest Rural, West Coast Inner City, and Southeast Suburban provided the most training. Even teachers reluctant to implement use of the Internet had done so to some extent at these schools. Technical support resources also varied across the schools. Midwest Rural had the most official technical-support full-time-equivalents per faculty member. Southeast Suburban had a considerable array of technical support resources, both official and informal. At the two schools with the fewest technical-support full-time-equivalents, West Coast Inner City and West Coast Community, teachers' complaints about not having sufficient help to do what they might otherwise do were the most numerous.

Leadership

Leadership tasks identified in the educational change literature as critical to facilitating change include obtaining resources (time, money, facilities), protecting the change effort from interruptions and interference, providing recognition for implementers of the change, and melding the innovation with the policies and procedures of the school (Firestone & Corbett, 1987). The need for these tasks was evident in the findings across the five schools, although how they were accomplished, by whom, and how successfully differed among the schools.

Obtaining resources. *All schools* (except Midwest Inner City which had recently opened with new equipment and infrastructure already in place) *had staff that worked hard to obtain resources for technology beyond the regular school budget.* Midwest Rural's administration had arranged to have a grant writer available to the school, and the school had obtained millions of dollars in grant money over a period of several years. Southeast Suburban's teachers had been active in grant writing, their efforts were supported by the school leadership, and this school had also obtained millions of dollars in grant money. For years, West Coast Community's technology coordinator had pursued cooperative arrangements within the community and grants that had enabled the school to develop its communications infrastructure and acquire computer equipment. Technology personnel at this school and at West Coast Inner City had written proposals for and received grant monies from the state for equipment, infrastructure, and teacher training. Midwest Inner City was finding that without grant money, it could not refurbish or replace its now aging equipment and infrastructure. *States, too, shared in this leadership task.* In one of the states, the governor had allocated state lottery money to schools, which helped in purchasing computers and other technology. A second state had obtained a federal grant to have a state-level technology innovation grant program, and had initiated another program with state funds to help all schools in the state purchase computer equipment and infrastructure, support teacher training, and upgrade and refurbish technology on an ongoing basis.

Protecting the change effort from interruptions and interference. *Leadership in four of the schools had managed to retain enough focus on the technology integration agenda to make progress.* At Midwest Rural, technology integration was such a high priority that nothing was likely to interfere. At this school, the comment was made that if something had to go, teachers would be pink-slipped before the technology was allowed to slip. At Southeast Suburban, the leadership team's commitment to technology integration, the school's involvement with Technology Innovation Challenge grants, the teacher training efforts the school had encouraged and initiated, and the community's interest in the school's technology integration combined to make technology integration a priority agenda. State grants awarded to West Coast Inner City and West Coast Community made technology integration a major focus for these schools at the time of the study. Southeast Suburban, West Coast Inner City, and West Coast Community were in states where technology integration in schools was a major state agenda. At Midwest Inner City, the state and school district had other agendas that took priority over technology integration, and made it impossible for the school's leadership to protect staff time and energy in order to focus on technology integration. The state's requirement that schools implement graduation standards was a major priority in the state and school district. In addition, the school district, whose decisions had contributed to the changed student body in this school, demanded improved performance by students on basic skills tests. Finally, the school had a unique curriculum plan that teachers needed to develop in order for the school to function. These agendas prevailed despite the school leadership's interest in technology.

Recognizing implementers of the change. *Recognition for implementers of technology integration was provided in the schools in different ways.* Recognition was most extensive at Midwest Rural, where teachers who integrated technology were given a laptop computer for their own use, and those who shared their work at conferences were provided with a substitute, a stipend, and reimbursement for their travel, per diem, and conference expenses. Southeast Suburban recognized "key leaders" in technology integration by providing them with laptop computers for their own use, sending them to special training, and giving them special roles in the school related to technology. For example, these teachers were released from teaching to varying extents in order to supervise computer labs and mentor teachers and students. These teachers also were able to teach their classes in these labs. West Coast Inner City recognized a core group of teachers who had integrated the Internet and other technology use in their classroom by giving them special status within the school. They helped the technology coordinator provide technical and curricular support in the school and manage the school's state grant. They were the teachers to whom the technology coordinator sent visitors who wanted to learn what the school was doing with its technology. They were called on to mentor other teachers during the training this school provided for all teachers. These teachers did not receive extra pay, nor were they released from any teaching responsibilities. Their recognition was primarily the respect and admiration they were given within the school. West Coast Community sent its technology-integration-leader teachers to conferences and training outside the school and provided them with new computer equipment and a stipend. Midwest Inner City refurbished or upgraded the equipment of its key technology implementers, and these teachers also were asked to serve on its technology committee, which gave them a voice in school decisions regarding technology. *In all of the schools, teachers respected and admired their colleagues who were heavily involved in technology integration.* The social recognition bestowed on this group of teachers by others and the perception these teachers had of themselves as a special group were clear in all of the schools. The tone for these patterns was set in most of the schools by the attitude of the administration and technology personnel toward these teachers.

Melding the innovation with the policies and procedures of the school. *In all of the schools, there was evidence that technology integration had been melded with the policies and procedures of the school, although the degree to which this was the case differed among the schools.* All of the schools had integrated technology competence goals for students within the schools' learning goals. Policies regarding student use of the school's technology had been developed, and procedures had been established for achieving compliance. Administrators used e-mail to communicate with staff. Important information that teachers needed was provided via e-mail. Three schools required teachers to use e-mail for communication, and computerized grading and attendance systems. Implementation of the state graduation standards at Midwest Inner City required teachers to use computers and the Internet. Midwest Rural had adopted a policy of not providing print copies of what could be obtained on the Internet (e.g., dictionaries). This school was also moving to implement technology competencies as criteria in the school's teacher evaluation system, and other schools were considering this for the future. West Coast Community had melded its overall school planning process with its technology planning process, and its and Southeast Suburban's technology committees were part of their site-based management structures.

<u>Assistance and Support</u>

Training and the right amount of assistance from diverse sources facilitates change (Louis, 1992). Chapter 5 indicates that *teachers felt undertrained and underassisted,* even in the schools that provided the most training and support. School staff reported that teachers varied widely in their technology skills. It was evident in the interviews with teachers that some required more training and a longer time to learn and practice than did others. These variations in teachers' needs made it challenging for the schools to plan training and support that fit everyone's needs. Teachers did, however, indicate the characteristics of training that made it helpful and encouraged them *ology skills appreciated training that helped them develop mentoring skills. Teachers consistently* to participate in it. *Teachers responded most positively to training that was (a) regular, (b) required, (c) relevant to their subject area, (d) accompanied by economic and social incentives, (e) geared to their needs, and (f) supportive of interdisciplinary efforts. Teachers with advanced techn indicated that being paid for the time spent in training was important*, although at Southeast Suburban it seemed that being able to earn an advanced degree or certificate with the technology-focused courses the school offered was an incentive for many teachers to participate.

In all of the schools, diverse sources of support were available, including technology staff, media specialists, colleagues, and students. *Teachers clearly identified characteristics of technical and curricular support that were especially helpful: (a) advanced knowledge, (b) ability to handle an array of kinds of problems, (c) proximity, (d) accessibility, and (e) helpfulness and patience*. The attitude of the support person was as important as what they knew. Teachers expressed their appreciation for support persons who did not talk down to them, treated them with respect, and were willing to repeat things and help them without making them feel inept even though they often felt that way themselves. Technology coordinators in several schools mentioned their frustration at being asked the same question multiple times by a teacher and how difficult it was to remain patient, which they admitted they were not always able to do.

Stages of Change

Theories of school reform have also characterized change in terms of stages. Three stages—planning, implementation, and continuous improvement—are discussed by Adelman (1997). The planning stage involves exploring and practicing by a few risk-taking teachers, creating goals, developing resources, and developing new organizational arrangements. The implementation stage is signaled when a decision is made to expand the initiative, and there is an expectation that everyone, or almost everyone, will become users of the innovation, and those who led the way will assist their peers in learning and using it. The continuous improvement stage is indicated by a fully or widely implemented innovation, with continuing refinement and adaptation of the initiative based on frequent evaluation of its appropriateness and benefits for those served.

All five schools had experienced the planning stage. Four were in the implementation stage, and one was in the continuous improvement stage. West Coast Inner City had early pioneer teachers whose experience in the National Science Foundation's Supercomputer Program for Educators provided opportunities to explore the Internet and then create a small computer and telecommunications network in the school. In addition, this school's district had used its Technology Innovation Challenge grant and other related grants to train a core group of teachers in Web-based curriculum design in several of its schools, including West Coast Inner City. West Coast Community's technology coordinator had also used the supercomputer program as an opportunity to explore the Internet and establish telecommunications connectivity for the school. These two schools had very recently moved to the implementation stage of change in their technology integration with the help of state grants. They were providing computers to all teachers in all classrooms, expanding their infrastructure to accommodate the increased telecommunications load, and providing training to all teachers (although West Coast Inner City provided much more of this).

Midwest Inner City's planning stage had occurred before the school opened. Equipment was in place, and technologically skilled teachers, or ones interested in technology, had been hired. When the school opened, it was poised for technology implementation. Given the other agendas that superseded technology integration in this school and the need to develop the school's curriculum immediately after it opened, implementation of technology integration had proceeded more slowly than anticipated or desired.

Midwest Rural was in the continuous improvement stage. All teachers had had computers in their classrooms for years and had received regular training in using technology for years. Computerized grading and attendance procedures had been well established for a long time. A computer refurbishing and replacement system was well established and had been in operation for several years. The school's recent move to buy laptop computers for its students (in addition to the five computers in each classroom and the school-wide computer labs it already had) was a refinement that school personnel felt would improve its ability to meet student needs. This school's efforts to influence policies at the state and federal levels that would affect technology integration in schools demonstrate its intent to create a more technology-friendly context for its own operation and for other schools.

Southeast Suburban was farther along in the implementation stage than these three schools. Although some teachers were still getting their first computer in this school, most teachers were using the Internet in their teaching to some degree. The school's recent movement to new facets of Internet and technology use (e.g., involvement in the Virtual High School, offering a Generation WHY program to students, teaching senior citizens technology skills) and its interest in training teachers across the country reflect the beginnings of movement beyond basic implementation of school-wide teacher use of the Internet to refinement and adaptation of the initiative.

Regardless of the stage of change a school was in, teachers within each school varied in the extent to which they used technology. Adelman (1997) points out that the implementation stage is the time when resisters dig in their heels. One teacher said she was retiring to avoid having to deal with computers and the Internet. Technology staff in most of the schools said that they responded to such individuals by agreeing to disagree, and focused their energies on supporting teachers who were willing to try what the Internet had to offer. The next section provides further insights into these and other patterns. Adelman also points out that the professional development that is typically provided for teachers during the implementation stage leads some talented teachers to take on multiple roles and, as a result, find a new career path and leave the classroom. This pattern was evident across the schools.

Internal Context of the School

Although the study involved spending no more than 3 or 4 days in each school, hardly enough time to become familiar with the school's general patterns and culture, teacher interviews did reveal perspectives reflecting the internal contexts of the schools.

Organizational Conditions

Louis (1992) identifies three organizational conditions that promote sustained change: pressure from administrators; collegial support, risk taking, and willingness to confront disagreements; and structures that enhance teacher autonomy and decentralization.

Pressure from administrators. Pressure from administrators to change may take the form of leadership, vision, and encouragement. This kind of pressure was seen most clearly in Midwest Rural and Southeast Suburban. Midwest Rural teachers' comments made it clear that they knew they were expected to use technology, and they also referred to the vision that their school leadership provided. Teachers at Southeast Suburban spoke largely of encouragement and support from administrators, and also referred to their leaders' vision. *Vision, expectations, and encouragement and support were the avenues through which administrators in these schools exerted pressure on teachers to implement technology integration.*

Collegial support, risk taking, and willingness to confront disagreements. Collegial support was most notable in the comments of teachers at Southeast Suburban and West Coast Inner City, although teachers in all of the schools acknowledged the help and support they received from their teacher colleagues in their Internet-related efforts. As discussed in Chapter 8, *the support teachers felt from their colleagues helped them to take the risk of trying to use the Internet in their teaching.* Teachers at Midwest Inner City, however, had as much or more to say about a lack of collegial support from certain quarters in the school.

Structures that enhance teacher autonomy and decentralization. *Schools in which the degree of teacher autonomy and decentralization varied all seemed to accomplish technology implementation, with one exception; too much decentralization appeared to inhibit technology integration at one school.* Decentralization that appeared to facilitate technology integration was apparent at Southeast Suburban and West Coast Community, where department-level planning for technology integration was the most prominent and encouraged. At the same time, structures were in place in these two schools that coordinated unit plans from a school-wide perspective. Southeast Suburban departments were able to propose how they would like to use their allocation of technology money, the kind of equipment they would like to have, and if they wanted computers, the kind of configuration they would like to have. The school's technology committee reviewed these plans and provided a forum where representatives from all departments could assess the impact of their unit's plan on other units, and adjust their plan accordingly. Departments at West Coast Community submitted plans to the school's site council, which assessed them in relation to the school's overall learning goals and plan. Teachers at this school had the most opportunity to request equipment unique to them as individuals. At Midwest Rural and West Coast Inner City, classrooms had a standard equipment allocation, with some exceptions, and technology planning was done by centralized staff in consultation with a core group of teachers. At Midwest Inner City, teachers in departments were beginning to realize that if they wanted something different than they had, they would have to take the initiative. Some departments had pursued grant proposals to add equipment to their unit with external funds. There were, however, no structures in place that intentionally enhanced this autonomy. The school's curriculum structure emphasized decentralization, but this seemed to inhibit, rather than support, the development of school-wide technology integration, as reported in Chapter 8. Teachers in this school's self-contained units and isolated elective areas indicated that they did not know what technology was available, or what was happening with technology, in the rest of the school.

Teaching Staff Stage of Career

Some educational change literature suggests that teachers' stage of career can influence how willing teachers are to implement an innovation that requires considerable work and time on their part. This literature suggests that experienced and weary teachers might not want to learn the new content and approaches required by the innovation (Huberman, 1988). Evidence suggests that teachers with fewer years of teaching experience are more likely to report using the computer and the Internet for a number of teaching-related functions than are teachers with 20 years or more of teaching experience (Office of Educational Research and Improvement, 2000). This implies that schools whose teaching staff is heavily weighted toward very experienced teachers may find it more difficult to implement innovations.

No relationship was found in this study between years of teaching experience and the length of teachers' Internet experience, but teachers' age was related to the length of their Internet experience (Table 23). Younger teachers are underrepresented and older teachers are overrepresented among teachers with less than 1 year of experience in using the Internet. This is also the case, although less so, for teachers who reported having 1–2 years of experience with the Internet. Among teacher respondents with 3–4 years of Internet experience, middle-aged teachers are overrepresented and older teachers are underrepresented. Among teacher respondents with 5–6 years of Internet experience, younger teachers are overrepresented and all other age groups are slightly underrepresented. Interestingly, those with 7 or more years of Internet experience are equally represented among younger and older teachers. These data suggest that, in general, younger teachers have more Internet experience than older teachers, but this pattern does not completely characterize all Internet experience categories. A group of older teacher respondents had been Internet users for a long time, to the same extent as younger teachers.

Table 23

*Relationship Between Teacher-Respondents' Age and Length of Their Internet Experience**

	Teacher age				
Experience with the Internet	≤ 33 years	34–41 years	42–49 years	≥ 50 years	Row subtotal
	(10.6)	(6.57)	(8.6)	(8.6)	
< 1 year	1	7	7	23	38
	(20.4)	(12.6)	(16.5)	(23.4)	
1–2 years	15	13	19	26	73
	(28.8)	(17.8)	(23.3)	(33.0)	
3–4 years	28	22	30	23	103
	(18.8)	(11.6)	(15.2)	(21.5)	
5–6 years	32	7	11	17	67
	(10.4)	(6.4)	(8.38)	(11.9)	
≥ 7 years	13	6	5	13	37
Column subtotal	89	55	72	102	318 Total

*Expected frequencies in parentheses.
Chi-square = 42.2.
Degrees of freedom = 12.
$p < 0.001$.

Table 24 examines the relationship between teacher respondents' age and their level of comfort with the Internet. Among the teachers who reported being very comfortable in using the Internet, younger teachers were overrepresented and older teachers were underrepresented. Teachers who said they were somewhat uncomfortable included statistically fewer younger teachers than expected, and more older teachers than expected. These data suggest that, to some extent, younger teachers felt more comfortable using the Internet than older teachers, but this pattern does not completely characterize all points of age-comfort intersection.

Data on both experience and comfort with the Internet suggest that teachers' stage of career, as indicated by age, may have played a role in some teachers' willingness to try the Internet in their teaching. It is possible that some of the numerous comments about lack of time and other complaints expressed by teachers regarding the Internet, and reported in Chapter 5, may have been related to teachers' inexperience with the Internet and unwillingness to take on a demanding learning and restructuring task. Staff were interviewed in all schools who were clearly resistant to integrating the Internet into their teaching. The chi-square test was used to test the relationship between age distribution and school, but no relationship was found. *Overall, findings do not suggest that teacher stage of career was a highly significant factor in the technology integration that these schools had accomplished.*

Table 24

Relationship Between Teacher-Respondents' Age and Their Level of Comfort in Using the Internet[*]

	Teacher age				
Level of comfort	≤ 33 years	34–41 years	42–49 years	≥ 50 years	Row subtotal
Very comfortable	(31.5) 42	(18.6) 21	(25.8) 25	(36.1) 24	112
Somewhat comfortable	(34.0) 32	(20.1) 22	(27.8) 28	(39.0) 39	121
Neither comfortable nor uncomfortable	(10.4) 8	(6.15) 4	(8.51) 12	(11.9) 13	37
Somewhat uncomfortable	(9.84) 4	(5.81) 4	(8.05) .5	(11.3) 22	35
Very uncomfortable	(2.25) 2	(1.33) 1	(1.84) 2	(2.58) 3	8
Column subtotal	88	52	72	101	313 Total

[*]Expected frequencies in parentheses.
Chi-square = 26.6.
Degrees of freedom = 12.
$p = 0.009$.

School Culture

The literature on educational reform and school culture includes several concepts that are relevant to study findings. One is the idea that in order for change to occur, regularities (expected ways of behaving, patterns) must change, and the social system must be reckoned with (Goodlad, 1975; Sarason, 1971, 1982). *Changes in social system regularities were apparent in all five schools. One of these was change in the age-old notion that teachers teach and students learn.* Students were in fact teaching their teachers about technology, and teachers were learning from their students. This turnabout in teacher-student roles and relationships was uncomfortable to some teachers, but most had adjusted to it and were beginning to see their students, themselves, and their teacher-student relationships in new ways.

A second social system pattern was observed in these schools that may represent a new basis for power and influence in schools. *Technology knowledge and skill was a source of power and influence for individuals in these schools.* A core group of teachers and other staff (primarily technology staff) who possessed considerable technology knowledge and skill were involved in making decisions and providing services that affected almost everyone in the school. There seemed to be at least three reasons for this group's power and influence. First, school administrations and school district agendas that placed technology at the forefront of schools' priorities linked these individuals' expertise to important, valued school activities and goals. Second, these individuals had brought resources into the schools that provided the equipment and other wherewithal teachers needed in order to accomplish the technology integration they were expected to do. Third, teachers who were learning about technology were highly dependent on the individuals in this group to provide them with the assistance, training, and support they needed in order to do the technology integration expected of them.

The cultural-related concepts, sacred and profane norms, were also reflected in the data. Changes that leave sacred norms (those that are inviolable) intact and affect only profane norms (those that are subject to change or redefinition) are more likely to be accepted (Rossman, Corbett, & Firestone, 1988). Teachers' views reported in Chapter 6 concerning the impact of the Internet on reading, and in Chapter 7, concerning the Internet as a replacement or supplement for books, reveal differences in how close the use of books and reading from books was to a sacred norm for some teachers. A number of teachers expressed the belief that use of books, reading from books, and libraries full of books provided something that was irreplaceable. For these teachers, *the use of books and libraries, and reading from books in school was a sacred norm*, and change in it represented a wrenching loss, not just for teaching and learning, but also for the teacher as a person and a professional. Loss is one of the threats that change brings (Fullan, 1991; Marris, 1974). Other teachers were delighted to be able to use the Internet instead of books and libraries. For them, *the norm of using books and reading from them in schools was a profane norm*, one that could be changed without emotional stress. Change could even be welcomed.

Different orientations with respect to sacred and profane norms were also reflected on a school-wide basis, as the following perspectives indicate:

> *Anything else new that comes up, we'll probably explore and try.* (Southeast Suburban)

> *We've got to try to find a balance there . . . make sure that we keep infusing people that are not going to erode what we have.* (West Coast Community)

Rossman et al. (1988) suggest that change in sacred norms is very unlikely. *The most likely way that change in sacred norms occurs is through faculty turnover and bringing in people with new perspectives. Two schools (Midwest Rural and Southeast Suburban) indicated that one of their technology integration strategies was to use technology knowledge and skills, and openness to the use of technology in teaching, as criteria in hiring new faculty.*

Two conditions that Rossman et al. (1988) identify as promoting cultural change in schools—experiencing a dramatic event and time—are reflected in the study findings. *Two schools had experienced dramatic events in their histories.* Midwest Rural was threatened with closure by the state if student academic performance did not improve. A new superintendent who offered technology integration as a way to improve academic performance was welcomed by the school board and community, which had little or no experience with or knowledge of computers.

Southeast Suburban and its school district had faced a dissatisfied community regarding student achievement, as well. In this school, the introduction of site-based management and fine-grained analysis of student performance ups and downs (and not technology integration) had been the responses, but the management team who made these changes, and achieved acceptance and recognition for improving achievement, was also committed to technology integration and began planning for it.

Regarding time, Rossman et al. (1988) suggest that *a considerable period of time is needed for the change process to unfold, and this was borne out in the study schools' experience.* Midwest Rural, West Coast Inner City, and West Coast Community had explored and used computer technology for a long time—from 12–25 years. Southeast Suburban had been working to integrate Internet technology for about 5 years. Midwest Inner City had the shortest timeline—4 years since it had opened as a high-tech high school. The stage of change in each of these schools reflected these timelines to some extent. Midwest Rural had had an implementation agenda for more than 10 years, and had reached the stage of continuous improvement. Southeast Suburban had had an implementation agenda for about 5 years, and was beginning to move from the implementation stage of change into the continuous improvement stage. West Coast Inner City and West Coast Community had had implementation agendas for 1–2 years and were in the implementation stage. Midwest Inner City had assumed an implementation agenda 4 years earlier, when it opened, but had been preoccupied with other agendas and had experienced less implementation than anticipated and desired. *Attention focus, as well as time, seems needed for change to occur.*

External Context of the School

The external context of the school encompasses the values and beliefs that prevail within a school's community, state, and nation, and the forces, events, and resources reflected within these arenas of school context. Louis (1992) asserts that social and community support are particularly important for major changes to occur in schools, and that there needs to be a match between the desired change and the community's expectations for schooling. In addition, community infrastructures (e.g., financial and other resources) can be important factors supporting change. Finally, broader societal values influence educational change. Study findings reflect these dimensions in the external contexts of the five schools.

Community and State

Four of the schools enjoyed considerable support from their communities. These schools' technology integration agendas matched their communities' expectations for schooling, and their communities and states had resources and infrastructures that supported the schools' technology integration efforts. The fifth school's experience was quite different.

Midwest Inner City's community was the most amorphous of all of the schools. Its mission was to serve the entire school district, but in reality it largely served the neighborhood in which it was located. Many parents in this neighborhood were not familiar with technology. This school's district required the school to focus on raising its students' basic skills test scores, and the state's priority was implementing graduation standards. Consequently, there was little match between the expectations coming from the school's external context and technology integration. This school's state and district had also changed policies that eliminated teacher in-service days, thereby reducing opportunities for teacher training regarding technology. Of all the schools, this school appeared to have the least support from its community, school district, and state for technology integration efforts.

West Coast Inner City also had community support for technology integration. The technology facilities in several higher education institutions in the community and area were made available to the school for teacher training and for students and teachers to use in the evenings and on weekends. These institutions also provided technology integration training for teachers. The community had formed groups to support the school, community members participated on school committees, and the community had passed a referendum that provided funding for developing the school's technology infrastructure. This school's state was providing the school with funds to support computer equipment purchases and teacher training as part of a statewide effort to enhance the technological capacity of all schools.

Midwest Rural's community supported the school's technology agenda because the community wanted to keep its school, and believed that a technology-rich school would improve students' test scores. This community also had a unique financial resource that, despite the poverty that characterized much of the community, provided the school with funds needed to accomplish its technology-integration agenda. Midwest Rural provided Internet access and technology education for community members, which also created community support for its technology agenda. A statewide telecommunications network supported this school's technology efforts, and it was working with higher education institutions in the area to explore wireless alternatives. This school reported, however, that it had had to set up a card catalog in its library to give its students experience in using it because they had not done well on a standardized state test that asked questions about a traditional card catalog. The students were used to using an on-line catalog of the library's holdings.

West Coast Community enjoyed support from its community, a college town. Many of West Coast Community's parents were on college faculties, and valued education. The colleges had telecommunications infrastructure, and they provided the school with access to their networks. Parents and local businesses helped the school gain access to computers, other technology, and other telecommunications infrastructure. Representatives from these groups served on the school's planning council and had participated in decisions this group had made to expend substantial portions of the school's funds for technology. The support of this school's state for technology integration was reflected in a program that was providing funds for computers, infrastructure, and training to all schools in the state. Changes in policies of this school's state, however, had eliminated teacher in-service days for which teacher technology training had been planned.

Southeast Suburban experienced a press from the community to help students learn about technology. This school found itself behind in the computer technology it had, compared to what many of its students had at home, and was continually pressed by the community to provide students experience with ever more recent technology developments. This school's state provided an array of supports that helped the school in its technology integration efforts:

Regional technology training centers provided teacher training, state policy required teacher technology skills for recertification, and state lottery money was allocated to schools—which furthered their technology acquisition.

<u>Broader Society</u>

The connection between a nation's values, history, and school reform movements is not straightforward. Sarason (1982) suggests that educational reform cannot be understood without understanding its historical context, and Berube (1994) suggests that larger movements in society are required for educational reform to occur. Reid (1986) suggests that the historical context within which educational change takes place not only defines and limits a field of action, but also provides a rhetorical ground for the change. While recognizing the influence of this larger cultural sphere on school reform, it is also acknowledged that schools possess a tenacious stability that resists reform. Meyer (1977, 1980, 1987, 1992) suggests that the institutional categories that make up schools (e.g., teachers, students, curricular topics, type of school) lend stability. Others suggest that schools resist change because they reflect underlying interests of powerful groups who wish to maintain the status quo (Gordon, 1991; Katz, 1971). Katz (1987) puts these two views together by suggesting that local contexts mediate larger social forces so that the way these forces play out in each school may differ considerably, and is difficult to predict.

Several broad economic, demographic, and cultural patterns are reflected in the data from the five schools. Economically, *the economic boom of the 1990s in the United States was reflected in technology-integration-focused policies of two of the states in particular, which had allocated significant sums of money for computer and infrastructure acquisition in schools*.

Demographically, *the recent influx of new immigrants into the United States from areas of the world in which mass education is limited is reflected in a pronounced way in two of the schools*, Midwest Inner City and West Coast Inner City, where students new to the United States made up a substantial portion of the student body. Teachers in these schools faced additional challenges in attempting to integrate technology, as some of their students were unable to use the Internet because they could not read. Some Internet functions (e.g., sending e-mail messages) also required students to be able to write. At West Coast Inner City, teachers had found ways to harness the Internet in helping students learn these basic skills. For example, one West Coast Inner City English Language Learner teacher reported that language translation Internet sites helped students learn English and helped her understand students' languages. In contrast, Midwest Inner City English Language Learner teachers seemed to see themselves as either teaching their students use of the Internet, or teaching them to read and write English, and their district had made it clear that they needed to do the latter. The differences that were apparent in the perspectives of teachers at these two schools illustrate Katz's (1987) assertion that local context mediates the impact of larger social movements.

Another aspect of this national demographic trend is the poverty that new immigrant groups often experience in this country. Poverty also characterizes many members of minority groups with a long history in this country. *Student bodies in the three schools with the most substantial portions of students representing minority groups and new immigrants also had the highest* *proportions of students eligible for free or reduced-price lunch. In two of these schools, technology integration by teachers was curtailed because teachers could not be sure that their students had sufficient access to computers to complete required assignments because students lacked home access to the Internet.* Teachers were concerned that despite having Internet access in school, students without a computer at home did not have the same opportunity to do Internet-based assignments as students who had Internet access at home. In one of the schools, after-school computer lab hours were generous, and staff were working to get community-based computer centers established where students could gain additional Internet access that could ease the inequities in access that staff saw. *In the third school, where all students were provided with laptop computers that they took home and used in school, this issue was not a concern for teachers.* Again, this illustrates how the local context mediates the effect of external context patterns.

Culturally, a focus on technology, the belief in its value, and ever-increasing use of it are reflected in most sectors of life in the United States. Parental demands in Southeast Suburban for their students to have access to computers in the school reflected this valuing and expansion of technology, as did technology integration-focused federal government programs during the 1990s. *Federal programs that focused on technology integration supported the schools' technology integration efforts in significant ways.* The Federal Universal Services Fund E-rate monies, which since 1996 have helped share the cost of telecommunications services and equipment for schools and libraries, were explicitly mentioned by two of the schools as reducing their telecommunications outlays in one case, and used by their statewide communications network in ways that benefited the school in the other. One of the schools reported that its state had had one of the highest application rates in the country for these monies. Three of the schools had been or were involved in the federal Technology Innovation Challenge Grant Program, which created opportunities for schools and their partners by awarding grants between 1995 and 1999 to create curriculum, and other resources and ideas, that would promote the use of technology in schools. One of these schools was involved in, or used the results of, four of these projects. The National Science Foundation's Supercomputer Program for Educators, which exposed science, math, and technology education teachers to the possibilities of computer use in education in the early 1990s, had been an important force in early technology integration efforts in two of the schools.

The cultural pattern of valuing technology and its integration throughout societal sectors was also clearly reflected in teachers' comments reported in Chapter 4, in which teachers said they used the Internet because it reflected the real world and because it was accepted, expected, and even demanded today. Teachers saw it as part of the culture. Helping students learn to use the Internet was needed if students were to be prepared for their futures. This belief was also evident in the schools that served many students who came from a background of poverty. Teachers and staff in these schools saw technology expertise and understanding as a route to a better economic future for their students. *The focus in the United States on efficiency was also reflected in teachers' and students' comments reported in Chapter 4, which indicated that one reason they appreciated the Internet was because it was fast and allowed them to do aspects of their work quickly. It saved them time, effort, and money.*

Another cultural value that was reflected in study findings is equality of opportunity. Reid's (1986) comment that the historical context provides a rhetorical ground for change is relevant here. The equality-focused rhetoric surrounding technology integration in schools is summarized in the term "digital divide." Much concern has been expressed at the national level about the implications if some students have access to technology and others do not. For example, it is feared that students without opportunities to learn computer and Internet skills will not be able to get good jobs in a society where work increasingly incorporates these technologies. *Digital Divide,* a Public Broadcasting System documentary series that aired in 2000, reflected the national concern about this issue (Public Broadcasting System, n.d.). *It is believed that one way to address unequal access among students to computers and the Internet is to be sure that all youth have opportunities to use these technologies in public schools. Study findings suggest that this belief is valid to some extent, but also indicate that the extent of students' access to computers and the Internet reflected at most of the schools in this study helps alleviate, but does not fully compensate for, lack of exposure to technology at home.* Figure 2 in Chapter 5 shows that more students from schools with many students from high poverty backgrounds reported using the Internet in school, compared to students from schools with more affluent students. But school access to the Internet was not the same as home access, as both students and teachers made clear. Limited after-school hours in computer labs constrained computer use opportunities for students in some schools. But even schools that had generous hours and provided summer access reported that students did not take advantage of these opportunities. The reasons for this were not learned, but might include transportation issues, after-school and summer jobs, and student frustration with filters employed by the schools to keep them off prohibited Web sites. Students with Internet access at home still had more access opportunity than students who had to depend on school access alone. The bold move by Midwest Rural to purchase laptop computers for all of its high school students and expect them to use them at school and take them home during the school year removed computer access inequities among students, but could not completely remove inequities in access to the Internet because some students did not have the needed access at home.

Another equal-opportunity concern has been the kind of experience with technology that different students are offered. *Schools appeared to differ to some extent in the degree to which they provided all their students opportunities to use as well as create Internet-based resources. It was also clear that some teachers questioned the value of teaching Internet technology to students they saw as having limited futures. Similarly, some teachers thought that students who didn't have basic skills were not able to benefit from using the Internet. These views and patterns are not in step with the notion of equal opportunity, and reflect the tenacity and resistance to change of patterns of unequal opportunity in schools.*

Discussion

The foregoing examination of study findings in light of educational change theory helps illuminate the reasons behind the school profiles of technology integration that were observed. Figure 6 summarizes the contextual and change process conditions that supported Internet implementation, as discussed in the foregoing analysis. A summary discussion of each school is provided below in relation to these conditions.

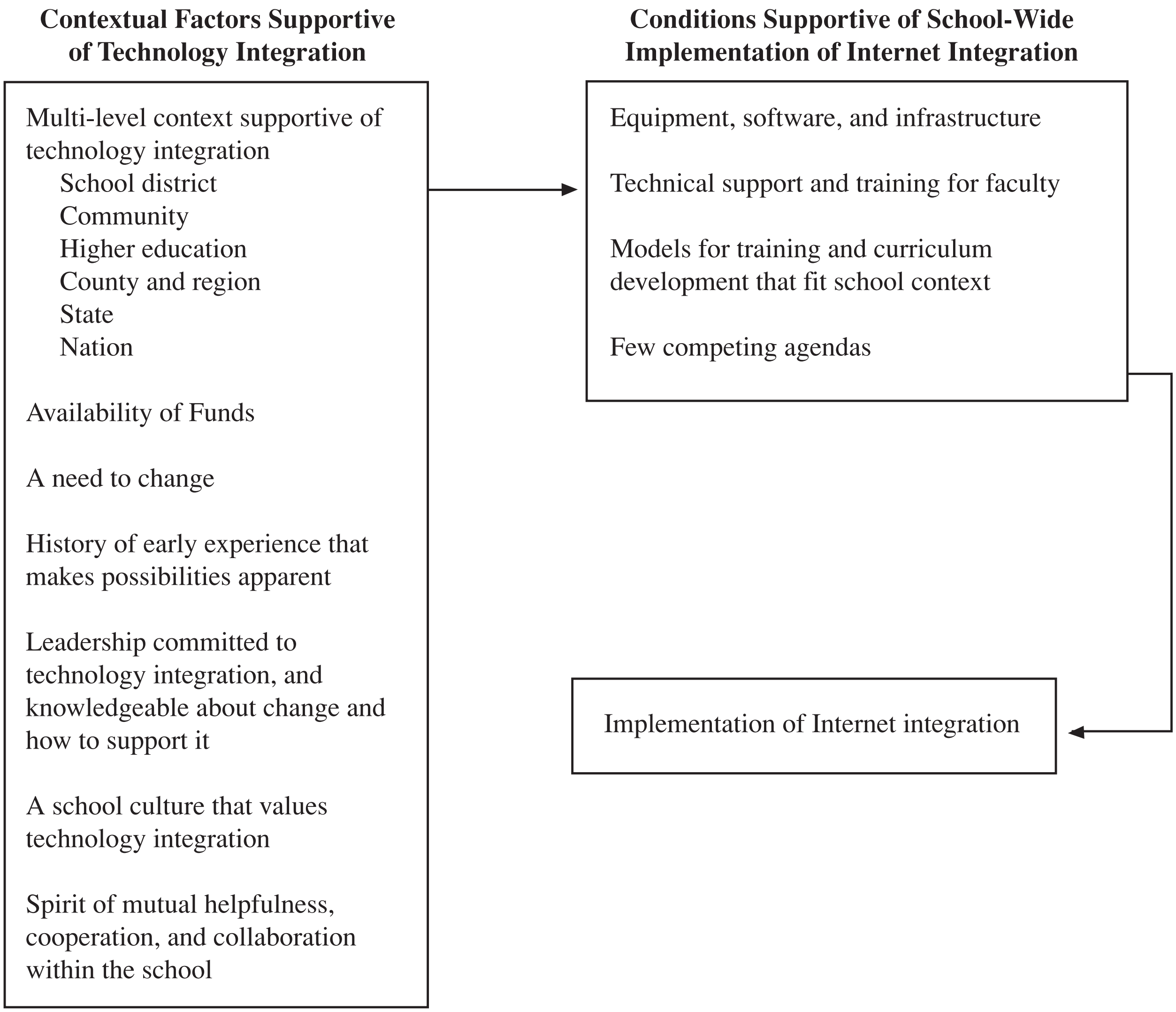

Figure 6. Factors and conditions supporting school-wide implementation of Internet integration.

Midwest Inner City

Midwest Inner City had received support for a technology integration agenda from the school-district-wide community when this new school had been planned as a high-tech high school. Since its opening, however, its school district had taken actions that changed its student body and its community, resulting in less technology-focused students than had been anticipated. The district made raising the academic achievement of these students a central goal for the school. Its state's major education agenda was implementation of graduation standards, which the school was obligated to pursue. The state's policies regarding the required number of school days had changed, and the district had added to the new requirements, with the result that all teacher in-service days had been eliminated. The school was well equipped for technology integration when it opened, but funds for updating, upgrading, and refurbishing equipment were not built into its budget. Teachers who came to the school when it opened had a history of experience with technology, or were interested in learning about technology. When the school took on unanticipated characteristics that made technology integration less central, many of these teachers left. The school's leadership was committed to technology integration, but necessity demanded attention to the state's and district's agendas for the school. Teachers found helpful, cooperative colleagues to support their technology integration efforts, but factions within the school led a number of teachers to feel a lack of collegial sharing and helpfulness.

The school's equipment was getting older, and its capacities were too limited for the demands of the Internet and the number of simultaneous users. Technical support was provided, but until recently, personnel problems had led teachers to feel inadequately supported. Teacher training was offered, but few teachers participated. With no teacher in-service days available, there was no school time when training could be offered. The teachers reported feeling overwhelmed by the multiple agendas the school was pursuing and the challenges of large classes with students who had many needs.

West Coast Inner City

West Coast Inner City also enjoyed a multilevel context supportive of technology integration. Its school district had taken the initiative for technology integration by applying for and receiving one of the first federal Technology Innovation Challenge grants in the nation. Its community was interested in and supportive of the school's technology integration agenda. Higher education institutions in the community and area had been extremely supportive of technology integration in the schools, and provided training, computer facilities, and curriculum development models that aided West Coast Inner City's technology integration efforts. Funds for technology integration were available through the school district's federal grant, a levy referendum, and a state grant to the school. This school had a long history of experimentation with Internet use, stimulated by participation of pioneer teachers in the National Science Foundation's Supercomputer Program for Educators. Leadership committed to technology integration was evident within the school and the district, and came especially from technology staff. The school's culture had pockets that intensely valued technology integration, and it was clear that as other units and teachers became more knowledgeable about possibilities, they were becoming more open to Internet use. A strong spirit of mutual helpfulness, cooperation, and collaboration was evident within the school.

Regarding conditions supportive of school-wide implementation of Internet integration, the school had recently been able to acquire the equipment, software, and infrastructure needed to implement use of the Internet school-wide. Excellent technical support resources were available, but were thin in relation to the school-wide demands for them. This school was second only to Midwest Rural in the amount of training it provided to every instructional staff person. Thanks to its district's prior work and experience, and the connections this school enjoyed with higher education institutions, strong models for training and curriculum development were available and were used extensively to help teachers integrate the Internet in their teaching and curriculum. Technology integration was a central agenda in the school at the time of the study.

Midwest Rural

Midwest Rural was embedded in a multilevel context supportive of technology integration, including a school district in which technology integration was a number-one agenda item. Its community had internalized the valuing of technology that school leadership encouraged. Its state had established a telecommunications network that supported that school's efforts, and the school was working with higher education institutions in its region to improve its telecommunications capacities. The school had benefited from national programs, specifically the federal E-rate and Technology Innovation Challenge Grant programs. The school had funds available to support its technology integration agenda as a result of hiring a grant writer, which had generated several grants bringing millions of dollars into the school. In addition, the district had a unique resource within its geographic boundaries that provided substantial funds through the regular tax levies that supported the school. The school had experienced a need to change and had tied technology integration to the desired change. It had a long history of experience with technology integration. Its leadership was highly committed to technology integration, and knowledgeable about change and how to support it. A school culture of valuing technology integration was so strong, teachers said it would be impossible to remain there and not be open to using technology.

Regarding conditions supportive of school-wide implementation of Internet integration, Midwest Rural had been able to obtain the needed equipment, software, and infrastructure to a degree surpassing that of the other study schools. It had the most generous technical support resources profile of all of the schools and provided the most technology training for its staff. Competing agendas were kept at bay by school leadership that would not allow interference with the school's technology integration.

West Coast Community

A district systems manager who had been highly committed to technology integration for decades had exerted considerable influence on West Coast Community's technology integration. The school's community provided the school with telecommunications services, and higher education institutions in the community had entered into cooperative agreements with the school that had promoted the school's technology integration agenda. Parents were generally supportive, as well, and had donated equipment and other resources to the school in support of technology integration. The state had launched a program to provide all schools with equipment, infrastructure, and teacher training. The school had allocated substantial funds from its own budget to technology integration, and the state had awarded technology-focused funds to the school through a special grant. State policies regarding teacher in-service days had been changed, which had reduced the number of days that had been planned for providing teacher technology training. The desire to preserve traditions that were perceived as central to the school's record of academic excellence pervaded the school. This school had the longest history of early experiences with the Internet and computers. The National Science Foundation's Supercomputer Program for Educators had stimulated and supported some of these experiences. The school had administrators over time who were supportive of technology integration. Teachers' autonomy as professionals was valued. Within this individual autonomy-oriented atmosphere, a spirit of mutual helpfulness, cooperation, and collaboration was evident. Technology integration was valued intensely in some sectors of the school and less so in others.

The school had substantially increased its computer equipment, software, and infrastructure to support school-wide Internet implementation, but several teachers still had equipment that was too old to handle the Internet. Technical support resources were mostly comprised of teachers who were given no release time for this function. Technology training for teachers was very limited. Technology integration had been melded in with other school priorities, where it retained special emphasis, but its place was not more central than other agendas to which the school was equally or more committed.

Southeast Suburban

Southeast Suburban was also embedded in a multilevel context supportive of technology integration. Its school district provided information, funds, and encouragement that contributed to the school's technology integration, and its community pressed the school to expose students to technology in ways that would develop their skills. Higher education institutions provided consultation and brought training into the school that helped teachers develop their technology skills and earn advanced degrees in instructional technology. Regional centers, sponsored by the state, provided training for teachers, and the school and its district had benefited from four federal Technology Innovation Challenge grants, one of which had been awarded to the school and one to its district. This school was in a state where applications for federal E-rate monies were among the most numerous in the United States, and the school had a distance education facility that a state network supported by these monies had made possible. Southeast Suburban's upper-middle-class community's tax base was sufficient to provide considerable funds for technology integration, and its state also provided lottery money to schools for this purpose. Grants written by teachers brought in additional technology-integration-focused funds. Earlier in its history, the school had faced dissatisfaction from its community regarding its student achievement record, and an orientation of openness to change was clearly present. Several teachers had experimented with and pursued technology integration earlier in the school's history, which had provided a base of experience upon which to expand access to the Internet to the entire school. The school's leadership was clearly committed to technology integration, believing it to be essential for helping students prepare for their futures. School leadership was also knowledgeable about change and how to support it, as evidenced by the clearly articulated change strategies that were outlined. The school culture clearly valued technology integration and what the Internet could provide. A spirit of mutual helpfulness, cooperation, and collaboration was extremely strong in this school.

The school had significantly increased its equipment, software, and infrastructure over the past 2 years, and technical support and training were available to faculty through a wide variety of sources. A model for training and curriculum was provided by the school's Technology Innovation Challenge grant. Technology integration was a central part of the school's overall agenda to be an excellent school.

Conclusions, Implications, and Recommendations

Conclusions

Interpretation of the study findings in light of educational change theories makes it clear that integration of the Internet in high schools, like most major school reforms, is a complex phenomenon.

- Equal access to the Internet is a difficult goal to achieve. Providing Internet access for students in school to the extent achieved in the five study schools alleviates, but does not eliminate, disparities in access among students. Cultural-level support for Internet integration in high schools is embedded in beliefs about the economic value of technology skills and in values of equality—especially equal opportunity. Those who decry the digital divide believe that making students more equal in their level of technology skills will make their economic opportunities more equal.

  - The study findings that Internet access in school is used more by students in inner-city schools (with many students from poor families) than by students in suburban schools (with many students from affluent families) suggest that Internet access in school may, indeed, have a desired equalizing effect.

  - As many teachers pointed out, however, Internet access at school does not provide the same amount or kind of access as having the Internet available at home. Consequently, providing access to the Internet in school in the manner observed in the five study schools moves in the direction of equalizing access for all students, but does not fully achieve it. Even the school that gave laptop computers to students did not ensure full equality in Internet access because not all students' homes had telephones or Internet access.

- But more-than-equal access to the Internet is needed to achieve equal opportunity. If all students are to have equal opportunity regarding the Internet, equal opportunities to learn a range of Internet-based technologies are also needed. This study did not analyze in detail the kinds of curricular involvement that students from different backgrounds had with the Internet. Nevertheless, it was evident in one school, in particular, that gifted students were systematically taught how to create Internet resources. It was not clear that other students were similarly systematically exposed to such learning in this school.

- Both the internal and external contexts of a school are important factors in its integration of the Internet:

  - Technology integration is most likely to occur in a school when it is a priority of the school, the school district, the community, the state, and the nation. As study findings show, even schools committed to technology integration will have difficulty in accomplishing it unless they have support for their agenda in at least some of their external contexts. Four of the schools in the study had clear support in both their internal, and one or more of their external, contexts (supportive community, higher education system, school district, state). The fifth school had little or no support from its external contexts. Its district and state imposed major competing agendas. Its local community was inexperienced regarding technology, and was focused on priorities of adjusting to life in a new culture and obtaining basic needs. Support from higher education was minimal. Under these conditions, this school had not been able to achieve its technology integration visions, despite its official identity as a high-tech school.

- Federal and state programs designed to promote technology integration have an impact on some schools, but not others, because the local context mediates participation in and the effect of these programs. Federal programs (e.g., National Science Foundation's Supercomputer Program for Educators, Technology Innovation Challenge Grant Program, E-rate Program) had significantly contributed to the development of technology integration in four of the five schools. The fifth school had not participated in these programs; it opened after one of these programs had ended, and was consumed by getting established and by state and district agendas during the years another grant program ran.

- Policies and practices in school district, state, and national contexts can unwittingly impede Internet integration efforts in schools. For example, standardized tests that question students about tools (e.g., a traditional card catalog) they have not experienced because their school uses technology-based approaches work against technology integration in schools. States and school districts whose policies reduce or eliminate teacher in-service days reduce opportunities for schools to provide technology training for their teachers.

- The more a school's norms are "sacred" (inviolable), and the more that these sacred norms conflict with technology integration, the more technology integration will be hindered. The fewer such norms, and the more that are consistent with technology integration, the more Internet integration will be encouraged. Sacred norms that may hinder Internet acceptance include the belief that use of books is a necessity, and the idea that teachers always know more than students and must always direct student learning. Some teachers in four of the schools expressed regret and a sense of loss in contemplating the possibility of replacing books with Internet resources.

- The more a school emphasizes technology skills in its criteria for hiring new teachers, the more likely it is that sacred norms that deter Internet integration will weaken as staff turnover occurs. The sense that older, experienced teachers are the ones resisting technology integration was not reflected in the study findings. New, young teachers and experienced teachers, alike, were resistant to using the Internet, and teachers in both age groups were enthusiastic users of the Internet.

- To the extent that technology integration is perceived as helping a school address a dramatic event, technology integration will be supported. This phenomenon was clearest in the school where technology integration and improvement in student performance were simultaneous (although the data did not prove a causal relationship between the two). In a second school facing a crisis regarding student performance, the Internet was seen as deterring, or at least not aiding, the performance of students having trouble academically. This school's technology integration agenda was superseded by, rather than integrated with, an agenda to improve student academic performance.

• Leadership for technology integration in a school is a critical factor in how smoothly and effectively technology integration proceeds:

  - Leadership for technology integration can come from a variety of sources, including administrators, technology staff, and teachers.

  - It is easier to protect teachers from competing agendas and to focus school resources on technology integration when administrators lead, or at least are committed to, technology integration. Leadership for technology integration from administrators is important because of the opportunities administrators have to set a tone for an entire school that pervades patterns of recognition for staff and values communicated throughout the school.

  - Technology integration may languish if attempted along with too many other major agendas. Administrators are in the strongest position, relative to other school staff, to focus the school's agendas and communicate school priorities.

  - Technology integration requires equipment, infrastructure, teacher training, and technical and curricular support. Funds beyond a school's regular budget are almost certain to be required, and must be found. Seeking funds and encouraging staff to seek funds were critical functions of leadership regarding technology integration. Schools in which the administration encouraged and supported grant writing and was well informed about district, state, and national opportunities had been able to acquire the funds needed to support these aspects of technology integration.

  - Technology integration is facilitated by leadership that is knowledgeable about how to plan for and cope with change, and that establishes clear and effective strategies for bringing about technology integration. Schools in which the leadership had implemented clearly articulated and well-thought-out strategies for technology integration had made the most progress in terms of stage of change. Effective strategies included, but were not limited to, obtaining needed equipment and infrastructure, creating a need for teachers to use the equipment, providing teachers with training, and recognizing teachers who use and integrate the Internet.

- Technology integration is most likely to occur in a school when it is linked to the school's central mission and priorities. The schools who had made the most progress in Internet implementation had also simultaneously significantly improved the academic achievement of their students.

- Teachers are encouraged to participate in technology integration by training, by having time for learning and curriculum integration work, by having to use technology to do their work, by having a say in decisions about technology, and by receiving recognition for their integration efforts.

  - Teachers need time and training in order to find relevant material on the Internet, to create and publish material on the Internet for use in their classes, and to incorporate these resources in their curriculum.

  - The more aspects of the school that affect teachers (e.g., communication systems; assignment information, submission, and feedback systems; teacher evaluation policies) in which the Internet is incorporated, the more likely it is that teachers will learn to use and incorporate the Internet. The two schools that had made the most progress in Internet implementation had integrated its use into multiple facets of school operation.

  - Incentives and recognition for teachers who incorporate the Internet in their curriculum and teaching processes help teachers get, and stay, involved in technology integration.

- The link between technological expertise and teachers' and students' social status among their peers is likely to continue as long as technology integration remains a priority in a school's internal and external contexts. Recognition by school leadership of teachers who are willing to learn and try Internet-based teaching approaches plays a role in this status for teachers.

- The fact that Internet integration leaves basic school categories in place is predictive of Internet integration's persistence, but also suggests that the Internet may not change school curriculum and teaching in fundamental ways.

  - Most changes in the teaching-learning system introduced by the Internet are compatible with existing school "scripts" and categories (Meyer, 1977, 1980, 1987, 1992). Use of the Internet does not require change in school schedules. Classrooms, teachers, students, administrators, and subject areas continue to make up school structures. Technology staff is a new staff category, but it is an added category that does not disrupt established categories. Teachers can use the Internet to do the same kinds of teaching they now do. Lectures illustrated with Internet material, worksheets that send students to the Internet instead of to books to find answers, tests taken on the Internet instead of with paper and pencil, and use of the Internet to support simulations are all examples of ways in which the Internet can be incorporated into the kinds of teaching that teachers do already.

- Whether or not the Internet has a transformative effect on school curriculum and teaching practices depends on how students and teachers use it, and whether teachers learn different ways of viewing teaching and learning and their own and students' roles. Changes in curriculum and teaching practices and styles may not necessarily result directly from integrating the Internet, but may be an indirect result of a shift in student-teacher relationships that occurs when teachers depend on students' knowledge of technology to supplement their own.

- Integration of the Internet in schools takes time. Each of the study schools had been involved in using the Internet for several years, and had built up a foundation of experience.

- Integration of the Internet in high school curricula is a more complex and pervasive change than was the introduction of microcomputers into schools in the 1980s, because the integration of the Internet is school-wide and affects all curriculum areas. During the 1980s, the use of microcomputers was largely oriented to specific software programs that were used only in certain subject areas. In contrast, the vast resources on the Internet include materials of potential interest and usefulness to all subject areas. Because the scope of Internet integration has the potential to be much broader, it may solidify the place of computers in high school curricula.

Implications

- Technology integration in schools is not the responsibility of schools alone. Schools whose internal and external contexts are supportive of technology integration are more likely to be successful in achieving it. Thus, those who wish to support technology integration in schools need to look beyond the school, as well as within it, to determine how to achieve the factors and conditions noted in Figure 6.

- Addressing the digital divide requires attention to more than Internet access in schools. Development of students' aspirations, interests, and access to technology outside of school, and of attitudes among school personnel that lead them to view all students as candidates for Internet-based opportunities, are parts of the picture that also need attention.

Recommendations

- Schools are a logical place to seek to equalize students' opportunities for using and learning about the Internet, but simply providing access to the Internet in schools may not be sufficient to equalize access opportunities. Community-based computer centers accessible to students and their parents should also be developed, in addition to expanding Internet access in schools. In some communities, the school may become such a center, with after-school and evening hours when its computers are available to both students and community members. One of the schools in the study had already established itself to some extent as such a center, and a second school was considering taking on a community center role. Libraries can also serve such a function if they have sufficient computer facilities.

- Studies are needed regarding the Internet as a potentially transformative technology and the conditions under which it becomes so. Research is needed on several levels.

  - School-level research that follows a school system over time as the Internet is introduced is needed to track the process of system change as it happens, and the factors that influence it.

  - Classroom-level research is needed to provide insight into ways in which the Internet may or may not affect teaching and learning processes. This research should include a focus on the factors and circumstances associated with Internet integration that lead teachers to see new ways of teaching and consider new possibilities for their own and students' roles, as opposed to incorporating the Internet into the kind of teaching they have always done.

  - Finally, context-focused studies that extend beyond the school are needed to deepen understanding of the roles that the school district, the community, higher education, the state, and the federal government play in supporting Internet use in schools. The findings reported here suggest that without support from one or more of these external contexts, schools are likely to have a difficult time initiating and sustaining integration of the Internet within school curriculum and teaching-learning practices. Such studies should include experiments that introduce changes in contextual elements, and observe their impact. Results from such experiments would be useful in guiding the actions of policy makers who wish to support Internet use in schools.

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APPENDIX A: STAFF SURVEY QUESTIONNAIRE FORMATS

Principal

INTERNET TECHNOLOGY SURVEY

Several of the following questions will ask about your use of Internet technologies. These include: e-mail, World Wide Web browsing, telnet/file transfer protocol (FTP), listservs/news groups, video conferencing, telephony/ audio conferencing, chat rooms and remote access to computers or files.

1- Name: (Please print)

Last First M.I.

____

2- Gender:

(Circle one)
a. Male
b. Female

3- Age:

(Circle one)
a. Less than or equal to 25 years
b. 26-33 years
c. 34-41 years
d. 42-49 years
e. 50 years or above

4- Where do you access the Internet?

(Circle all that apply)
a. School
b. Home
c. Cyber cafe
d. Community library
e. Any other place (please specify: ____)

Principal

5- Please circle the response in each column below that most accurately describes your administrative experience and your experience with Internet use.

(Circle one response in each column)

5.1-Your experience with Internet use:		**5.2-Your administrative experience at this high school:**		**5.3-Your total administrative experience:**	
a	Less than 6 months	a	Less than 6 months	a	Less than 6 months
b	Between 6 and 12 months	b	Between 6 and 12 months	b	Between 6 and 12 months
c	1- 2 years	c	1- 2 years	c	1- 2 years
d	3- 4 years	d	3- 4 years	d	3- 4 years
e	5- 6 years	e	5- 6 years	e	5- 6 years
f	7-8 years	f	7-8 years	f	7-8 years
g	9-10 years	g	9-10 years	g	9-10 years
h	More than 10 years	h	More than 10 years	h	More than 10 years

6- Which Internet-based technologies have you used more than once in the past year?

(Circle all that apply)

a. E-mail
b. World Wide Web
c. Telnet/File Transfer Protocol (FTP)
d. Remote access to computers or files
e. Video conferencing
f. Audio conferencing/telephony
g. Listservs/news groups
h. Chat rooms
i. Down loading music and/or videos
j. Other (please specify:

____

____)

7- How comfortable do you feel using Internet-based technology?

(Circle one)

a. Very comfortable
b. Somewhat comfortable
c. Neither comfortable nor uncomfortable
d. Somewhat uncomfortable
e. Very uncomfortable

Principal

8- At school, which person(s) and/or material(s) do you seek out for assistance/ support or information related to your use of the Internet?

(Circle all that apply)
a. Technology coordinator(s)
b. Media personnel/librarian(s)
c. Reading material(s)
d. Online resources
e. Audio/video tutorials/resources
f. Teacher(s)
g. Student(s)
h. Counselors
i. Other Administrator(s)
j. I don't seek assistance/support/information at school regarding my use of the Internet.
k. I provide assistance to others in using Internet rather than seeking help.
l. Other (please specify: ____)

9- For the current school year (1999-2000) how many hours of professional development in the use of Internet-based technology will you have received by the end of school year?

(Circle one)
a. 0
b. 5 hours or less
c. 6-10 hours
d. 11-15 hours
e. More than 15 hours

10- Circle the response that most accurately describes the location of the computer(s) on which you <u>most often</u> access the Internet at school.

(Circle one)
a. My office/work space
b. Other administrative offices/reception area or other office area in the building
c. An office or a classroom in one of the instructional departments
d. Media center, library, or computer lab
e. Other (please specify: ____)

Principal

11- To what extent do you value having Internet access in your school?

(Circle one)
a. Essential
b. Important but not essential
c. Not essential and not important
d. Not sure

12- How frequently do you use the Internet for personal and professional purposes?

(Circle one)
a. Never
b. Less than once a month
c. 1-3 days a month
d. Once a week
e. 2-4 days a week
f. Daily

13- For each of the following items, circle the response that most accurately describes how often you use the Internet for the following purposes.

(Circle one response per item)

13.1- Resource/information acquisition

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

13.2- Sharing files/documents with others

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

13.3- Collaborative projects/work with others

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

Principal

13.4- Individual projects/work

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

13.5- Seeking expertise on aspects of work/projects

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

Principal

13.6- On-line publishing of your work

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

13.7- Web page development and maintenance

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

13.8- Communication with other administrative staff

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

13.9- Communication with teachers

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

13.10- Communication with students

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

Principal

13.11- Communication with parents

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

13.12- Communication with board members and/or other community representatives

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

13.13- Student data management

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

Principal

13.14- Other (please specify: ____)

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

13.15- Other (please specify: ____)

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

13.16- Other (please specify: ____)

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

Principal

14- Estimate the number of computers that are currently connected to the Internet at your school.

a. For teachers' use ____________
b. For administrative staff use ____________
c. For student use ____________
d. Other (please specify:____________________) ____________
e. Total (should equal the sum of a, b, and c) ____________

15- Estimate the number of computers having Internet connections which are located in each of the following areas.

a. Classrooms/instructional rooms ____________
b. Library/media center ____________
c. Computer lab(s) ____________
d. Teacher/staff/administrative offices ____________
e. Other (please specify:____________________) ____________
f. Total (should equal the sum of a through e) ____________

16- What is the total number of students in your school building in the 1999-2000 academic year?

____

17- What is the total number of teachers in your school building in the 1999- 2000 academic year?

____

18- Please specify the number of FTE staff that have responsibilities for supporting computer technology at your school.

_____._____

Principal

19- Rank from 1 (most) to 8 (least) the degree of leadership, that each of the following groups have provided (e.g. seeking grants, bringing in current computer technology etc.) in improving access to the Internet at your school.

19.1- Administrator(s) ________________
19.2- Teacher(s) ________________
19.3- Media center personnel/ Librarian(s) ________________
19.4- Technology coordinator(s) ________________
19.5- Parent(s) ________________
19.6- Community business and/or organization(s) ________________
19.7- State education agency or other state agencies ________________
19.8- Other(please specify:_____________________ ________________

20- Which person(s) and/or material(s) is/are responsible or available to support teachers in their use of Internet–based technologies at your school?

(Circle all that apply)
a. Technology coordinator(s)
b. Media personnel/librarian(s)
c. Reading material(s)
d. Online resources
e. Audio/video tutorials/resources
f. Teacher(s)
g. Student(s)
h. Counselors
i. Other administrator(s)
j. Other (please specify: ____)

21- Estimate the percentage of staff who received school or district-sponsored training in the use of Internet-based technology during school year 1999- 2000:

____

Principal

22- Please specify the URLs or names of Internet sites that you most frequently use related to your administrative processes and professional development purposes:

Thank you!

Teachers

INTERNET TECHNOLOGY SURVEY

Several of the following questions will ask about your use of Internet technologies. These include: e-mail, World Wide Web browsing, telnet/file transfer protocol (FTP), listservs/news groups, video conferencing, telephony/audio conferencing, chat rooms and remote access to computers or files.

1- Name: (Please print)

Last First M.I.

____

2- Gender:

(Circle one)
a. Male
b. Female

3- Age:

(Circle one)
a. Less than or equal to 25 years
b. 26-33 years
c. 34-41 years
d. 42-49 years
e. 50 years or above

4- Where do you access the Internet?

(Circle all that apply)
a. School
b. Home
c. Cyber cafe
d. Community library
e. Any other place (please specify: ________________________________)

Teachers

5- Please circle the response that most accurately describes your teaching experience and your experience with the Internet use.

(Circle one response in each column)

5.1–Your experience with the Internet use:		**5.2-Your teaching experience at this high school:**		**5.3-Your total teaching experience:**	
a	Less than 6 months	a	Less than 6 months	a	Less than 6 months
b	Between 6 and 12 months	b	Between 6 and 12 months	b	Between 6 and 12 months
c	1- 2 years	c	1- 2 years	c	1- 2 years
d	3- 4 years	d	3- 4 years	d	3- 4 years
e	5- 6 years	e	5- 6 years	e	5- 6 years
f	7-8 years	f	7-8 years	f	7-8 years
g	9-10 years	g	9-10 years	g	9-10 years
h	More than 10 years	h	More than 10 years	h	More than 10 years

6- Which Internet-based technologies have you used more than once in the past year?

(Circle all that apply)

a. E-mail
b. World Wide Web
c. Telnet/File Transfer Protocol (FTP)
d. Remote access to computers or files
e. Video conferencing
f. Audio conferencing/telephony
g. Listservs/news groups
h. Chat rooms
i. Down loading music and/or videos
j. Other (please specify:____

____)

7- How comfortable do you feel using Internet-based technology?

(Circle one)

a. Very comfortable
b. Somewhat comfortable
c. Neither comfortable or uncomfortable
d. Somewhat uncomfortable
e. Very uncomfortable

Teachers

8- At school, which person(s) and/or material(s) do you seek out for assistance/support or information related to your use of the Internet?

(Circle all that apply)

a. Technology coordinator(s)
b. Media personnel/librarian(s)
c. Reading material(s)
d. Online resources
e. Audio/video tutorials/resources
f. Other teacher(s)
g. Student(s)
h. Counselors
i. Administrator(s)
j. I don't seek assistance/support/information at school regarding my use of the Internet.
k. I provide assistance to others in using Internet rather than seeking help.
l. Other (please specify: ______________________________)

9- For the current school year (1999-2000) how many hours of professional development in the use of Internet-based technology will you have received by the end of school year?

(Circle one)

a. 0
b. 5 hours or less
c. 6-10 hours
d. 11-15 hours
e. More than 15 hours

10- Circle the response that most accurately describes the location of computers on which you and your students most often access the Internet at school.

(Circle one response in each column)

10.1- I most often access the Internet on computers at school in:		**10.2- My students most often access the Internet on computers at school in:**	
a	My office/work space	a	My office/work space
b	My department's work space	b	Teachers' work space in my department.
c	Another department's work space	c	Teachers' work space in another dept.
d	Class room(s) in my department	d	Class room(s) in my department
e	Class room(s) in another department	e	Class room(s) in another department
f	A central location in the school (e.g. media center, library, computer lab, etc.)	f	A central location in the school (e.g. media center, library, computer lab, etc.)
g	Other (please specify:	g	Other (please specify:

Teachers

11- To what extent do you value having Internet access in your school?

(Circle one)
a. Essential
b. Important but not essential
c. Not essential and not important
d. Not sure

12- How frequently do you use the Internet for personal and professional purposes?

(Circle one response in each column)

12.1- How frequently do you use the Internet for personal and professional purposes?		**12.2- How frequently do you use the Internet in your classroom(s)?**		**12.3- How frequently do your students use the Internet in your classroom(s)?**	
a	Never	a	Never	a	Never
b	Less than once a month	b	Less than once a month	b	Less than once a month
c	1-3 days a month	c	1-3 days a month	c	1-3 days a month
d	Once a week	d	Once a week	d	Once a week
e	2-4 days a week	e	2-4 days a week	e	2-4 days a week
f	Daily	f	Daily	f	Daily

Teachers

13- Complete the following chart for <u>EVERY</u> class you teach and activity you supervise at school this term.

13.1- Subject (s) or activity(ies)	13.2- Grade levels of students enrolled	13.3-Estimate the # of female students enrolled	13.4- Estimate the # of male students enrolled	13.5- Estimate the # of nonwhite students enrolled	13.6- Please enter the code from the KEY below that best indicates how frequently you use Internet technologies during class sessions or activity meetings & events.	13.7- Please enter the code from the list below that best indicates how frequently you give assignments or tasks to students that require access to Internet technologies
<u>Example</u>: Math I	**9**	**15**	**17**	**16**	**d**	**d**

<u>KEY:</u>	**<u>CODE:</u>**
Never	a
Less than once a month	b
1-3 days a month	c
Once a week	d
2-4 days a week	e
Daily	f

Teachers

14- For each of the following items, circle the response that most accurately describes how often you use the Internet for the following purposes.

(Circle one response for each item)

14.1- Resource/information acquisition

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

14.2- Sharing files/documents with others

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

14.3- Collaborative projects/work with others

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

14.4- Individual projects/work

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

14.5- Seeking expertise on aspects of work/projects

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

14.6- On-line publishing of your work

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

14.7- Web page development and maintenance

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

Teachers

14.8- Communication with administrative staff

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

14.9- Communication with other teachers

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

14.10- Communication with students

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

14.11-Communication with parents

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

14.12- Other (please specify: ____)

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

14.13- Other (please specify: ____)

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

14.14- Other (please specify: ____)

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

Teachers

15- Please specify the URLs or names of Internet sites that you most frequently use related to your teaching and professional development purposes:

Thank you!

Technology coordinator, media center personnel,
Librarian, computer lab supervisor

INTERNET TECHNOLOGY SURVEY

Several of the following questions will ask about your use of Internet technologies. These include: e-mail, World Wide Web browsing, telnet/file transfer protocol (FTP), listservs/news groups, video conferencing, telephony/ audio conferencing, chat rooms and remote access to computers or files.

1- Name: (Please print)

Last First M.I.

____

2- Gender:

(Circle one)
a. Male
b. Female

3- Age:

(Circle one)
a. Less than or equal to 25 years
b. 26-33 years
c. 34-41 years
d. 42-49 years
e. 50 years or above

4- What is your job title?

____

5- What are your responsibilities in this role?

____
____
____
____
____
____

Technology coordinator, media center personnel,
Librarian, computer lab supervisor

6- Where do you access the Internet?

(Circle all that apply)

a. School
b. Home
c. Cyber cafe
d. Community library
e. Any other place (please specify: ____)

7- Please circle the response that most accurately describes your teaching/ supervising experience as a media specialist/librarian, technology coordinator, or computer lab supervisor, and your experience with Internet use.

(Circle one response in each column)

7.1- Your experience with Internet use:		**7.2- Your experience in this high school as a technology coordinator, media specialist/librarian, or computer lab supervisor:**		**7.3- Your total experience as a technology coordinator, media specialist/librarian, or computer lab supervisor:**	
a	Less than 6 months	a	Less than 6 months	a	Less than 6 months
b	Between 6 and 12 months	b	Between 6 and 12 months	b	Between 6 and 12 months
c	1- 2 years	c	1- 2 years	c	1- 2 years
d	3- 4 years	d	3- 4 years	d	3- 4 years
e	5- 6 years	e	5- 6 years	e	5- 6 years
f	7-8 years	f	7-8 years	f	7-8 years
g	9-10 years	g	9-10 years	g	9-10 years
h	More than 10 years	h	More than 10 years	h	More than 10 years

Technology coordinator, media center personnel,
Librarian, computer lab supervisor

8- Which Internet-based technologies have you used more than once in the past year?

(Circle all that apply)
a. E-mail
b. World Wide Web
c. Telnet/File Transfer Protocol (FTP)
d. Remote access to computers or files
e. Video conferencing
f. Audio conferencing/telephony
g. Listservs/news groups
h. Chat rooms
i. Down loading music and/or videos
j. Other (please specify:
____

____)

9- How comfortable do you feel using Internet-based technology?

(Circle one)
a. Very comfortable
b. Somewhat comfortable
c. Neither comfortable or uncomfortable
d. Somewhat uncomfortable
e. Very uncomfortable

Technology coordinator, media center personnel,
Librarian, computer lab supervisor

10- At school, which person(s) and/or material(s) do you seek out for assistance/support or information related to your use of the Internet?

(Circle all that apply)

a. Other technology coordinator(s)
b. Other media personnel/librarian(s)
c. Reading material(s)
d. Online resources
e. Audio/video tutorials/resources
f. Teacher(s)
g. Student(s)
h. Counselors
i. Administrator(s)
j. I don't seek assistance/support/information at school regarding my use of the Internet.
k. I provide assistance to others in using Internet rather than seeking help.
l. Other (please specify: ______________________________)

11- For the current school year (1999-2000) how many hours of professional development in the use of Internet-based technology will you have received by the end of school year?

(Circle one)

a. 0
b. 5 hours or less
c. 6-10 hours
d. 11-15 hours
e. More than 15 hours

12- Circle the response that most accurately describes the location of the computer(s) on which you <u>most often</u> access the Internet at school.

(Circle one)

a. My office/work space
b. Another office area in the building
c. An office or a classroom in one of the instructional departments
d. Media center, library, or computer lab
e. Other (please specify: ______________________________)

Technology coordinator, media center personnel,
Librarian, computer lab supervisor

13- To what extent do you value having Internet access in your school?

(Circle one)
a. Essential
b. Important but not essential
c. Not essential and not important
d. Not sure

14- How frequently do you use the Internet for personal and professional purposes?

(Circle one)
a. Never
b. Less than once a month
c. 1-3 days a month
d. Once a week
e. 2-4 days a week
f. Daily

15- Which of the following facility(ies) are you responsible for?

(Circle all that apply)
a. Media center
b. Library
c. Computer lab
d. Other (please specify: ____)

16- Estimate the number of computers with Internet connection that are available in the facility(ies) you circled in item 15:

a. For staff/ teachers/ administrative use ____________
b. For student use ____________
c. Other (please specify:___________________________) ____________
d. Total (should equal the sum of a, b, and c) ____________

17- Please indicate the size of the <u>smallest</u> group that uses the facility(ies) you identified in item 15.

____

Technology coordinator, media center personnel,
Librarian, computer lab supervisor

18- Please indicate the size of the largest group that uses the facility(ies) you identified in item 15.

____

19- How many hours in a typical day do you spend in facilitating/supervising students and /or staff in using Internet-based technologies?

____

20- It is most typical for me to provide Internet-related help to students:

(Circle one)
a. Individually
b. In groups
c. Individually and in groups about equally

21- It is most typical for me to provide Internet-related help to staff:

(Circle one)
a. Individually
b. In groups
c. Individually and in groups about equally

Technology coordinator, media center personnel,
Librarian, computer lab supervisor

22- In each list of Internet-based technologies below, circle all those for which you spend a substantial amount of time helping the school's students and staff.

(Circle all that apply)

22.1- I spend substantial time helping STUDENTS in the following Internet-based technologies:		**22.2- I spend substantial time helping STAFF in the following Internet-based technologies:**	
a	E-mail	a	E-mail
b	World Wide Web	b	World Wide Web
c	Audio conferencing/telephony	c	Audio conferencing/telephony
d	Listservs/news groups	d	Listservs/news group
e	Chat rooms	e	Chat rooms
f	Remote access to computers or files	f	Remote access to computers or files
g	Telnet/File Transfer Protocol (FTP)	g	Telnet/File Transfer Protocol (FTP)
h	Down loading music and /or videos	h	Down loading music and /or videos
i	Other (please specify):	i	Other (please specify):

23- For each of the following items, circle the response that most accurately describes how often you use the Internet for the following purposes.

(Circle one response for each item)

23.1- Resource/information acquisition

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

23.2- Sharing files/documents with others

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

23.3- Collaborative projects/work with others

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

Technology coordinator, media center personnel,
Librarian, computer lab supervisor

23.4- Individual projects/work

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

23.5- Seeking expertise on aspects of work/projects

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

23.6- On-line publishing of your work

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

23.7- Web page development and maintenance

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

23.8- Communication with administrators/staff

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

23.9- Communication with teachers

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

23.10- Communication with students

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

Technology coordinator, media center personnel,
Librarian, computer lab supervisor

23.11- Communication with parents

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

23.12- Other (please specify: ______________________________)

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

23.13- Other (please specify: ______________________________)

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

23.14- Other (please specify: ______________________________)

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

24- Please specify the URLs or names of Internet sites that you most frequently use related to your responsibilities and your professional development purposes:

____

____

____

____

____

Thank you!

APPENDIX B: STUDENT SURVEY QUESTIONNAIRE FORMAT

Students

INTERNET TECHNOLOGY SURVEY

Several of the following questions will ask about your use of Internet technologies. These include: e-mail, World Wide Web browsing, downloading music and/or video, Listservs/news groups, video conferencing, telephony/ audio conferencing, chat rooms, telnet/file transfer protocol (FTP), and remote access to computers or files.

1- Gender:

(Circle one)
a. Male
b. Female

2- Age:______________

3- Your grade in school right now:

(Circle one)
a. Nine
b. Ten
c. Eleven
d. Twelve

4- Race/ethnicity:

(Circle one)
a. African American
b. Alaska Native
c. Asian
d. Filipino
e. Hispanic, Chicano, Latino
f. Native American/American Indian
g. Pacific Islander
h. White/Caucasian
i. Multi-racial
j. Other (please specify: ____)

Students

5- Where do you use the Internet?

(Circle all that apply)

a. School
b. Home
c. Cyber cafe
d. Community library
e. Any other place (please specify: ____)

6- Please circle the response that best describes how long you have been using the Internet.

(Circle one)

a. Less than 6 months
b. 6 months –1 year
c. 1- 2 years
d. 2- 3 years
e. 3- 4 years
f. 4-5 years
g. 5-7 years
h. 7-10 years
i. More than 10 years

7- Which of the following Internet-based technologies have you used more than once in the past year?

(Circle all that apply)

a. E-mail
b. World Wide Web
c. Telnet/File Transfer Protocol (FTP)
d. Remote access to computers or files
e. Video conferencing
f. Audio conferencing/telephony
g. Listservs/news groups
h. Chat rooms
i. Down loading music and/or videos
j. Other (please specify: ____
____)

Students

8- How comfortable do you feel using Internet-based technology?

(Circle one)
a. Very comfortable
b. Somewhat comfortable
c. Neither comfortable or uncomfortable
d. Somewhat uncomfortable
e. Very uncomfortable

9- At school, which person(s) and/or material(s) do you seek out for assistance/ support or information related to your use of the Internet?

(Circle all that apply)
a. Technology coordinator(s)
b. Media personnel/librarian(s)
c. Reading material(s)
d. Online resources
e. Audio/video tutorials/resources
f. Teacher(s)
g. Other student(s)
h. Counselor(s)
i. Administrator(s)
j. I don't seek assistance/support/information at school regarding my use of the Internet.
k. I provide assistance to others in using the Internet.
l. Other (please specify: ____)

10- Circle the response that best describes the location of computers on which you <u>most often</u> use the Internet <u>at school</u>.

(Circle one)
a. Teachers' work space
b. Class rooms
c. A central location in the school (e.g.: media center, computer lab, library etc.)
d. Lap top computer I carry with me

Students

11- How important is it to you to have access to the Internet in your school?

(Circle one)
a. Very important
b. Somewhat important
c. Neither important or unimportant
d. Not very important
e. Not important at all
f. Not sure

12- How often do you use the Internet?

(Circle one)
a. Never
b. Less than once a month
c. 1-3 days a month
d. Once a week
e. 2-4 days a week
f. Daily

13- Using the Internet for classes at school:

(Circle one)
a. Makes my classes and/or schoolwork more interesting.
b. Has no effect on my classes and/or schoolwork.
c. Makes my classes and/or school work less interesting.
d. Not sure.
e. The Internet is not used in my classes and/or school work.

14- Using the Internet <u>in</u> school:

(Circle one)
a. Has improved my grades in school.
b. Has had no effect on my grades in school.
c. Has lowered my grades in school.
d. Not sure
e. The Internet is not used in my classes and /or schoolwork.

Students

15- Using the Internet <u>outside</u> of school:

(Circle one)
a. Has improved my grades in school
b. Has had no effect on my grades in school
c. Has lowered my grades in school
d. Not sure
e. I never use the Internet outside school

16- What is your approximate grade average this year?

(Circle one)
a. About A
b. About B
c. About C
d. About D
e. Below D

Students

17- Complete the following chart (using the key below) for EVERY class you take on a typical day at school.

KEY:
a. Never
b. Less than once a month
c. 1-3 days a month
d. Once a week
e. 2-4 days a week
f. Daily

17.1- Subject(s) or activities in your daily school schedule (Please Print)	**17.2- Grade level of subject or activity**	17.3-Using the **KEY provided above**, write in how often **you as a student,** use the Internet **during each class or activity** you listed in column 17.1	17.4-Using the **KEY provided above**, write in how often **you** use the Internet at school or at home for **ASSIGNMENTS** given in these classes or activities.
Example: **Social Studies**	**10**	**c. (1-3 days a month)**	**d. (Once a week)**

(please turn to the other side of this page)

Students

18- For each of the following items, circle the response that most accurately describes how often you use the Internet for the following purposes.

(1)- To get information

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

(2)- Share files/documents with others

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

(3)- My own individual projects

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

(4)- Projects I do with others

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

(5)- Find experts who know about project topics I am working on

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

(6)- On-line publishing of my work

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

(7)- Web page development and maintenance

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

Students

(8)- Communication with other students

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

(9)- Communication with teachers

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

(10)- Communication with administrative staff

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

(11)- Other (please specify: ____)

a	b	c	d	e	f
Never	Less than once a month	1-3 days a month	Once a week	2-4 days a week	Daily

Thank you!

APPENDIX C: STAFF AND STUDENT INTERVIEW PROTOCOLS

School Staff

SCHOOL STAFF INTERVIEW PROTOCOL

Thank you for being willing to spend some time with me today talking about your teaching and the Internet. You may or may not remember that on the consent form you signed earlier permission was asked to tape record this interview. Is that still all right with you?

•**clarification and elaboration of Internet patterns and uses reported on the survey questionnaire**;

> "I noticed on the survey questionnaire you filled out earlier that you indicated ______________. Can you tell me a little more about that?
>
> Can you tell me the kinds of things this includes?
>
> Can you give some examples ?"
>
> Can you help me understand how this response on this question relates to that response on that question?
>
> If you were to complete this question, what would be your response?

•**why/what are the reasons you use Internet as you do (as reflected in the following survey questions):**

- the Internet technologies question (Which Internet-based technologies have you used more than once in the past year? question)
- the frequency of use question (How frequently do you use the Internet for personal and professional purposes? in the classroom)
- the use of the Internet in classes (for teachers—the schedule chart question)
- the purposes question

OR

> Why do you use the Internet at home but not at school

•**what factors have facilitated and impeded your efforts to use the Internet?**

School Staff

•**what do you perceive as <u>consequences</u> of Internet use?**

<u>for</u>

<u>your professional work</u>
<u>your professional development</u>;
<u>student learning</u>, <u>achievement</u> (if relevant)
<u>student motivation, interest, engagement</u> (if relevant)

•**What kinds of help regarding the Internet do you get from whom?**

What kinds of help do you provide to whom?

•**What would be most helpful to you in using the Internet in the <u>future</u>.**
•in your professional work?
•for your own professional development?
•in helping others develop?

I see our time is about up. Thank you for your time and willingness to share your experience and thoughts with me regarding the Internet.

(Note: In addition to this general structure of questions, use probes that follow up interviewee responses, such as "can you explain what you mean by _____, can you say a little more about __________, how does this differ from what you said earlier," etc.)

Student focus group

STUDENT FOCUS GROUP INTERVIEW PROTOCOL

Thanks for agreeing to spend a few minutes today talking with me about your experience with using the Internet with your school work. We are doing a research study on the use of the Internet in schools and want to know how students feel about it, so we're really glad you can help us. Is it okay if I tape record our conversation so I don't miss anything?

Can you briefly describe the kinds of activities you are doing in your classes that involve the Internet, if any?

What supports your involvement with the Internet?

What hinders you involvement with the Internet?

What difference, if any, are your experiences with the Internet making in
- **your academic performance?**
- **how you feel about school**?
- **your social life**?

•**When you want help with the Internet, who do you go to? What kinds of things do you seek help on?**

What kinds of help do you provide to others? Who do you provide this help to?

What would be most helpful to you in using the Internet in school the future?

(Note: In addition to this general structure of questions, use probes that follow up interviewee responses, such as "can you explain what you mean by _____, can you say a little more about ___________, how does this differ from what you said earlier," etc.)