St. Andrew's Middle School Technology Integration: Analysis and Recommendations

Prepared by Students
in the Fall Semester 2000 Class in

Systems Analysis and Evaluation

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1.0 EXECUTIVE SUMMARY

This report represents the results of a systems analysis and evaluation of the use and integration of computer technology at St. Andrew's Middle School in Austin, Texas. The study proposal resulted from a meeting in May 2000, between Dr. Ronald E. Wyllys, Professor of Library and Information Science at the University of Texas at Austin, and Mr. Tim McGhee, principal of St. Andrew's Middle School. Under the direction of Dr. Wyllys, students in the Systems Analysis and Evaluation class in the Graduate School of Library and Information Science, The University of Texas at Austin conducted the evaluation during September - November 2000.

1.1 SUMMARY OF IDENTIFIED REQUIREMENTS

By interviewing teachers, staff, and students, the class identified concerns related to the use and integration of computers into the educational process. Three general areas of concern emerged: professional development, technical support, and instructional resources.

The Systems Analysis class divided into groups focusing on the above three areas. The class conducted a review of current literature and looked at some of lessons learned by schools already using technology. In addition, members of the class assembled a listing of educational resources (Appendix C).

1.2 FACULTY

The primary focus of the recommendations is on the faculty:

- Teachers stated a need for training and support.
- The faculty, in conjunction with the principal, play a primary role in curriculum development at St. Andrew’s Middle School
- A lesson learned from the experience of technology integration at other schools was that overall success was dependent upon the enthusiasm and adequate preparation of the faculty.

1.3 ADMINISTRATIVE STAFF

A description and recommendations have been provided for integration of the new Blackbaud administrative software (Appendix D).

1.4 STUDENT BODY

Most students have adequate technology skills. As teachers become more comfortable with technology, much of the computer training for the students will evolve naturally from increased classroom integration and teacher instruction.

1.5 GENERAL RECOMMENDATIONS

A general plan of recommendations was formulated based on research and interviews.

1.5.1 TECHNOLOGY PLANNING

Technology Planning: The first step in implementation is the creation of a technology planning document. A planning committee, consisting of teachers, administrators, technology personnel, and community members, generally carries out this step.

1.5.2 TECHNOLOGY SUPPORT

Technical Support: Functions and a suggested structure for the technical support unit are listed. Several sources of labor are given, with a recommended ratio of support staff to computers. A technical support model is proposed at the end of this section.

1.5.3 PROFESSIONAL DEVELOPMENT

Professional Development: Skills assessment should be done on a periodical basis. Results of the skills assessment survey of students and faculty is included, as well as resources for creating future surveys. Several methods of delivering training are listed. A professional development model is proposed at the end of this section.

1.5.4 INSTRUCTIONAL OPTIONS

Instructional Options: Incorporation of technology into the curriculum offers new ways of learning and communicating, as well as offering new resources. Gradual integration of technology is encouraged in order to allow faculty time to gain comfort with technology.

1.5.5 POLICY ISSUES

Policy Issues: Among policy issues addressed are equitable access, acceptable use, Internet use, security, and downloading. The proposal does not provide specific policies; however, we stress that faculty and staff must formulate and agree upon policies for the use of technology.

2.0 INTRODUCTION

2.1 HISTORY OF SITUATION

2.1.1 SUMMARY

The creation of St. Andrew's High School had implications for St. Andrew's Middle School, both in terms of curriculum and in use of technology. High school construction included a complete wireless network, with the intention of having all students and faculty use laptops in the classroom. While many students in the lower school were receiving exposure to computers in the classroom, the middle school was not providing a similar exposure to technology. In 2000, a wireless network was set up at the middle school and laptops were purchased for faculty use. Additionally, the school began a pilot program in an eighth-grade history class, where all students purchased laptops for use as part of the curriculum.

2.1.2 TECHNOLOGY INTEGRATION TIMELINE

- April 1999: The upper school laptop computing initiative required upper school students and faculty to use laptop computers for teaching and learning;
- Spring 2000: The middle school began to acquire parts of the Academy Suite, distributed by Blackbaud.
- Spring 2000: The middle school acquired 80 laptops for use in the curriculum.
- Fall 2000: The middle school upgraded to a wireless network.
- Fall 2000: A pilot laptop program was initiated at the middle school.
- Spring 2001: Blackbaud software will be fully integrated.

2.2 PROJECT BACKGROUND

2.2.1 PROPOSAL BY DR. WYLLYS

In May 2000, Dr. Ronald E. Wyllys contacted Principal Tim McGhee to offer help in developing a technology integration plan for the Middle School. They discussed preparing the faculty and staff to make optimal use of the technological resources available. In particular, they focused on three principal questions:

> 1) How can the Middle School use its microcomputer-related resources, and the further resources—especially those of the World-Wide Web—that are enabled via microcomputers, to prepare students to use microcomputers and the Web in the Upper School and beyond?
> 2) How can the Middle School assist its faculty in using microcomputer-related resources in their teaching, both in the classroom and as tools for the development of curriculum materials and resources?
> 3) What kinds of staff support will be needed in order fully to realize the potential of the Middle School's microcomputer-related resources in teaching students and in assisting faculty members? (R. Wyllys, personal communication with T. McGhee, May 27, 2000).

2.2.2 INTERVIEW WITH MR. McGHEE

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In September 2000, Mr. McGhee met with the class to discuss the school's needs for this project. He reiterated the three principal goals stated above. In particular, he was interested in developing a broad vision of how the school would use technology. However, he emphasized that faculty would want more practical suggestions for the use of technology.

Prior to his meeting with our class, Mr. McGhee had discussed the project with the faculty, asking them to consider the "single most important thing that would most assist [them] in using technology" (T. McGhee, personal communication, September, 14, 2000).

2.3 MISSION STATEMENT

The mission of the systems-analysis class was to evaluate existing use of technology at St. Andrew's Middle School and to recommend appropriate methods and guidelines for smoothly integrating technology into school processes.

3.0 LITERATURE REVIEW

3.1 INTRODUCTION

"Computers in the future may weigh no more than 1.5 tons." *Popular Mechanics*, 1949

The rapid dissemination of the personal computer in the mid-1980s has given rise to a vast literature on the role of digital technology in educational contexts. How vast can perhaps be hinted at by noting that for the last fourteen years the *Journal of Research on Computing in Education* has had no trouble coexisting with the quite distinct *Journal of Educational Computing Research*. And of course these two form only a small subset of the similarly themed journals that have come and gone, and continue to arise. The journal literature, however, is matched if not exceeded by the number of monographs published on the topic. Few of these books, which are often nearly out-of-

date by the time they are published, have any lasting impact. Even those that are quickly forgotten, however, do at least leave us with a substantial record of the issue.

This chapter presents a broad survey of the part of that literature that is concerned with the uses of computers in secondary schools, with a particular focus on the middle grades. For the most part we will not be looking at specific case studies, or if we do so, our primary focus will be to relate those cases to a larger theme in the literature (relevant case studies are examined in the chapter on Best Practices). Our main areas of interest relating to the general topic of computers in the middle school classroom are these: Research on influences and benefits; research and commentary on approaches to implementation; reviews and discussions of the types of software and Web-based educational resources available or in use (sources for reviews for specific software will be in an appendix); acceptable use policies, filtering, and first amendment rights; privacy and fourth amendment rights; and health issues (e.g., carpal tunnel, RSI, eye strain).

This literature review will be supported by an online, searchable database of citations to recent literature relating to our topic.

3.2 COMPUTERS IN THE SCHOOLS

> "I think there is a world market for maybe five computers" — Thomas Watson Senior, Chairman of IBM, 1943

From 1983 to 1990, the number of computers in U.S. schools designated for instructional use grew from 50,000 to 2.6 million (Becker, 1990; quoted in Means, 2000). At that point, the student-to-computer ratio was estimated at 20 to 1. That ratio had dropped below 6 to 1 by 1999. This figure is not so impressive if one imagines that included in the count are outmoded legacy computers like the Commodore or the Mac Classic. Other figures, however, show that the rate at which newer technologies are appearing in the schools is also quite high. The ratio of students to multimedia computers dropped from 21.2 to 1 in 1997 to 9.9 to 1 in 1999. Likewise, the ratio of students to Internet-connected computers dropped from 19.7 to 1 in 1998 to 13.6 to 1 in 1999. Some 89% of schools were connected to the Internet in 1999 (Technology Counts, 1997,1999)).

In the last couple of years, however, the favored unit of analysis has been shifting from the school itself, to the classroom, and the questions now being asked are likely to be framed in terms of computer capacity in the classroom itself. This is part of an overall trend towards integrating computer technology more fully into all aspects of the pedagogical process. The long-prevalent idea of a computer lab, typically used by large groups of students for short periods of time, outside of their usual classroom context, is falling out of favor; and computers in schools are increasingly found in classrooms, where, it is hoped, they will become an integral part of the curriculum in all subjects. This transformation is still underway: in 1998 there were 17 students to each classroom computer (Technology Counts, 1998), and the number of U.S. classrooms that were connected was just over 50% (Jerald & Orlofsky, 1999, quoted in Hasselbring, Barron and Risko, 2000)

3.3 COMPUTER USE IN THE SCHOOLS

Although the literature on computers in education is rife with differences of opinion on nearly every topic, there is near unanimity on one point: increasing computer hardware, software, and networking capacity in the schools does not mean that that technology will be used well, or at all (Wiburg, 1995).

In 1990-1991, schools and districts spent $2.1 million for computers, while in 1997-98, they spent $2.1 billion (SIIA, 1999). Yet, according to a 1999 National Center for Educational Statistics study on teacher quality, it was reported that only 20% of all teachers feel “very well prepared” to integrate technology into their teaching (U.S. Department of Education, 1999). Education Week surveyed 1407 teachers and found that only 53% use software for pedagogical purposes in their classrooms, and only 61% use the Web for this purpose. About 40% indicated that their students do not use classroom computers at all during a typical school week. Other studies, some of them more regionally focused, show even lower rates of technology use (Matthews, 1998).

3.4 RESISTANCE TO EDUCATIONAL TECHNOLOGY

3.4.1 PROFESSIONAL DEVELOPMENT

This significant lag in the effective use of the burgeoning technological capacity in the schools is a subject of much debate, with some arguing that the lag is evidence that technology has been introduced too quickly, and others arguing that this pace is good but that professional staff training and arrangements for technical support need to be increased to keep up.

A 1995 Office of Technology Assessment report stated that school computers are likely to be used ineffectively or will be underused if less than 30% of the technology budget is spent on professional development (Office of Technology Assessment, 1995). This level of funding is not typical, however. As recently as 1997, only two states reported that more than 30% of their teachers had received nine hours or more of professional development in technology (Education Week, 1997). Wenglinsky (1998) reported that 40% of the teaching force did not receive instruction on how to use the Internet, and an additional 18% had less than eight hours of such instruction.

This is not to say that professional development is being ignored completely. In a Technology Counts report (1998), investigators found that teachers from almost all states now receive some professional development in computer use. Some 89% of the teachers surveyed reported that they had received some training on how to use the computer for instruction. The percentages of teachers who had training in high-end technologies such as multimedia and/or online activities, however, were notably lower.

Even when professional development is available, however, there has been a tendency to focus on fundamental computer skills rather than on how to integrate the technology into instruction or on how to assess its benefits (Milken,1998; OTA, 1995); and Kennedy (1999) argues that this difference influences the effectiveness of technology use. Training in the integration of technology into the curriculum is nearly always more helpful than basic technology skills training alone; Trotter (1999) reports that combining the two has the best effect.

The absence of teacher technical support other than training is a further barrier to effective use of instructional technology. Teachers are often not given time to plan for the integration of the technology into their curriculum (Milken, 1999). In 1998, only 29% of schools had a full-time technology coordinator (Technology Counts, 1998), and there has been a tendency, though it is less prevalent now than in the past, for those technology coordinators to teach computer skills to the students rather than provide technology support for teachers (Becker, 1994). Strudler (1994) found that teachers frequently cited the need for on-site technology support, and Tuijnman and ten Brummelhuis (1992) have established that there is a connection between this sort of support and integrated computer use in eighth-grade curricula (Tuijnman and Ten Brummelhuis, 1992, quoted in Fuller, 2000).

3.4.2 THE PSYCHOLOGICAL FACTOR

In addition to the strictly technical aspects of training and support, there has been an examination in the literature of several psychological factors that may influence technology implementation. Fullan and Stiegelbauer (1991) noted that people need support in the early stages of implementation, because it is at this time that people most often have concerns and self-doubt. In discussions of technology-based learning environments, students are usually given the focus, whereas the teacher's role in the acceptance, implementation, and outcome of educational computing has received less attention, even though there is considerable evidence pointing to the centrality of teachers in the process of educational innovation (Chen, 1991; Fullan, 1982; Fuller, 2000). In particular, recent research indicates that successful implementation of new technologies is heavily dependent on teachers' attitudes towards technological innovation in general as well as to the specific technologies and products available.

There are a number of reasons teachers may be negatively disposed towards technological innovation. Some may have a general fear or distrust of change. Some may fear that the students will understand the technology and how to use it better than the teachers will. And some teachers may be concerned about the time that may have to be invested in new training, or the time that may be lost in the classroom due to technical malfunctions.

All of these factors are elements of what has been called 'technostress'. Studies on 'technostress' became common in the late 1980s and early 1990s (librarians were usually the focus) (Hudiberg, 1996). Studies on technostress among

teachers were not far behind (McKenzie, Mims, Davidson & Clay, 1996). In her study, McKenzie came to this conclusion:

> If the numbers of this study are representative of the whole then little is being done in schools, at any level, to seriously address the issue of technostress (123 out of 305 respondents indicated that no activities were being conducted in their schools to deal with this problem). Continued failure to respond to the needs of educators for training in the management of technostress could result in serious problems with the implementation of technological advancements in schools of the future. This could be disastrous for all concerned.

McKenzie found that there was a range of programs in place to combat technostress, and that these programs ranged from additional technical support and training to teacher support groups and exercise programs. It is probably not too surprising, however, that among the teachers she surveyed the two most popular activities for combating technostress were:

1) increasing training opportunities in technology and
2) providing more technological assistance to technology users in the schools.

In other words, teachers in this study did not think that their technostress was grounded in a psychological disposition that could be reoriented by support groups and exercise. Rather, they thought that their (generally negative) psychological disposition towards technology was grounded in a real or perceived lack of training and technical support.

3.4.3 THE SKEPTICISM FACTOR

Finally, there is the possibility that teachers are not making full use of available technology because they simply disagree with the claim that it can have a beneficial role to play in the classroom (Huan, Compley, Williams, and Waxman, 1992; Padron, 1992); or at the very least, in *their* classroom. They may believe that computers are not suited to the developmental needs of young children, or present more disadvantages than advantages in comparison with traditional teaching methods. They may have no particular objection to computers themselves, but believe that there are no good curricular resources available to use on the computer. This response is not entirely surprising: over the years, schools have attempted to adopt a great number of innovations, technological and otherwise, most of which rapidly fall out of fashion (Cuban, 1986). To many teachers, computers may appear to be one more educational fashion.

It is an interesting feature of the literature that those writing on educational technology are, in the predominant majority, enthusiastic supporters and practitioners of it, while at the same time one of the major foci of this advocacy literature is their colleagues who are less favorably disposed. None seems to be arguing that current education technology could or should replace teachers – but everyone seems to understand that teachers who choose to do so can block, if not the technology itself, then at least its successful implementation and integration into the curriculum. The question of *how* to implement, then, has been an important one.

3.5 IMPLEMENTATION STRATEGIES

3.5.1 THE RATE OF INNOVATION

Viewed through the broadest lens, there are two major strategies evident in the literature for the implementation of digital technologies in grade schools. The first, and probably the most common, involves the setting of goals for adoption of a certain level of technology by a certain date. These goals sometimes involve the entire systems, but quite often involve, at least in the short term, a subpart of the system. The second strategy relies on a more spontaneous model in which acceptance and implementation of new technologies diffuses, at a pace not determined by policy, throughout the school system as teachers voluntarily take advantage of hardware, software, training, and technical support made available to them.

The second approach is grounded in research, conducted over the past forty years or so, which purports to show that people in a system presented with the possibility of a significant innovation respond in ways that can be patterned predictably. Everett Rogers, for example, argues that his research, conducted internationally and with a wide range of different systems and different types of innovations, shows that typically about 2.5% of the members of a system that is facing the prospect of implementing a significant new idea or technology will be 'change agents', or 'innovators'. (Rogers, 1995 p. 262). They will voluntarily adopt the new innovation, and given the proper support, will generally be successful in implementing it — in large part because they are motivated and therefore open to training and self-learning. In the educational environment, this motivation is particularly important because the response of the students is crucial to success, and the enthusiasm of the teacher will be a strong influence on student response.

If these 'change agents' are successful, another 13.5% will be persuaded, both by force of good example and by direct communication with the change agents, to adopt the innovation as well — these are the 'early adopters'.

At the point of 10-25% adoption, there is a 'take-off' period: "interpersonal networks become activated so that a critical mass of adopters begins using an innovation." (Rogers, 1995, p. 12). The implementation curve rises rapidly, and another 34% implement in a fairly rapid period of diffusion. The late majority, the next 34% to adopt, respond either to the demonstration of success, or to an increasing sense that adoption is necessary. This pressure may come from economic necessity, or from peer pressure. The remainder are termed 'laggards' (who eventually adopt), and non-adopters.

With less precision and less theory, but with a wealth of recent experience, Microsoft's national laptop-education program, Anytime Anywhere Learning, has provided similar conclusions:

> In every teaching environment, there will be a small group of technology advocates who actively embrace the changes brought about by integrating laptops into the classroom. These persons have a natural enthusiasm about participating in a program and are more willing to negotiate the change that comes with new forms of technology. These leaders are a very important resource within a teaching community. Every effort should be made to support their willingness to grow and develop within a curriculum. These leaders can help with problem solving and will serve as role models for other teachers, students, and parents who may be more resistant to change. Ongoing support of their professional development is key to building a leadership team that will train and build momentum with other staff members. (A guide to getting started, 2000.)

If Rogers is correct, this is a strong argument for not setting timelines, but relying on voluntary adoption, with the expectation that a slow start will be followed by rapid innovation diffusion. This approach will require a patient administration, a willingness to look for success in the medium or long term, while investing time, energy, and money in a relatively low-yielding short term. The long-term nature of the educational technology project is asserted by the Panel of Educational Technology of the President's Committee of Advisors on Science and Technology as well: "Another part of the same report called for realistic budgeting for technology-related expenditures within schools, noting that the much-touted return-on-investment for educational technology was a long-term prospect." (cited in Reeves, 1998)

Many other reports support the conclusion that implementation efforts should recruit strategically and proceed with patience. Evans-Andris (1995) found that teaching styles have critical implications for how computers are used, and Miller & Olsen (1995) report that a teacher's prior practices and philosophy influence the rate and success of integration. One study found that more experienced teachers (thirteen-year veterans on average) were the most successful with technology integration (Brady, 1991). These studies suggest that some teachers are better suited to be the innovators than are others. As for patience, Dwyer (1994) reported that significant changes in classroom environments and teaching methods became evident eight years after implementation efforts began. And a 1990 study by the Center for Technology in Education (cited in Burnett, 1995) argued that it can take as much as five or six years for teachers, even if positively predisposed to technological innovation, to become sufficiently comfortable with computers to able to use them effectively in their classrooms.

3.5.2 RECENT EXPERIENCES: SOME GENERAL CONSIDERATIONS

Based on several years of experience assisting schools throughout the United States with technology integration, Microsoft's Anytime Anywhere Learning program has provided a basis for drawing a general portrait of the features that promote successful laptop programs. The discussion that follows draws heavily from internal analyses of the program, as well as from analyses and documents of other programs. For a closer examination of specific implementation efforts, see the Best Practices section of this report.

3.5.2.1 OVERVIEW OF THE *ANYTIME ANYWHERE LEARNING* PROGRAM

Over the past decade, many schools have explored the possibilities of integrating mobile computing with learning. More recently, due to improved portable computing technology as well as successful pilot programs using laptops and other portables, an increasing number of K-12 schools are encouraging their students to use laptop computers. Inspired by successful use of laptops in Australian schools, two technology corporations, Microsoft and Toshiba, began one of the most high-profile programs now underway: the Anytime Anywhere Learning (AAL) Program (Healey, 1999). This project seeks to promote the use of laptops in K-12 education, providing hardware packages for schools, and in some cases, software and technical support as well.

But the basic question is, how are schools integrating laptops into their technology infrastructure? We can find some answers in an ongoing study of Anytime Anywhere Learning, published as the Rockman Report. In their study, Rockman et al. (1998) identified five models of laptop use currently in place at the K-12 level:

- Concentrated — each student has his or her own laptop for use at home or in school
- Class set — a school-purchased classroom set is shared among teachers
- Dispersed — in any given classroom, there are students with and without laptops
- Desktop — each classroom is permanently assigned a few laptops for students to share
- Mixed — some combination of the above models.

Each model has potential advantages, either in terms of instructional benefits, ease of implementation, or savings. In the concentrated model, teachers are free to integrate technology fully into instruction as well as assignments, since all students have access to a computer for homework, study, and projects. In the class set and dispersed models, teachers are free to integrate laptops during the school day; however, there may still be students within the same class who lack access to a computer in the home, so integration options are more limited. In the desktop model, although the computers are owned and maintained by the school, a student working on a computer-based project during the school day might be allowed to take the laptop home to complete his or her work. Also, teachers are better able to reconfigure their classroom setup to suit their technology integration needs.

Many factors can play a role in which sort of program a school interested in laptop education will choose. Finances, of course, play a big role, as does the related concern of equity. Here is a description of a mixed laptop program in Beaufort, South Carolina:

> Lady's Island Middle School in Beaufort, South Carolina, where 140 out of 350 sixth-grade students have elected to participate in the laptop program, uses a combination of laptop-only and mixed classes. In Catherine Farmer's math class, one-third of the students use laptops. To ensure that the class runs smoothly, Farmer's students are arranged in teams of three, with a laptop student bracketed by two students who can follow the on-screen activity. Students who do not have laptops are given electronic calculators and printouts of spreadsheets that the laptop students use electronically. (A guide to getting started, 2000.)

One can see here an effort to maintain equity within the context of an optional laptop program, but one can also see that this effort may not fully address the disparity in access between those who have, and those who do not.

In contrast, another 6th grade in Beaufort has a concentrated model on a limited scale. All the students in the laptop classroom are required to have and use laptops. But there are significantly fewer students taking part than at Lady's Island.

> In the Robert Smalls Elementary School in Beaufort, South Carolina, 55 of the school's 359 sixth graders are grouped into laptop classes. Because the school uses a "team" approach to teaching, its laptop-trained teachers "team-teach" the laptop students

The focus on laptop-only classes enables teachers to include curriculum components that cannot be taught unless each student has a laptop. (A guide, 2000). But even as the teachers have a lot more leeway to investigate and make use of the specific features that computer technology can bring to the classroom, they appear to be reaching fewer students. The non-participating students not only fail to control a laptop (like the 'flank' students at Lady's Island) — they are in a separate classroom learning a separate curriculum.

For many schools, the ideal would be to use laptops to create opportunities for all students to have access to a computer both during and outside of the school day. However, few schools will be able to make this happen in one rapid transition. Indeed, not many schools will be able to make this happen even in a somewhat longer time-frame. Given the concerns for money, equity, the need for professional development, the difficulty in achieving a consistent technical infrastructure, and the possibility of teacher resistance, implementation is likely to be incremental in most schools. There is nothing wrong with this, and in fact much of the literature we review here essentially advocates such a course. It does require strategic decisions to be made, however.

One of the biggest difficulties is the one just discussed: in limited laptop programs, who gets to participate? Since most schools will not be able to provide the laptops for their students, there is a danger here of providing further advantages to the already advantaged. A second problem is that the literature is replete with advice to provide strong technical support and training to teachers, yet it will be difficult to justify the time and expense of a technology coordinator or a regular series of training classes when a program is reaching only a small number of students and involves only a small percentage of the teachers. It is often the expense involved and the politics of procuring the funding to cover that expense that motivates more accelerated implementation efforts (Gold, 1999).

From the AAL experiences it has been reported that "[t]eachers incorporate laptops into the classroom most successfully if they've had access to their own for a 3 to 12 months before laptops are distributed to students" (A guide, 2000). But support for this will not always be easy to find: "There's not a lot of support for buying technology for teachers or administrators. Comparatively, they'll buy it in a second for the kids." (Claire Sheff-Kohn, superintendent of Lawrence Township Public Schools, cited in Gold, 1999). Moreover, if teachers are phasing into the program at varying stages, training programs must be maintained at all different levels. According to the Meadowbrook Middle School Integrated Technology Plan: "A good professional development plan augments teacher success by including structured courses at a variety of levels to meet the various interests and skill levels among the staff that support ongoing growth and development because staff development is an ongoing process". (Meadowbrook, 1997). For an example of a developed training program covering all levels, see Anderson, 1998 (http://wms.luminet.net/maryalice/Internet_staff_development.html).

One program tackles this problem by using Web-based interactive training modules that "will provide staff with the option for self-directed training at their convenience. Staff will be able to access these modules during prep periods, seminar periods or to check out overnight. (Long Range State Technology Plan, n.d.). This school also suggests mentoring relationships between teachers just starting out and teachers at the pioneer schools. Judi Harris also recommends this, although she advises that the mentor should not be too far advanced beyond the level of the neophyte, for in this situation there is a tendency for the gap in abilities to be demoralizing rather than inspiring (Harris, 2000)

Other more technical issues arise. If a school implementing its technology use in stages, it may well be building up its technology capacity in stages. This requires additional planning.

> Plan for increased network demand as the laptop program and other networking functions expand over the years. If school's resources are limited, it can establish a smaller network, and then expand it over time to make orderly and cost-effective scalability and growth of technical resources. Be sure to choose an open, scalable, standards-based system that can work with the existing technology as well as with future technology. In this way, school's investment will continue to serve it as its needs expand. Avoid

proprietary systems that could lock the school into technology that may become obsolete. (A guide, 2000.)

Many school take a half-way approach, implementing across an entire grade or two. This is likely to require that some teachers innovate before they would have chosen to do so on their own, but it also simplifies issues of consistency in curriculum, equity in access, and may help rationalize the incremental development of the technical infrastructure.

3.6 COMPUTERS AND THE CURRICULUM

3.6.1 THE EARLY DAYS

Patrick Suppes made the first well known attempt to use computers for educational purposes. In 1960, he attempted to create an authorware program (a program that developers, teachers, and others could use to create their own digital curricula), which he called "Coursewriter". This apparently did not come to much, but in 1963 Suppes developed a math tutorial for elementary students that included feedback, lesson branching and score keeping within the context of a drill-based program.

In the 1970s, two major efforts at computerized instruction, TICCIT (Time-Shared Interactive Computer Controlled Information Television) and PLATO (Programmed Logic for Automatic Teaching Operation), were funded by the National Science Foundation (Suppes & Macken, 1978). Both were drill-based, both were found to be minimally effective, and both cost an enormous amount of money. As they were being abandoned in the mid 1970s, and along with them the concept of Computer Assisted Instruction (CAI), the microcomputer made its appearance. By 1984 and the introduction of the Macintosh, microcomputers had a significant foothold in the schools. Although instructional software was being produced—by 1986 there were 7,000 software packages on the market (Jolicoeur & Berger, 1986)—, there was not much effort in the schools to reenact the curriculum-oriented efforts of PLATO. Instead, the computers were more often used to teach computers. Computer-literacy requirements appeared, and students learned BASIC and LOGO.

The use of curriculum software received a boost when federal funding was made available to Chapter 1 (now Title 1) schools to purchase hardware and software. This created a market for Instruction Learning Systems (ILS), which generally reproduced the drill-oriented structure of the earlier programs. Van Dusen and Worthen (1995) provide a critical assessment of the effectiveness of ILS.

A second trend during the 1980s was towards the use of 'productivity' software: wordprocessing, spreadsheets, and database programs. While these applications were not inherently 'curricular', they were in fact more easily integrated into existing curricula than much of the drill-based software. The latter, though inherently curricular, were rarely brought into the existing classroom flow, for obvious reasons: computers tended to be in labs, not in the classroom, and the programs were 'standalones'. No teacher intervention was required, or invited. A student writing a paper assigned as part of the already existing curriculum, however, could use a wordprocessor as a tool, and given the ease of revision, a teacher might be more likely to recommend multiple drafts and to intervene with suggested corrections and other feedback. Or a single computer in a science classroom could have a database application which students could use to enter and compare data from experiments (Reeves, n.d).

A third development in the eighties was the advent and widespread use of Rapid Application Development (RAD) tools like Logo, HyperCard, and HyperStudio. With HyperCard, Apple pioneered a programming environment scripted in a language closely resembling English, with a flexible and easy-to-understand visual interface driven by user events. Even as HyperCard itself appears to be headed for the dustbin of history, these features now define at least a dozen other RAD tools. HyperCard was especially suited to the grade-school educational environment, not only because it had an easy learning curve, but also because it was both free and preinstalled on all Macintosh computers from its inception in 1987 till the 1990s. Not only could teachers write programs for free, but in Macintosh-based classrooms the students could use them for free. HyperCard was widely used in the tradition of ILS, TICCIT, and PLATO: to create drill-based programs. It was very well suited to producing self-correcting, feedback-rich flash card, fill-in-the-blank, multiple-choice and matching exercises.

3.6.2 THE 1990s AND BEYOND

HyperCard constitutes a nice metaphor for, if not an actual influence on, the evolution of educational technology in the last decade; for although it is true that HyperCard was well suited for creating drill-based programs, it also provided the first widespread exposure to the idea of the hyperlink, which would soon become the basic navigational mechanism of the World-Wide Web. This ability to create and follow flexible navigational patterns has had considerable appeal among one of the strongest schools of thought in education theory in the 1990s, the constructivists (Barab, Hay & Duffy, 1998).

It is impossible to engage the educational technology literature of the last decade without noticing the strong and often explicit dedication to constructivist discourse (Strommen, 1995; Reil 1994). In the constructivist view, education should promote "a shift from linear to hypermedia learning, from instruction to construction and discovery, from absorbing material to learning to navigate and how to learn, from school to lifelong learning, from one size fits all to customized, self-directed learning." (Tapscott, 1998). From a non-constructivist point of view, the constructivist-vs.-non-constructivist divide can take on a subtle but noticeably different shading: "[The traditional world view is] dependent on analysis, systematicity, logic, convergent thinking, structure, objectivism, mathematics, and the scientific method. . . .[The new world view is] a move toward synthesis, irregularity, intuition, divergent thinking, subjectivism, narrative description, and individual interpretation." (Maddux & Johnson, 1997).

In either rendering, however, hyperlinking, RAD tools (that allow not only teachers but also students to write their own programs), engaging multimedia hardware and applications, email, and videoconferencing software, all seem very promising for supporting this approach; and the constructivist enthusiasm for these tools evident in the literature reflects this confluence. It is important to note, however, that not all teachers who promote these same objectives (and perhaps have promoted them for many years) consider themselves constructivists. And many who see great promise in recent developments in education technology do so from within different frameworks.

From whatever philosophical vantage point, however, there is little doubt that the majority of writers today are less interested in drill-based instruction or the uncomplicated use of productivity software. Instead, the promise of educational technology is thought to be in its ability to connect remote users for collaborative projects that engage higher-order thinking skills in a creative way.

3.6.3 LEARNING AND LEADING WITH TECHNOLOGY

To get a sense of what the claims are and what sort of curricular material is being discussed, it may be worth looking at one article in some depth. A good example is an article in the September 1998 issue of Learning and Leading with Technology by University of Texas at Austin professor Judi Harris (Harris, 1998). Her essay is worth an extended look, not only because it lists Internet resources that she has seen put into effective use in the classroom (many of which are still available), but also because she provides a sort of taxonomy of the various types of digital curricula. Harris begins by asserting a distinction between teleresearch and telecollaboration. Teleresearch involves using the Internet to search for information. For Harris, this sort of activity is useful, and is perhaps a good first use of the Internet technology for teachers who are new to it. But she does not think that teleresearch on its own takes full advantage of networking capabilities. Her article, then, is a review of telecollaboration possibilities, which often incorporate, but are never limited to, teleresearch. Telecollaboration, as its name implies, involves using the network to interact with one or more other people: other students, other teachers, other classes, mentors, remote speakers, etc.

Harris divides telecollaboration activities into three broad categories: Interpersonal Exchange, Information Collection and Analysis, and Problem Solving.

3.6.2.1 INTERPERSONAL EXCHANGE

Interpersonal Exchange is the oldest and among the most popular types of educational telecomputing activities: one in which individuals or groups 'talk' electronically with one another by using electronic mail (email), asynchronous large-group discussion tools (such as Web conferences, bulletin boards, and newsgroups), or real-time text or audio- and video-conferencing tools (such as Internet Relay Chat (IRC) or CU-SeeMe)

Within the category of Interpersonal Exchange, Harris identifies the following activities:

- Keypals.

  This is basically an Internet version of penpals. In some cases, students from two schools in remote locales communicate via email regularly with each other. Real-time chat is also a possibility here, optionally including video.

- Global Classrooms.

  A variation on keypals which focuses on a structured, collective project.

- Electronic Appearances.

  Using real-time chat or videoconferencing software, remote guest speakers can make 'appearances'.

- Telementoring.

  An extension of electronic appearances in which guest experts maintain a digital correspondence with interested students over time.

- Question-and-Answer.

  The numerous 'ask-an-expert' services often freely available on the Web are prime examples.

- Impersonation/role playing.

  A student or students take on an identity (perhaps an historically important figure) and answers questions emailed by other students.

3.6.2.2 INFORMATION COLLECTION AND ANALYSIS

Within the category of Information Collection and Analysis, Harris identifies the following activities:

- Information Exchanges.

  Combines telecollaboration with teleresearch. Harris's example is the Global Grocery List Project, in which students in remote locations share information about prices in their region, and then "research and discuss the reasons for these differences in cost"

- Database Creation.

  Students in remote locations create and populate their own databases, which is then available to themselves and others. Harris's example is Kidlink's Multicultural Calendar, in which students enter information about holidays celebrated in their region.

- Electronic Publishing.

  This is basically the production of a student publication online: "The appeal of an international audience is powerful . . . "

- Telefieldtrips.

  In one version, a class on a real fieldtrip broadcasts their experience to classes that witness it virtually. The second version, well known due to the popularity of MayaQuest, involves a professional expedition

presenting their efforts and discoveries on the Web. In MayaQuest, a team of archaeologists "travel by bicycle through Mesoamerica, exploring rain forests and Mayan ruins".

- Pooled data analysis.

  Students in remote locations gather data on agreed upon topics, and then analyze the "patterns that emerge from the combined samples" Example: RoadKill '98, "which asks students to report the numbers, types and locations of animals killed I the streets between the student's homes and schools." Students then try to "observe, explain and predict seasonal and incidental patterns of roadkill."

3.6.2.3 PROBLEM SOLVING

Within the category of Problem Solving, Harris identifies the following activities:

- Information Searches.

  Often structured as competition, Harris's example is Geo Game, in which students from each participating school provide 10 clues relating to their location. All the clues are collected, and a list of clue sets and locations is distributed to all the schools. Each school tries to match each clue set with its location. This strikes us as an example in which the role of the Internet is not fundamental. Email will facilitate the collection and distribution of lists, but snailmail could do this just as well. And the Web will facilitate research, but Harris is presenting these activities as telecollaborative. The telecollaborative element here seems to be minimal and incidental.

- Peer feedback activities.

  Students post their work on the network, and other students and/ or mentors post critiques.

- Parallel problem solving.

  Presented with the same problem, students in remote locations work out their solutions and then share their approaches to the problems online with the other students.

- Sequential Creation.

  Students contribute to pictures, musical pieces, or stories, then pass them on to another school. Again, this seems to us to be an activity that benefits only minimally, and only in terms of speed, from being conducted in the networked environment.

- Telepresent problem solving.

  Students meet online (probably via some sort of videoconferencing software) to work on a common problem.

- Social Action projects.

  As an example, Harris cites the Rope Pump Project: Clean Water for Nicaragua, in which low-tech pumps are provided to villages in Nicaragua, partly through money raised by classes in the United States. "After a pump is installed, children from the village communicate with the students who bought the pump, describing the way village life has changed . . . " Presumably, this communication is over the net and includes video and the possibility of back-and-forth communication.

In one of our own interviews with a teacher at St. Andrew's, we may have uncovered an 'activity structure' Harris has missed. The same teacher who referred to the majority of software in her field as 'junk', expressed an interest in technologies or software that would allow students to help other students. The ThinkQuest program from Advanced Network & Services is built on this premise. Students are challenged to create educational Websites for other students to use. A quick scan of the site suggests that the completed projects (all of which are archived and indexed

by topic) are of varying quality. As of this writing, one interesting project to view is from ThinkQuest, which is located at this Web address: http://library.thinkquest.org/C007948/.

This is a German-as-a-second-language instruction site; it includes readings, multimedia interviews with native speakers (with transcripts), hypertext vocabulary help, grammar reference, and exercises. The site design is superb — the entire site is better than some professional educational sites we have seen.

3.6.3 EVALUATION OF RESOURCES

The evaluation of resources in educational technology is a hotly contested area. Appropriate controlled conditions for testing have not found consensus (Reiser & Kegelmann, 1994), and most studies rely on small sample sizes and often do not even mention, let alone control for, all relevant variables. Appropriate criteria for determining student progress are also contested. Nevertheless, studies abound, and perhaps not surprisingly, come to radically different conclusions (Hasselbring et al., 2000).

As an example of the problematic nature of evaluation in this area, we can look at a recent discussion on the influences of educational technology on learning, teaching, and teacher education (Rhodes, 2000). She researched a wide range of recent data, from books, comparison studies, case studies, government records, and Websites. She came to these conclusions:

- First, effective learning environments are knowledge-centered wherein the emphasis is on understanding rather than remembering.
- Second, effective learning environments are learner-centered, wherein individual learners' personal and cultural backgrounds and learning styles are valued.
- Third, effective learning environments are community-centered, wherein learning activities are collaborative and foster a community of practice that involves legitimate peripheral participation.
- Fourth, effective learning environments are authentically assessment-centered, wherein formative assessment is used to make students' thinking visible to them and evaluations are performance-oriented.

One can immediately see that 'learning environments' of this kind may be very difficult to evaluate. Standardized exams, for example, are clearly not the correct form for evaluation of these kinds of environments. Yet they are just as clearly one of the most widely accepted forms of measurement.

3.6.3 EVALUATION OF SPECIFIC CURRICULAR RESOURCES

A major issue is the evaluation of curricular resources offered for computer-assisted use. Here is one expert's comment:

> Judah Schwartz, a professor of education at Harvard and a co-director of the school's Educational Technology Center, told me that a few newer applications, when used properly, can dramatically expand children's math and science thinking by giving them new tools to "make and explore conjectures." Still, Schwartz acknowledges that perhaps "ninety-nine percent" of the educational programs are "terrible, really terrible." (Oppenheimer, 1997)

For teachers on the front lines, the evaluation of specific software packages and Web-based curricula, especially those that will add to the school's technology expenditures, is of paramount importance. Unfortunately, although there is no paucity of evaluations, there are relatively few that present enough detail or are presented with enough analytical rigor to be very useful. Developers themselves rarely conduct rigorous evaluation of their products before marketing them (Reiser & Kegelmann 1994). Research journals sometimes contain articles detailing the results of a study of a particular program or application. But, as noted above, methodologies are not consistent, and evaluative mechanisms generally reflect the educational philosophy of the investigator. It may be that till the field has gained consensus on guidelines for research, expert but non-scientific reviews will provide the strongest basis (short of procuring evaluation copies of the software for self-evaluation, which is often possible) for teachers to evaluate digital curricula.

Feature articles like that of Judi Harris, presented at length above, are often good places to find comparative expert reviews. One can search for product reviews on the Web, but this should be done warily. There are many Websites containing reviews, but they are often out-of-date. Most software packages are updated frequently, so an older review does not usually provide accurate information. Keep in mind that just because the home page of a software review site says that it was recently updated, that does not mean that the reviews available from that site have been updated. A good example of this is the review site for second-language learning software located at http://www-writing.berkeley.edu/chorus/call/reviews.html.

This page was updated in mid-2000, and will often be the first hit on a Google search (which is supposed to be a sign of popularity, if not also reliability), but the review for Spanish Now!, one of the most popular and best received Spanish-language programs, was written in 1997. Spanish Now! has been so completely revised since then that this review no longer even describes the product that you might actually purchase at present.

Given the rapidity with which new digital curricula appear (and disappear) it is important to know where to find reliable software reviews. *Learning and Leading with Technology* had a good software review section in 1998, but that section has unfortunately disappeared, apparently replaced by an uncritical 'New Software Releases' section. One wonders if this disappearance of sometimes critical reviews may have something to do with the heavy industry-advertising presence in the magazine.

The journal *Technology and Learning* has short reviews in each issue, occasional comparative review articles, and a yearly article devoted to the top software of the year. Even better, they have an online searchable database of their reviews: http://www.techlearning.com/review.html.

Online, reviews can also be found at SREB's Evalutech: http://www.evalutech.sreb.org/. They claim over 5,000 reviews, but this includes book reviews. Reviews tend to be short, but useful. The database is searchable, and the search interface has many options. Unfortunately, you can only search by all formats (which includes books), or by one format. It would be useful to be able to choose multiple formats without choosing all of them. The same is true of the date delimiter.

California Instructional Technology Clearinghouse Recommended Software Reviews can be found at http://clearinghouse.k12.ca.us/. This is a searchable database of over 2000 software reviews. The rating system seems to range from 'exemplary' to 'desirable' to' state-adopted', so you will not find much criticism here. It is explicitly a database of recommended software. However, the bar might be set a bit low, here. For example, *Key into Spanish*, a CD-ROM product, is an electronic Spanish-English and English-Spanish dictionary. As bilingual dictionaries go it is adequate, but not one of the best. As digital products go, it adds nothing to the idea of a searchable database of dictionary entries. So, although there is nothing in particular wrong with this title, is it worth $50 (the listed price)? A good print dictionary could be purchased for this amount. And there is already a very good bilingual dictionary available for free on the Web (Diccionario general de la lengua Espanola Vox, n.d.). If teachers are looking to software reviewers to help them avoid not just bad but also unnecessary or overpriced software, then this review falls short of that goal.

The Superkids Education Software Review is another searchable database of reviews, and the reviews seem to be quite in-depth. You can find SuperKids at this Web address: http://www.superkids.com/aWeb/pages/reviews/reviews.shtml.

Second-language learning is one of the curricular areas in which a great deal of computer work has been done. The online journal *Language Learning and Technology* (http://llt.msu.edu/) has excellent reviews (unfortunately it publishes sparingly, so there is not an extensive archive). The IALL Foreign Language Software Database (http://dante.dartmouth.edu/fldb/) has an extensive list of software and some good reviews, but is a bit unwieldy to use. And there is another review Website based in the Language Institute at the University of Hull that is worth a look (http://www.hull.ac.uk/cti/).

There are also several fee-based sources for reviews. The Educational Products Information Exchange Educational Software Selector (TESS) is located on the Web at http://www.interhelp.com/epie_tess.htm n.d. has a subscription-only database that claims to cover "all current software".

Only the Best 2000-2001: The Annual Guide to the Highest-Rated Educational Software and Multimedia from the Association for Supervision and Curriculum Development can be ordered from their online store at http://shop.ascd.org/ProductDisplay.cfm?ProductID=100234.

And there is a subscription database claiming 4,200 reviews of children's software at http://www.childrenssoftware.com/Tango3.acgi$/softsearch.taf?function=form.

3.6.5 EVALUATION OF A LAPTOP PROGRAM

The study discussed below demonstrates the range of evaluative mechanisms, from student self-evaluation to standardized exams, that are brought into play in the assessment of educational technology effectiveness.

In "Learning by Laptop" (Stevenson, 1999), Ken Stevenson, an associate professor of educational leadership and policy at University of South Carolina, reported on a middle-school laptop program in Beaufort County, South Carolina. Around 250 of the Beaufort district's 1,200 6th grade students at three middle schools participated in the project. These students were followed through the 7th grade to find out the influence of the laptop computers on their learning and on academic achievements.

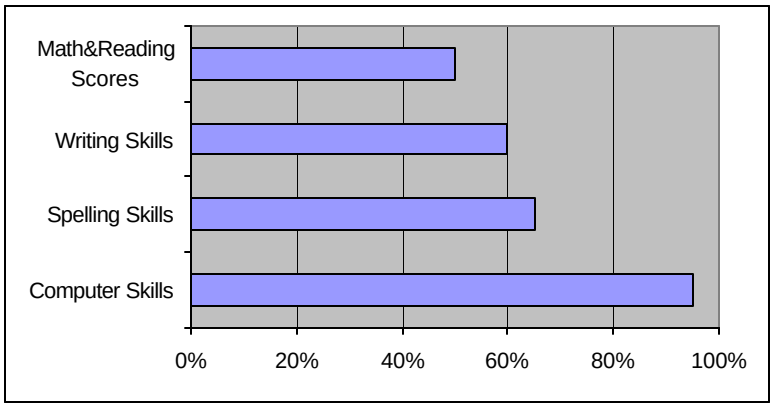
Students were surveyed before the project began and then again after using the laptops in an attempt to gauge the impact of the laptops. In addition, data were analyzed from the Metropolitan Achievement Test—Edition 7, which is a national standardized achievement test. In particular, test scores of 7th graders who were second-year laptop users, were compared to others who did not use the laptops as a notebook. In addition, the pre-project achievement scores of both groups were compared to determine whether there were differences between two groups. Finally, the study examined the relation between school attendance and using laptops.

Table 3.6.5.1 shows the before and after percentages of students using computers at school and at home, and for what purpose:

Table 3.6.5.1

	Using computers At school	Using computers At home	Purpose of using computers
Before the laptop project	15%	30%	for games 65%
After the laptop project	75%	97%	for school work 80%

The next chart shows which skills were improved after the laptop project. Nearly 95% of the 6th-grade laptop students reported that they had improved their computer skills as outcomes of this project. Some 65% of the students indicated that using laptops helped them improve their spelling skills. And 60% of the students said that using laptops has improved their writing skills. Around 50% of the students also said that the use of a laptop had improved their math and reading scores:



Additionally, most students in the project said that laptop use had positively affected student behavior, and 85% of the students thought that the laptops improved students' communication.

From the standardized exams, Stevenson concluded the following:

- Seventh graders participating in the laptop project for two years maintained their level of academic achievement over time, while non-participants experienced a decline in standardized achievement level.
- Students who were laptop participants for two years and who were on free and reduced lunch benefited most from the project. By the end of the second year, these students were scoring as well as students not on free or reduced lunch who were not laptop participants.
- Students who were not laptop participants and who were on free and reduced lunch had the greatest declines in academic achievement over the two-year period. Their average standardized score decreased significantly from 5th to 7th grade.
- Non-participation in the laptop project was associated with negative achievement gains for boys. Boys who did not participate during the two years of the project experienced a significant drop in standardized achievement scores from 5th to 7th grade.
- Non-participation in the laptop project was associated with negative achievement gains for students classified by race as “other.” Their average standardized achievement scores dropped significantly from 5th to 7th grade.
- Girls participating in the laptop project continued to slightly outperform their male laptop counterparts.
- Participation in the laptop project was associated with fewer days of student absences and with less tardiness.

On the basis of these data, Stevenson argues that "use of the laptop computers as electronic notebooks is associated with sustained level of academic achievement over time; and sustaining and improving academic achievement among groups of students who historically have not been as successful in school."

While this study gives us some insight into the sort of questions researchers are asking, and the means by which they are seeking answers, it is only one in a veritable sea of research analyses. The following sources provide one good way to approach this voluminous material (though one should always be careful to know who are the authors, publishers, and funders of this sort of study). Full citations for these major meta-studies (evaluative studies of the studies) and methodological reviews of the last few years can be found in the bibliography to this paper.

3.7 CONSTITUTIONAL RIGHTS, THE INTERNET AND THE SCHOOLS

When schools administrators (and parents) worry about what children might do online, they are typically worried that a child may: suffer a loss of privacy, view ‘inappropriate’ or ‘offensive’ material, put others in jeopardy, break the law, make threats, be offensive or cruel to others, meet someone online, and/or fail to distinguish between the true and the false (getnetwise, n.d.). On the other hand, many parent (and some school administrators as well) may worry that the worries above will lead to policies that will infringe on the child's free access to information, freedom

of expression, and right to privacy. Schools usually respond to these concerns with a clearly stated and well advertised acceptable-use policy, and in some cases with filtering software, or with desktop- or network-monitoring mechanisms. In the sections below, we discuss some of these issues in more detail. Although we touch on legal issues, nothing here should be taken as constituting legal advice of any kind.

3.7.1 APPROPRIATE USE POLICIES AND STUDENTS' SPEECH

Mark Williams writes that over 12,000 schools worldwide now have Websites ("Your Webpage and Free Speech"). An important issue related to this rise in Internet technology and the increased access to information that it brings is what rights and responsibilities are implied in the production and dissemination of that information.

Williams writes that typically a school's Webpage contains more or less mundane information about the school, such as a calendar of events. Student Webpages are often linked to from the school's site, however.. Williams takes on the following question: if controversial content appears on a student's Website on the school server, whose expression would it be considered, the student's or the school's? Is it reasonable to assume that a reader of a school's Website presumes that the facts and opinions found therein are endorsed or created by the school because the site originated from school-owned equipment? The student pages could therefore be believed to have the sanction or imprimatur of the school or the school district.

Williams writes that traditional student publications such as newspapers and magazines may be regulated by the schools based on the landmark Supreme Court case, Hazelwood School District v. Kuhlmeier (1988). In that case, the Court found that censorship of student expression in school publications was a legitimate educational concern. However, the Court held that the regulated activity must be part of the curriculum, otherwise the speech is protected. Non-curriculum-related speech could be free of school control unless it was found to be vulgar or offensive or would result in a substantial and material disruption of the school's operation

Another issue Williams raises is the enforcement of an acceptable-use policy (AUP).

> An AUP is designed to prevent students from accessing inappropriate material on the Internet, as well as provide some remedy if they knowingly violate the policy. In *Boucher v. School Board of the School District of Greenfield* (1998), the court of appeals maintained that student material created on school computer equipment is subject to school control . The AUP should articulate school control of computer equipment to prevent "after the fact" challenges to the policy. The AUP should also discuss the curricular nature of Internet access and use, which then brings that use under the curriculum and therefore the Hazelwood ruling. Additional support for monitoring student speech would exist if the AUP also stated that the use of the Internet in school was a nonpublic forum—then control of student speech would certainly fall within the jurisdiction of the school . Student expression may only be limited by governmental officials if such expression does not have a governmental purpose and is incompatible with the purpose of such a forum and does not limit expressions of point of view . Finally, a well crafted AUP could prevent unauthorized student use as well as establish the school's policy regarding Internet use.

In *Digital Beat*, published by the Benton Foundation, Andy Carvin's “Student Free Speech Rights on the Internet and the Ghosts of Columbine” describes the fallout that has resulted from the Columbine massacre. The debate over Internet filtering was stoked by this event, as some parents and teachers attributed some of the blame for the massacre to what the students were exposed to on the Internet. Carvin goes on to write about previous instances of free speech controversy in school: “In 1969, the groundbreaking *Tinker v. Des Moines School District* case clearly expressed that students retain their First Amendment rights on school grounds, even if school administrators disagree with their speech…As Justice Abe Fortas famously wrote, ‘It can hardly be argued that either students or teachers shed their constitutional right to freedom of speech or expression at the schoolhouse gate.’” The free speech being protected in this case was the wearing of black armbands by high school students as a protest against the Vietnam War.

But Carvin also writes:

> At the same time, *Tinker* acknowledged situations in which administrative action was appropriate. Students' right of expression would be protected except in cases where that expression "materially disrupts class work or involves substantial disorder or invasion of the rights of others...." In other words, if a group of students blockaded the entrance to the school library to protest the availability of certain books, the action would be perceived as worthy of an administrative response. Similarly, if a student entered a classroom wearing a t-shirt featuring profanity, it would not be deemed as being within that student's right to free speech. Schools could discipline students for certain forms of expression, but only in those rare cases where their action was a tangible interruption to educational activities.

Carvin writes that the Hazelwood case effectively curtails much of the latitude given to students' free-speech liberties, "if the student speech was conducted as part of an educational activity — in this case, the official campus newspaper, which was published as part of a journalism class. . .the newspaper did not have a longstanding tradition specifically as a 'forum for public expression,' [so] the school was not bound to air student views freely."

In another case in 1998, Brandon Beussink of Marble Hill, Missouri, created a Website, from home, that derided the school's Website, using profanity and urging others to complain against what he thought of as its poor quality. The school flunked him and prevented him from graduating as punishment. U.S. District Judge Sippel sided with Beussink in his decision to issue an injunction against the school district from suspending Beussink because of his online activities. Carvin cites Judge Sippel:

> Beussink was not disciplined on February 17, 1998 because he was disrespectful or disruptive in the classroom. Beussink was disciplined because he expressed an opinion on the Internet which upset Principal Poorman.... Indeed, it is provocative and challenging speech, like Beussink's, which is most in need of the protection of the First Amendment. Popular speech is not likely to provoke censure. It is unpopular speech that invites censure. It is unpopular speech which needs the protection of the First Amendment. The First Amendment was designed for this very purpose. Speech within the school that substantially interferes with school discipline may be limited. Individual student speech which is unpopular but does not substantially interfere with school discipline is entitled to protection.

While Carvin promotes the idea that free speech includes what a student produces and posts on the Internet, he does not believe that Websites rife with violent imagery or vituperative rhetoric should be ignored by the school's teachers or administration. Instead they should be used as a signal that this student may need some counseling.

3.7.2 INTERNET FILTERING AND STUDENTS' ACCESS TO THE INTERNET

Shepard (n.d.) describes the growth of the Internet and the importance it will play in the future of today's students in terms of research and information sharing. Shepard says the danger in unlimited access to the Internet is the high incidence of sites that "contain highly graphic pornography, hate literature, and recipes for bombs." He presents a chart showing the large number of results he got when he did a basic search using terms such as "sex", "pornography", "hate", and "bomb".

He says one of the reason school districts are concerned is the liability they could face if students use their equipment to view such sites. Shepard writes about the Communications Decency Act, which is part of the Telecommunications Act of 1996, and declared that any person who

> by means of a telecommunications device knowingly makes, creates, or solicits, and initiates the transmission of, any comment, request, suggestion, proposal, image, or other communication which is obscene or indecent, knowing that the recipient of the communication "is under 18 years of age" could be fined and jailed for up to two years. It also makes it a crime to "display in a manner available" to a person under age 18 "any comment, request, suggestion, proposal, image, or other communication that, in context, depicts or describes, in terms patently offensive as measured by contemporary

> community standards, sexual or excretory activities or organs, regardless of whether the user of such service placed the call or initiated the communication.

Shepard says this act is controversial, but schools have three ways to approach Internet safety: Internet filtering software, a firewall, and an Acceptable-Use Policy (AUP). He does not believe that filtering software works, but argues that a firewall is a necessity. He goes on to say that an AUP should have a description of: the educational purposes of the technology; the school's responsibilities versus the parent's responsibilities; student safety and liability concerns; and the disciplinary process.

The American Civil Liberties Union's position on filtering software in schools and libraries is that students should be taught responsible use instead:

> Instead of requiring unconstitutional blocking software, schools and libraries should establish content-neutral rules about when and how young people should use the Internet, and hold educational seminars on responsible use of the Internet. (ACLU (n.d.))

The ACLU also relies on carefully crafted acceptable-use policies but warns against the "tap on the shoulder " method which would put teachers and librarians in a "big brother" position to monitor user behavior. This paper also applauds the Supreme Court decision to turn down the Communications Decency Act of 1996.

> Our vision of an uncensored Internet was clearly shared by the U.S. Supreme Court when it struck down the 1996 Communications Decency Act (CDA), a federal law that outlawed "indecent" communications online.
>
> Ruling unanimously in *Reno v. ACLU*, the Court declared the Internet to be a free speech zone, deserving of at least as much First Amendment protection as that afforded to books, newspapers and magazines. The government, the Court said, can no more restrict a person's access to words or images on the Internet than it could be allowed to snatch a book out of a reader's hands in the library, or cover over a statue of a nude in a museum.
>
> The nine Justices were clearly persuaded by the unique nature of the medium itself, citing with approval the lower federal court's conclusion that the Internet is "the most participatory form of mass speech yet developed," entitled to "the highest protection from governmental intrusion." The Internet, the Court concluded, is like "a vast library including millions of readily available and indexed publications," the content of which "is as diverse as human thought."

The ACLU believes that, if anything, filtering software should be used by parents and not by government entities. They also believe that filtering software often blocks sites that are not "offensive" but contain words that are being filtered, thus blocking exposure to sites regardless of whether they meet a decency standard.

3.7.3 PRIVACY, THE INTERNET AND THE SCHOOLS

Privacy issues in school policies usually outline how students should respect the privacy of others in regards to passwords and email messages. Little is generally said about the rights students have in terms of their own privacy. In a policy statement offered in District Internet Policy and Regulations (n.d.), privacy rights of those using the Internet under the school's auspices are outlined in this way:

> Routine maintenance and monitoring of the system may lead to discovery that the user has or is violating the District Internet Use Policy, the student disciplinary code, or the law. An individual search will be conducted if there is reasonable suspicion that a user has violated the law or the student disciplinary code. The nature of the investigation will be reasonable and in the context of the nature of the alleged violation.

While a school may try to control to some degree what is on a student's computer, by the above statement it still should, according the template offered, protect itself by also issuing the following caveat:

> The District Internet Use Policy contains restrictions on accessing inappropriate material and student use will be supervised. However, there is a wide range of material available on the Internet, some of which may not be fitting with the particular values of the families of the students. It is not practically possible for the District to monitor and enforce a wide range of social values in student use of the Internet. Further, the District recognizes that parents bear primary responsibility for transmitting their particular set of family values to their children. The District will encourage parents to specify to their child(ren) what material is and is not acceptable for their child(ren) to access through the District system.

In its online manual, the University of Virginia (2000) outlines rules for its students. A section of this handbook is entitled "Who Owns What?" and specifies that while the UVA may not own the student's computer, it does own all the infrastructure that connects the student's computer to the Internet and has authority over who uses its network and how it is used. From that, one can infer that anything the university deems offensive can be discontinued. But, how does the university find what it thinks will be offensive? Again, as in the above policy by the Netizen, the rules state that in the process of "diagnosing or resolving" system problems, an administrator can view or modify any file on the system. While administrators are expected to treat any such information as confidential, they also have a duty to report the information to the appropriate authorities.

In a section entitled Right to Privacy, the UVA issues standard warnings to students concerning the lack of privacy of information posted on the Web. Along with that it states the following:

> "The University will not impose any restraints on, nor make any effort to monitor the content of, communications other than those imposed by applicable federal, state, or local laws, including laws regarding the right to privacy and laws which prohibit defamatory material. Users of the University's information systems are advised that their communications are subject to such laws and that the consequences of violations can be severe."

In Bartlett (2000) the privacy of students' Web browsing has become on issue in New Hampshire. According to this article, a suit has been filed asserting that the list of URLs visited by students in a high school should be public record. The situation began when a parent in Exeter, NH, in an apparent reaction to the Columbine massacre wanted to filter the Websites students could see. When the school declined, he brought a suit against the district to disclose what Websites students did see. The district argued that this information should not be construed as public record and even if it were so construed, the district would be protected on the grounds of individual privacy. The plaintiff argued that students' expectations of privacy were nullified by the school's own Acceptable-Use Policy.

Featherly (2000) reports that the district superior court in Exeter agreed with the plaintiff "that a school district's Web log files had to be turned over to a private citizen who had requested the data under that state's "Right to Know" law." The article states that this is becoming more and more the case in locations around the country and the best way to protect the school's and student's rights to privacy is with a formal policy of record retention wherein the records are purged everyday, thus leaving no records to be disclosed to either concerned parents or marketers, who are starting to consider the information possessed by schools as valuable.

The right to privacy for students using the Internet seems to be an issue that is still contentious. A school, according to the articles surveyed, can best protect its own and its students interests by providing a policy that explicitly states what rights and responsibilities the students have before they ever get online. Parents should also agree upon this policy. The best way to safeguard students' privacy is allowing them the choice to use the Internet within the constraints the school allows.

3.8 COMPUTERS AND HEALTH RISKS

Over 100 million people in the United States today use computers. More than 50% experience eyestrain, headaches, blurred vision and other visual symptoms related to sustained use of the computer. This type of stress on the visual system can also cause body fatigue and reduced efficiency at work. (Grossman, n.d.). Dr. Edward Rosick argues

that computer use does not cause permanent sight damage, but that fatigue can result from staring at a computer screen for prolonged periods of time. He adds that this fatigue could lead to a lack of productivity. Grossman reports that eyestrain can be reduced by stress-relieving lenses prescribed specifically for computer operation, special anti-glare screens, eye exercises, and nutritional supplementation. (Grossman,, n.d.).

Of even greater concern, repetitive-stress injuries (RSIs) are epidemic among American adults — from 13 million to 20 million are affected, according to the National Academy of Sciences. Carpal-tunnel syndrome and related injuries caused by repetitive hand motions are the leading workplace hazard in the United States. (Fisher, 1999)

As the number-one workplace hazard in the United States today, RSIs and ways to combat them are being studied intensively. Ergonomic computer hardware and office furniture are studied, designed, and marketed, and exercise and postural studies and recommendations are made — to adults. However, very little attention has been paid to RSI or RSI risk patterns in children. Today, children increasingly use computers both for education and recreation. Millions of children use computers on a daily basis at school and at home. With extensive computer use, children can suffer both transient discomfort as well as potentially permanent damage to their health (American Optometric Association, 1997). Alan Hedge, one of the leading researchers on repetitive stress injuries, and a leader in the investigation of its effects on children, points out that "mass computerization in the workplace in the 1980s led to massive increases in repetitive-strain injuries (RSIs) in the 1990s. . . .What will mass computerization of the schools in the '90s lead to?" (quoted in Landon, 2000).

In a 1998 study, Hedge and others took on this question. (Oates, 1998). They found that computer-workstation designs in schools were substantially worse in ergonomic terms than those in offices — offices in which the RSI epidemic is taking place. Furniture was often not designed appropriately for smaller children, who often sat in chairs designed for people of a very different size, who had to look at a sharp upward angle to see the computer screen, and who had to hold their wrists at unnatural angles in order to manipulate the mouse. All these factors have been shown to play important roles in the onset of RSI in adults.

There are now some reports of pre-RSI symptoms in schoolchildren: "What you're seeing more in the younger kids is headaches and neck and upper-back soreness," says Andrea Fefferman, a chiropractor with Family Chiropractic Centre in Kanata, Ontario. "I am definitely seeing it in kids as young as seven and eight, and up until university." Dr. Fefferman says that these children report that they are spending several hours a day in front of a computer. (Landon, 2000).

Perhaps more importantly are increasing reports of teenagers and young college students developing RSI problems. Dr. Patrick Foye, an assistant professor of medicine and rehabilitation at the New Jersey Medical School in Newark, says, "I am seeing a significant number of people in their 20s with these disorders" (Fisher, 1999).

According to Hedge, the initial reaction to his report that children were at risk, albeit delayed risk, was "What is the purpose of this? There's no evidence that children are suffering from carpal-tunnel syndrome." He responds that "[w]e know it takes five to 10 years before these injuries develop. That's why we're seeing more and more university and college-age students developing these problems. . . This is a cumulative disorder, so these injuries began when these people were adolescents — 10 or 12 years old" (Fisher 1999).

RSI is an umbrella term for several afflictions, perhaps the best known of which is carpal-tunnel syndrome. RSI symptoms are usually mild at first, and often go unreported. By the time one is experiencing significant pain, numbness, or weakness, however, permanent damage may have been done, involving life-long pain, weakness, and loss of coordination. Schools will almost certainly have to devote considerable effort towards reducing risk for children in the next decade, just as workplaces have done in this one.

3.9 CONCLUSION

The proliferation of educational technology, and of its affiliated literature, has been remarkable for the past 20 years or more, and this proliferation is showing no signs of abating. While conflicting philosophies, methodologies, and opinions concerning computers in the schools are legion, the unifying principle we found in the literature surveyed was the importance of careful planning, often in areas in which current school personnel have little expertise. A

well thought-out technical infrastructure; the provision of good technical professional development for staff and faculty; careful selection and integration of digital curricular resources; clearly stated use policies that balance a school's need for order and for protection from liability with the first and fourth amendment constitutional rights for students: all these areas will require full-time attention from those schools that open their doors, even if only part way, to the digital age. And few schools will fail to fit this description.

Literature reviews are by nature conservative affairs: they reflect what has already been written, and do not generally strike out onto new trails. However, we might cautiously suggest that the one area covered in our review that is not based on an already extensive literature, and that is not related to an issue currently making big waves in schools across the country, will, in the next five to fifteen years, find its place in the spotlight. The few articles we cite here on the topic of computer use in grade schools and RSI are very likely to be the forerunners of a literature as vast as the others we have reviewed.

4.0 METHODOLOGIES AND ANALYSIS

4.1 METHODOLOGY

Since time and an uncertainty about faculty expectations were concerns, interviewing was the data-collection method used for this project. Interviewing allowed for immediate feedback and interaction that would not have been possible with another tool such as a survey. Interviews were conducted with faculty, students, administrative staff, technical staff, and the librarian. Both one-on-one and group interviews were conducted in person, on the phone, and by email. Different interview questions were used with different groups (Appendix B). The goal of data collection was to assess experience levels, concerns, and opinions about technology needs.

Interviews were also conducted with personnel in the Round Rock public school system, who had already implemented a program for applying technology in the classroom. Dr. Judi Harris, an Associate Professor of Curriculum and Instruction at UT and an authority on using technology in education, was also interviewed. These interviews supplied additional information about best practices conducted by other school systems. The structures of these interviews were open and had no prior set of suggested questions.

4.2 ANALYSIS

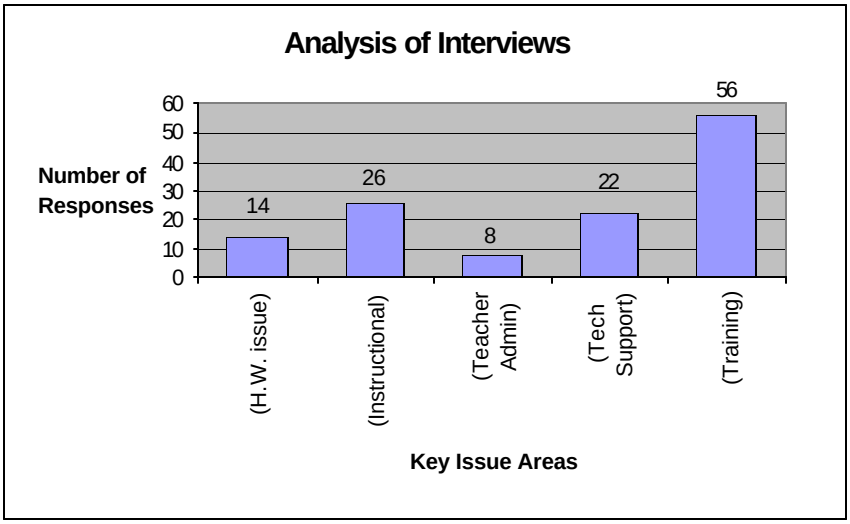
The Interview Analysis (IA) team started the review process by collecting notes from all interviews. The IA team reviewed each interview document and extracted verbatim or near-verbatim phrases that encapsulated any key issues, comments, or points noted throughout each interview. Team members discussed and agreed upon a set of one- or two-word categories to which to assign each comment. The IA team kept the categories broad in order to group comments together by Key Issue Areas. Some comments fell into multiple categories. Categories and descriptions are as follows:

- **Concern. Indicates stated concern. Concerns can be both positive and negative.
- Current Skill Level (Skill L/M/H, L=low, M=medium, H=high) refers to assessment of computer knowledge and skill level based on information included in a comment.
- Hardware Issue (H.W. Issue) refers to or alludes to the need for hardware items. Examples include RCA cables, printers, printer ribbons, computer microscopes, wireless PC cards, loaner laptops, etc.
- Instructional Resource (Instructional) refers to end-user instructional resources (not. resources about resources).
- Policy (Policy) refers to a statement regarding policy or indicating a need for policy.
- Teacher Administration (Teacher Admin) refers to the administrative activities of teachers, such as grading or the process of developing lesson plans.
- Technical Support (Tech Support) refers to any aspect of hardware, software, or network support.
- Training (Training) refers to any particularly identified software or hardware skill (e.g., using MS PowerPoint) or area of knowledge regarding the use of technology. Comments do not imply that the particular commentator lacked the skill, only that the need for the skill or knowledge among the general population of teachers might need to be addressed.

4.3 RESULTS

Interview results were sorted and arranged by category (Appendix B). The following are results sorted by number of comments per category, listed in descending order: Training, 56; Instructional, 26; **Concern 26; Tech Support, 22; H.W. issue, 14; Skill M, 12; Skill L, 10; comments, 9; Teacher Admin, 8; Skill H, 6; Policy, 4 (see Figure 4.3.1). The graph includes hardware issues, instructional, teacher admin, tech support, and training.

Figure 4.3.1



4.4 INTERVIEW SUMMARY

Three major themes emerged in our discussions with teachers: the need for more training, the need for more technical support, and the intention of using computers as a support tool rather than as a regular part of the curriculum. Following is a more detailed examination of those themes.

4.4.1 TECHNICAL SUPPORT:

By far, the need for training was the biggest concern expressed by both teachers and students. Though most seemed at least comfortable with technology, the teachers that were interviewed encompassed a broad spectrum in terms of their knowledge of, and experience in, using computers. Many had used common office applications, mostly wordprocessing and presentation software, and had some experience with email and Web browsing and searching. Teachers recognized the importance of receiving further training in order to realize the full potential of their laptops, but, at the same time, some teachers were afraid that benefits from further training would not be worth the time spent. Even many of those teachers who foresaw definite benefits from computer training were concerned about the amount of time that training would take away from teaching. Considering the amount of time that teachers spend developing and actually teaching their lesson plans, most teachers did not see a viable way to fit computer training into their already busy schedules. The training that the faculty requested the most was, in order of importance: advanced Internet searching (with the aim of finding resources and curriculum ideas), basic hardware troubleshooting, basic PC use, and MS Office applications.

4.4.2 INSTRUCTIONAL OPTIONS:

Almost all of the teachers felt that the current level of technical support was inadequate, and that the future success of the laptop integration would depend on increased availability and responsiveness of a technical support team. Currently, a single network administrator is in charge of all technical support for both St. Andrew's campuses and all three St. Andrew's schools: upper, middle and lower. Some teachers were aware that there was a technical support person but were unsure when he was at school. Other teachers were not aware that any support existed. Several teachers were concerned about the dependability of the network and suggested that the school have at least one technical support person and one network administrator on campus at all times. Some teachers seemed concerned that unresolved technical problems could disrupt their classes, detracting from the learning environment. Several teachers expressed interest in using their laptops for class presentations. These teachers had been unable to do so due to a lack of essential hardware or support in setting up equipment. Much of the skepticism about the immediate success of this program stemmed from the lack of adequate support.

4.4.3 PROFESSIONAL DEVELOPMENT:

Most of the teachers we talked to seemed reluctant to use computers as an integrated part of the classroom. Many teachers felt that they were doing a good job overall without computers, and they were reluctant to replace print resources with electronic ones and to use computers for drill work or for teaching basic skills. On the other hand, most teachers understood the benefit of using computers and the Internet to access materials not immediately available at the school. One teacher, for instance, wanted to use the Internet to show skeptical students practical applications of the math they were learning. Another teacher used a particular Website for students to study the original book reviews written about a 19th-century novel. Several teachers also expressed interest in using information from the Internet to create new curriculum materials or to find new resources to add value to their lessons. In essence, teachers saw computers mostly as an aid for reference and research, or "teleresearch," as Harris (1999) calls it. Only one teacher interviewed suggested using the Internet for "telecollaboration"—that is, working jointly with other students across the country or around the world via the World-Wide Web.

One of the most frequently mentioned potential benefits of using computers in teaching was in augmenting the core curriculum in order to address the needs of students at different skill levels. While the students at St. Andrew's, in general, seem advanced by public school standards, many teachers mentioned that, among students, there was a wide range of learning abilities and prior exposure to material. By working on computer-based resources outside of class, slower students could receive tutoring, and more advanced students could work ahead of the class.

Teachers were skeptical about the quality of educational software packages, though several teachers were currently using them. At least two teachers mentioned the difficulty of finding software that educates more than it entertains, and others found it difficult to find high-quality software at all. However, several members of the faculty reported that students responded to tasks with more enthusiasm if the tasks involved using computers. Teachers' ambivalence about the introduction of computers into the learning process highlighted the importance of performing a careful analysis of the benefits and drawbacks of using computers on an overall and case-by-case basis.

4.4.4 THE STUDENT PERSPECTIVE:

In conversations with students, including an in-class focus-group-type discussion, students seemed comfortable with computers, though the students in Mr. McGhee's class who had laptops were much more vocal about their comfort level. Like the teachers, they needed more advanced Internet training and expressed a need for typing skills. Most of the skills they have they learned on their own, though they have had repeated exposure to computers in class. For independent research, they seemed to rely almost exclusively on the Internet.

5.0 BEST PRACTICES

5.1 INTRODUCTION

After assessing current use, needs and expectations for technology at St. Andrew's Middle School, programs from other schools were examined to identify useful models in the areas of training, technical support, and instructional options. Teacher training is the most fundamental first step in the process of technology integration. Teachers must have the necessary skills and feel comfortable with technology in order to make it a viable educational tool. Second, adequate technical support is essential to facilitate programs and to prevent valuable class time from being wasted by technical problems. Technology must be seamlessly integrated into the classroom experience to be truly effective. Finally, the ultimate goal of technology integration is to have a dynamic and adaptive curriculum that allows teachers to meet the varying learning needs of their students.

As information technology becomes more integrated into our society, resources must expand to meet the changing needs of teachers and students using technology in education. Historically, technology has been taught in schools as a separate class. With one lab for 10 to 20 classes, scheduling is competitive and difficult. In recent years, educators have realized that this approach was not meeting the objectives of developing students prepared for real-world experiences. Therefore, schools need to think about making the computer as standard in the classroom as paper and pencils.

5.2 PROFESSIONAL DEVELOPMENT

Professional development for teachers has become an increasingly important subject in recent years, especially as part of the effort to integrate technology tools into the daily practice of teaching. Despite increased attention, however, the shape of professional development seems to have changed little. Teachers are, for the most part, still expected to learn on their own time, away from the work context in which new knowledge needs to be applied. The primary modality continues to be the workshop, a class, or a series of three or four classes, which last for a few hours or a few days.

The International Society for Technology in Education (ISTE), a non-profit organization of educational technology professionals, provides recommended standards for technical competency among teachers. The National Council for the Accreditation of Teacher Education endorses ISTE requirements and programs for the following:

- Educational Computing and Technology Literacy Endorsement
- Secondary Computer Science Endorsement
- Secondary Computer Science Education Initial Degree Program
- Educational Computing and Technology Leadership Advanced Program

ISTE standards are used in evaluating post-secondary education programs for teachers in the United States. Guidelines include curriculum standards, support standards, and assessment and evaluation standards (Stager, 1995). ISTE standards can be found in Appendix A, Section 1.0 and 2.0.

5.2.1 PROFESSIONAL DEVELOPMENT MODEL 1: NEW VISTA HIGH SCHOOL

New Vista High School in Boulder, Colorado provided professional development to their faculty in the 1997-1998 school year through a program called "The Working Shops." Providing the details of the plan and why this process was chosen, Steven Kalmon (1999) writes, "The basic design of the Working Shops process is deceptively simple: participants work in teams (usually with four or five members) in order to create products (e.g., curricula, projects, and learning tools)." A team might create a Web-searching lesson or an instructional lesson on desktop publishing (Kalmon, 1999). This technique appears to be productive in teaching the necessary skills to the teachers, by applying real tasks that are applicable to the classroom and lesson plans. Kalmon (1999) writes, "This approach fosters deeper and more sustainable engagement—one which supports both the concrete application of what one learns in daily practice and a larger sense of vision or purpose."

The Working Shops, currently New Vista's primary strategy for professional development, consist of an interdisciplinary team of teachers along with other professionals from the educational community. They usually meet at least once a month for at least a year. Meetings are usually three hours in duration and take place during the workday. The focus of the team is to develop new strategies for teaching and to learn new technological skills. Working Shops are different from traditional workshops in two ways. First, the workshops emphasize continuity and context. In other words, the tasks are holistic projects with expected outcomes. Second, the training is not conducted by outside personnel, unless specific needs are identified by the team members and require extra expertise. For example, the team may invite a guest speaker on a particular topic. Examples of teams are: Earth/Physical Science Integration, Integrated Math, Intra-Inter/Personal Skills, Social Studies Simulations, Transitions, Virtual Library, Web Research, and Writing Across the Curriculum (Kalmon, 1999).

5.2.2 PROFESSIONAL DEVELOPMENT MODEL 2: JORDAN MIDDLE SCHOOL

Five years ago, Jordan Middle School, located in Palo Alto, California, began the process of implementing technology. State technology-training funds are currently being used to develop staff. For the 2000-2001 academic year, 15 teachers are involved in a pilot laptop program. Each teacher is to participate in five full-day workshops. One workshop was held on August 23, 2000. There were to be two 2-day workshops later in the year, one in October 2000. Topics covered in the August workshop were mouse track-pads, battery levels, modems, Ethernet cables for home usage of laptops, wireless networking, and on-site technical resources. Software packages reviewed were Microsoft Office, Netscape, HyperStudio, AdobePhotoshopLE, PageMill, PowerGrade, Inspiration, and Geometer Sketchpad (Jordan Middle School, 2000). Information was given on how to request other software and

get it installed. This workshop also discussed what is involved in the pilot program of 60 sixth-grade students, expectations, and administration of the program.

The purpose of the two-day workshops is for teachers to "explore, plan, and develop techniques for using their laptops with students and to enhance their own workflow (Jordan Middle School, 2000). Technology mentors as well as technology coaches are used to assist teachers with technology related ideas and issues. The October training was made available online at http://jordan.palo-alto.ca.us/laptop/phase2-day1-tut.html. The title page links to the actual Site for WebQuest, http://www.pekin.net/pekin108/wash/Webquest. This Website hosts an interactive learning experience, *King Tutankhamun, was it murder?*, that allows teachers (and students) to participate in an actual online curriculum experience. The teachers get into groups of four or five, objectives are stated on the title page, and the game begins!

Besides the above-mentioned training, all teachers have the option of selecting from 12 computer-technology courses offered on in-service days. Among the topics are classroom projects with Appleworks, classroom projects on the Internet, classroom projects with Kidpix Studio, individualized learning online, keyboarding methods, making one computer work with thirty students, beginning and intermediate Microsoft Word, online projects in the secondary classroom, student-produced multi-media, using Internet resources, and Utah Educational Network staff development. (Jordan School District, 2000)

5.2.3 PROFESSIONAL DEVELOPMENT MODEL 3: ROUND ROCK INDEPENDENT SCHOOL DISTRICT (RRISD)

Each campus in the RRISD has a Technology Facilitator who serves as the primary on-campus technology-training and -support person. The job description states that the Technology Facilitator will, among other duties, "assist campus staff in planning, coordinating, and implementing the campus and district plans for instructional technology" and "provide one-on-one, 'just-in-time' training and support for technology users in the school." (RRISD, 2000d)

RRISD uses both just-in-case training and just-in-time training. The just-in-case training consists of instructional modules covering specific topics including: Windows 95; wordprocessing; spreadsheets; databases; graphics and desktop publishing; telecommunications; social, human, and ethical issues; multimedia; Web authoring; and email. The modules are taught by the campus Technology Facilitator using online materials, which are standardized across the district. The online materials include lesson plans and checklists for technology competencies. (RRISD, 2000b)

Just-in-case training is good for raising awareness, but is not the best way to train teachers. RRISD is currently emphasizing the just-in-time method of teacher development. (K. Turpin, personal communication, October 4, 2000) The Texas Education Agency Long-Range Plan for Technology 1996-2010, states that "just-in-time professional development rejects the standard of often irrelevant or ill-timed professional development presented just in case one ever needs it. It replaces this with a new standard for professional development, one that is on demand and just in time for effective use." (Texas Education Agency, 1996) Just-in-time training at RRISD primarily consists of "team teaching." The Technology Facilitator goes into the classroom and assists the teacher in using technology when something new is done for the first time. Teachers can participate at whatever levels they are comfortable with, from full participation, to sitting down and learning along with the students as the Technology Facilitator demonstrates (K. Turpin, personal communication, October 4, 2000).

5.3 TECHNICAL SUPPORT

High-quality technical support in a school setting is a key factor in ensuring the smooth transition of technology into the classroom. If teachers are assured that they will have on-site help with technical problems, they are more likely to support use of technology in the classroom. Many schools have rapidly upgraded the technology resources of their schools, but have paid little attention the selection and design of the support organization. Smith and Fisher (1999) writes, "The US Office of Technology Assessment (1995) cited the lack of technical support for teachers and students as a problem that interferes with the integration of computers into the classroom."

M. Margevicius (1999) recognizes that there are certain technology environments that require more support than others. One of the environments is an organization using laptops. Considerations that affect the amount of staffing needed for technical support are: levels of customer satisfaction, hours of use, morale, amount of peer support, number and complexity of tasks, and backlog of work. In order to establish the amount and level of support end-users require, it is beneficial to evaluate user expectations and current satisfaction levels. The researcher writes, "Used correctly, … customer satisfaction surveys, which help determine levels of PC support, often point out major gaps in end users' actual versus perceived requirements" (Margevicius, 1999).

5.3.1 TECHNICAL SUPPORT MODEL 1: BUSINESS ENVIRONMENT

End-users need a single-point-of-contact (SPOC), such as a help desk, for technical support. The SPOC takes a call, performs the root-cause analysis, generates a trouble ticket, and assigns the problem to "Level 2" or "Level 3" support (Margevicius, 1999). Efficient workflow enables the SPOC to delegate support tasks to appropriate individuals.

5.3.1.1 LEVEL 1: HELP DESK

A Help Desk is defined as the segment of technical support that performs services in direct support of end-users with hardware, software, and network components. Level 1 could include answering a phone hot-line as well as email inquiries and forwarding inquiries to appropriate personnel. The help desk or call center is a useful support element because it improves workflow, reduces organization workload, allows technical staff to concentrate on high-priority tasks, and speeds up the serving process (Giga Information Group, 1996).

5.3.1.2 LEVEL 2

The services performed by Level 2 relate to selection, installation, and maintenance of desktop software and hardware. This level of support performs installation and maintenance of local networks and connections to mainframes, Web servers, and dispatched support. Level 2 completes such tasks as installation and configuration, maintenance, and upgrades (Giga Information Group, 1996).

5.3.1.3 LEVEL 3

Level 3 performs tasks related to "the development of standards, the evaluation of new techniques, and the introduction of new technologies to end-users. Level 3 support also contributes to overall systems architecture, assists in project activities" and ensures that the organization is aligned with technology. Level 3 support also provides immediate support for highly complex problems (Margevicius, 1999).

5.3.2 AVERAGES OF TECHNICAL SUPPORT RATIOS

Beattie (2000) writes that the corporate standard for IT support is "one support personnel for every 50 PCs. In schools that distribute laptops to every student, that means 400 students and faculty require a technology staff of eight – hardly the norm." When sufficient technical resources are not available in school settings, teachers must become knowledgeable about technology. Obstacles encountered in staffing technical positions in schools include competition with businesses for skilled individuals, recruiting skilled individuals able to function in an educational environment, hesitation of school administrators to hire non-teaching staff, and difficulty in assessing the technical skills required for technical positions.

In corporate settings, the 1998 Gartner Group IT Spending and Staffing Survey results indicate that the "average IT-employee-to-enterprise-employee ratio is 6.58%, with a median of 4.67%." These figures do not reflect the amount of outsourced IT support that is also utilized (Potter & Guptill, 1999). Therefore, the amount of IT support is increased in proportion to the services provided by external organizations such as an Internet service provider. For each of the three types of technical support, Margevicius (1999) offers typical ratios of staffing (refer to Table 5.3.2.1). High-technology users require higher levels of technical support. In contrast, low- to medium-technology users require less technical support. A low-technology user is defined as a member of an organization who uses technology only after it has been proven stable and he or she is required to do so.

Table 5.3.2.1: IT/PC Support Ratios

	High Tech. Users	Medium Tech. Users	Low Tech. Users
Help Desk	1:80 to 1:110	1:120 to 1:160	1:200 to 1:260
Level 2	1:45 to 1:85	1:90 to 1:130	1:140 to 1:180
Level 3	1:250 to 1:400	1:400 to 1:700	1:800 to 1:1100

Source: Margevicius, 1999.

General IT-support ratios are provided by additional business-research reports. Company averages of IT and PC support are one end-user support person to every 100-150 users (Gliedman, 1998; Woo, 2000). At St. Andrew's Middle School, this level of support could be accomplished with one full-time person and additional part-time staff. Other averages mentioned by Woo (2000) recommend one help-desk analyst to 150 end-users. Another ratio provided by Vail (1999) states that "the industry standard is one technology specialist for every 60 users, a far cry from what goes on in public schools"

5.3.3 TECHNICAL SUPPORT MODEL 2: EDUCATION SERVICE PROVIDER (EDUSP)

EduSP is defined as an Application Service Provider (ASP) providing outsourced services to schools and universities by acquiring hardware and software applications as well as paying the maintenance and leasing fees. An example is the service offered by Sun Microsystems, Inc. "Sun Microsystems established the vision of distributed computing that makes the EduSP business model viable — The Network is the Computer. Sun now sees an opportunity to facilitate the information technology industry in building upon this EduSP model, thus significantly assisting the education community in lowering costs and offering their stakeholders far better computing facilities than would otherwise be possible" (Sun Microsystems, 1999). Sun employs and trains staff to provide support and maintain the network infrastructure, allowing the school or university to concentrate on education. The EduSP must provide services, networking, and application support. The EduSP provides services infrastructure, project management, and customer support. Networking includes a data center, WAN infrastructure, managed services, network monitoring, and network security. Finally, application services include license administration, application integration, application management, and application support.

According to Sun Microsystems (1999):

> The Education Service Provider model is a powerful new tool to help reduce expenses and enable new services for students, teachers, and administrators. With the new Education Service Provider model, the infrastructure of networked workstations and browsers, installed for use of the Internet, is immediately available to administrators, educators and students, allowing them to take advantage of the growing number of EduSP applications and services.

The cost to the school is lower in using an EduSP in two ways. School administration will not be required to spend a lot of time hiring and developing staff support, and the financial cost is lower than accomplishing in-house

technology integration (Sun Microsystems, 1999). In Table 5.3.3.1, Sun Microsystems (1999) exhibits how use of their system makes less work for the school administration in terms of IT support creation and maintenance.

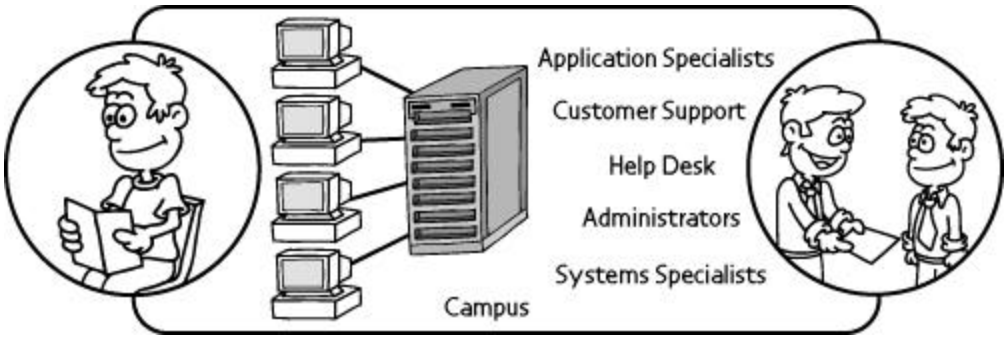
Table 5.3.3.1

EduSP: A Solution for Educators		
Customer Challenges	Traditional Solution	EduSP Solution
Hardware upgrades are frequent and expensive	School upgrades hardware as frequently as budget permits	EduSP buys hardware, installs upgrades
Applications upgrades are frequent and expensive	School upgrades software as frequently as budget permits	EduSP upgrades application software as frequently as required
Hardware and software maintenance is expensive	Must be funded by the school	EduSP contracts for maintenance
Hiring IT staff is expensive and increasingly difficult	Must be done by the school	EduSP recruits & retains expert staff
Planning for IT obsolescence	Often only possible on five-year cycles	Because costs are spread across multiple institutions, EduSP can afford to replace equipment & software as required
No disaster recovery	Disaster recovery is often so expensive that it is done without	EduSP contracts with SunGuard or other disaster recovery service
Financial resources for capital expenditures	Purchases often only possible on five-year cycles	Lease model eliminates need for capital outlay

Source: Sun Microsystems, 1999

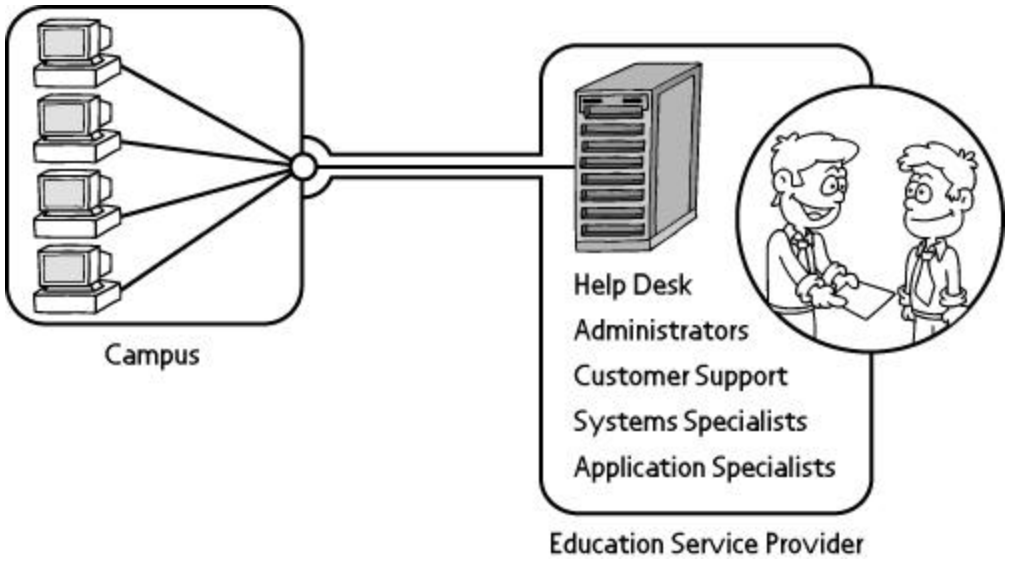
The figures below represent traditional in-house support and EduSP outsourcing. These representations detail areas that must be covered by a technical-support organization. The difference between the two is environmental: internal versus external support. Figure 5.3.3.1 represents the traditional model of technical support and structure in a school environment. Figure 5.3.3.2 illustrates the structure of services offered by an Education Service Provider in a school environment.

Figure 5.3.3.1 Old Campus Computing Model



Source: Sun Microsystems, Inc.

Figure 5.3.3.2 EduSP Model



Source: Sun Microsystems, Inc.

The technology plan outlined by Sun Microsystems is useful for schools planning to integrate technology even if they do not plan to enter into a contract with an EduSP. By looking at the discussion of the structure and areas that the EduSP covers, technology integrators can derive important elements of essential focus, especially in the area of technical support.

5.3.4 TECHNICAL SUPPORT MODEL 3: JORDAN MIDDLE SCHOOL

Jordan Middle School, Palo Alto, California, is implementing a pilot laptop program during the 2000-2001 school year. The school offers a Webpage for technical support at http://jordan.palo-alto.ca.us/laptop/support.html. This page identifies all of the technological components of the laptop program.

The technical staff consists of eight individuals. Five on-site staff are listed. Two technology mentors teach applications, help with Webpages, develop technology projects, and answer general questions about technology in the school. A network manager handles problems with Internet connections, printing, and repairs. The computer lab manager helps with software installations and lab reservations. The principal is also listed on the technical-support contact sheet (http://jordan.palo-alto.ca.us/laptop/contact.html) and can answer general questions about the laptop program. Three off-site personnel include Paula Hundley, the contact consultant with Bell Labs Research; the PTA President; and the PTA Fundraising Chair. Ms. Hundley responds to program questions, wireless issues, recurring problems, and instructional planning with laptops. The PTA contacts answer questions concerning funding and implementation updates, information on scholarship programs and donations, and volunteering (Jordan Middle School, 2000).

5.3.5 TECHNICAL SUPPORT MODEL 4: ROUND ROCK INDEPENDENT SCHOOL DISTRICT (RRISD)

Every RRISD campus has a Technology Facilitator who is the primary support person for technology. The Technology Facilitator is responsible for setting up beginning-of-the-year email and student network accounts as well as for coordinating the development and maintenance of the campus Website. The school district also employs hardware technicians and network specialists who are on call. When a technical problem arises, the Technology Facilitator performs initial trouble-shooting and then contacts the district technicians to ensure that problems are resolved quickly. RRISD has a ratio of one on-site support person to approximately 100 network users. With on-call

technical support, the Technology Facilitators are able to spend the majority of their time on instructional support. RRISD seeks to minimize their need for technical support by standardizing hardware, software, standards, and protocols across the district.

Some of the maintenance problems encountered by RRISD include crashed hard drives, loss of Ethernet connections, hub problems, improperly installed cards, and software conflicts. Software loaded by third parties has been a problem, so it is recommended that the maintenance person be present when any software is loaded. Email is very troublesome and causes lots of complaints, often because users do not understand the software. Viruses have been another source of network problems at RRISD. Virus definitions must be continuously updated. The Technology Facilitator keeps a maintenance logbook for all equipment. (K. Turpin, personal communication, October 4, 2000)

5.3.6 ADDITIONAL TECHNICAL SUPPORT STRATEGIES

5.3.6.1 STUDENT VOLUNTEERS

Since some students are already computer-literate, using students as technical support can be beneficial. Shields (1997) recommends that you "Take advantage of the technological aptitude of your students. Kids are often quite comfortable with computers, and, with some training, can take on many technical jobs, freeing you to concentrate on instruction" (Shields, 1997). Students can act as mentors and be trained along with teachers. Suggested guidelines published by *Technology and Learning* can be found in Appendix A, Section 3.0.

In Smyer, Texas, a troublesome teenager's hacking interests were used for good when the new technology director decided to employ him as a technology-support person. Vail (1999) writes, "Now a graduating senior, [the student] has worked with [the technology director] as her assistant, repairing computers, installing software, building a server, and troubleshooting for the network. If he needed help, he recruited other students in [the technology director's] computer class and assigned jobs to them. He even trained teachers and community members to use the Internet."

The decision to use student volunteers as technical support has proved to be a good idea. "Proponents of this arrangement say the experience benefits the students . . . . [B]ecause workers with these skills are in such high demand, students often receive lucrative job offers during the summer and upon graduation." (Vail, 1999). Also, the students may earn class credit. The students can perform activities of many kinds; for instance, working on the help desk, installing cable, building and maintaining Websites, and maintaining hardware. Judy Lind Holm in Marshalltown, Iowa organized a curriculum path for students called "Computer Consultants" for students interested in technology careers. Students begin in middle school and continue in high school. The students serve as technology experts for their schools, available to answer questions from teachers, install software, repair hardware, and perform other tasks. Another example of using students as technical support can be found in Bellingham, Washington. Student volunteers help teachers "retrieve lost documents, [make] sure the computer prints to the correct printer, [and install] virus-scan software" (Vail, 1999).

McKenzie, however, offers an alternative point of view. "Schools should not use children to make up for failing to allocate money to professional development and technical support . . . .[S]tudents should not be doing work meant for adults . . . " (personal communication as cited in Vail, 1999). Using students as additional support along with professional staff is a preferred solution. Guidelines for beginning a student-volunteer support program are available in the *Technology and Learning* article cited above (Shields, 1997).

5.3.6.2 PARENT VOLUNTEERS

Westside School in Westside, Oregon has become a "national model," according to an article at Microsoft in Education ("Writing the Book," 2000). The principal, Betty Stanhope, advises that an important factor in successfully integrating technology in the schools is involving parents in the process. One way of doing so is by using them as volunteer technical support. According to the principal at Westside School,

> It's standard for schools to solicit parental involvement. But at Westside, parents don't get by with just making copies or donating cookies for the bake sale—they're put to work

in the school's classrooms and computer lab. The technology consultant who trains Westside teachers also donates her time to train a group of parents who provide "just-in-time" assistance for teachers two mornings a week. That helps teachers make the most of their time for teaching ("Writing the Book," 2000).

5.3.6.3 LIBRARIANS AS TECHNOLOGY ADMINISTRATORS

In Bellingham School District in Washington, technical support is delivered on site by a team of technology integrators. The support team aids in training and classroom use of technology. "School library media specialists serve as technology coordinators at each school. They will receive ongoing training" (Bellingham School District, 1997). This act of assigning the role of technology coordinator to library personnel is quite common in schools integrating technology in a fast-paced environment, especially in public schools with little funding for additional staff. For the integration of educational technology, support staff must be highly trained. Bellingham insists on constant development of all support staff.

5.4 INSTRUCTIONAL OPTIONS

The strategies used to effectively incorporate technology into the curriculum should be related to educational goals of a particular unit and instructional methods used to teach the unit. The two instructional methodologies most frequently referred to in discussions of incorporating technology into education are the traditional method and the constructivist method. The traditional method is a teacher-centered method where the teacher is the source of information (e.g., lectures) and the center of activity (e.g., performs demonstrations). The constructivist method is a student-centered model in which students actively work at constructing their own knowledge through activities designed to stimulate learning. The teacher's role in this setting is to be a learning facilitator rather than an information disseminator (Garsnett, 1999). Different schools using these two different methods have effectively incorporated technology. Round Rock Independent School District (RRISD) is an example of a teacher-centered school, and the Dalton School in New York City is an example of a student-centered school. Through experimentation, both of these schools have molded technology to meet their educational goals.

5.4.1 INSTRUCTIONAL OPTIONS MODEL 1: ROUND ROCK INDEPENDENT SCHOOL DISTRICT (RRISD)

The Round Rock Independent School District (RRISD) is using an integrated approach to teaching computer literacy. Since 1984, the state of Texas has required computer-literacy training at the middle-school level in public school systems. At first, schools were required to have a separate computer class where students learned computer skills. Schools that wished to deviate from this method had to obtain a waiver to try a different approach. The state is now encouraging classroom integration of technology, and waivers are no longer required. RRISD's goals for technology integration are based on a set of "assured experiences" to which students are exposed. (K. Turpin, personal communication, October 4, 2000). Assured experiences are guarantees that every student has had the opportunity to learn technology. RRISD believes that "integration of technology into the learning environment is critical for personal success and full participation in the society of the 21st century" and therefore students must:

- Learn to evaluate and select appropriate hardware, software, and electronic resources for managing and communicating personal and professional information.
- Acquire the skills necessary to use technology tools to access, create, and communicate ideas and information.
- Apply information and technology tools for problem solving and communication
- Demonstrate an understanding of the laws and issues regarding the use of technology and society.
- (RRISD Definition of Assured Experiences, 2000)

RRISD's philosophy of integrating technology throughout its curriculum is reflected in the mission statement of the Instructional Technology Department. The department "is committed to school/home connectivity and the seamless integration of technology in life long learning…" (RRISD Instructional Technology Department, 2000)

To help achieve its goals, RRISD has applied for and received a Technology Integration in Education (TIE) grant funded by the US Department of Education Technology Literacy Challenge Fund. The purpose of the TIE grant is to promote the four goals of the National Educational Technology Plan:

- All teachers will have the training and support they need to help all students learn through computers and through the information superhighway.
- All teachers and students will have modern computers in their classrooms.
- Every classroom will be connected to the information superhighway.
- Effective and engaging software and online resources will be an integral part of every school curriculum. (Texas Education Agency, 2000)

RRISD will use the funds so that "students, teachers, and community members interact with mentors, experts and others in data-driven interdisciplinary units in the four core content areas, with emphasis on science and mathematics." (Texas Education Agency, 2000.)

A district-wide committee does technology planning for RRISD. The original members of the committee were teachers who taught computer literacy before RRISD changed to the integrated approach. RRISD's middle-school technology plan is being gradually phased in over three years. The first group of eighth graders will get their first exposure in eighth grade while the next group will come in with a year's experience, so the curriculum must be adjusted accordingly. The target date for complete implementation is May 2002. Teachers have recently been introduced to a standardized lesson-plan format with the goal of eventually having all lesson plans online.

Software is chosen by RRISD to accomplish specific curricular goals. Subject-based software is difficult to evaluate before purchase, and it is more practical to buy application software and fill it up with locally generated content. Along with application software, RRISD also uses the Internet for class work. Internet filters are not used, but guidelines have been written for what each age group is allowed to do on the Internet. RRISD has an acceptable-use policy that specifies what network users can and cannot do, and students must be under a teacher's supervision while using the system. Also, both teachers and students are required to complete ethics training (K. Turpin, personal communication, October 4, 2000).

5.4.2 INSTRUCTIONAL OPTIONS MODEL 2: DALTON SCHOOL

The Dalton School in New York City began incorporating technology into their curriculum in 1990 when they established the New Laboratory for Teaching and Learning, in an effort to explore how computers and advanced information technologies could help build the schools of tomorrow. The mission of the New Laboratory is to collaborate with universities, museums, corporations, and other schools to "pioneer prototypes for change from which more widespread educational reform can begin." Under the guidance of the New Laboratory, the Dalton Technology Plan was created. The plan was designed "to enhance communication within the community, create a new awareness of the range of information locally and globally available, and provide a powerful array of tools which make possible new modes of analysis and expression. Through the use of high-speed digital networks, the Dalton Technology Plan encourages an educational environment free of traditional constraints of time, resources, and space; where cooperation is a significant motivator, and inquiry and self-guided learning have intrinsic value." (The Dalton School, 2000a)

Incorporated into the traditional Dalton education are a number of technological tools that allow the students to pursue assignments designed to enhance problem solving and higher-level thinking skills. Interactive multimedia programs such as Archaeotype, where sixth graders are introduced to the history and culture of ancient Greece and Assyria, through simulated archaeological excavations, have altered the way traditional subjects are taught at Dalton. The technology also provides the students with access to a wider range of cultural works than would be traditionally available in the classroom. (The Dalton School, 2000b) The New Lab continues to develop multimedia curricular projects that promote a hands-on type of learning experience where students actively participate in the learning experience. In addition, an interdisciplinary approach to learning is promoted (The Dalton School, 2000c).

5.4.3 GENERAL PRINCIPLES

Technology can be incorporated into the instructional process in many ways, but the most effective programs share some common elements. The first principle is that technology is most often used in units where problem-solving skills and higher-level thinking skills are being taught. The computer provides information resources through the World-Wide Web, where decisions about information validity and relevance need to be made. Spreadsheets and database programs give students more options for collection and analysis of data. Units including technology can be as simple as a PowerPoint presentation that requires making choices based on reasoning skills, or more complicated, such as a group project where the final result is an artistic representation of how the digestive system works. The second principle common among effective programs is the use of technology in interdisciplinary units. Teachers have created units with technology elements on issues such as homelessness and energy conservation that incorporate skills from math, social studies, science, and the arts. Interdisciplinary units such as these provide learning environments that more closely represent the real world, helping students see the value of the material presented in class. Through technology, developing a unit plan can become an exercise in possibilities rather than limitations.

6.0 RECOMMENDATIONS FOR TECHNOLOGY INTEGRATION

6.1 TECHNOLOGY PLANNING

A technology plan is a “written document that represents the very best thinking accumulated in a particular environment for the purpose of studying technology infusion, then recommending direction for the future" (Forde, 1999). “Defining the implementation plan is the essence of planning efforts” (Valdez, n.d.). Planning should be an organized, continuous process that takes into account the mission and philosophy of the organization and should involve all stakeholders. Planning should be driven by educational goals and objectives rather than by technological developments. A planning committee generally carries out technology planning.

6.1.1 PLANNING COMMITTEE

A planning committee ideally includes administrators, teachers, librarians and members of the community. Before the formal planning process begins, the committee should have a clear understanding of current use of technology. The most important functions of the committee are to define a vision, establish goals, and develop a blueprint for implementation. Once a plan is developed, everyone involved should receive a copy of the plan, and the committee should set standards for review and evaluation of the plan.

6.1.2 TECHNOLOGY PLANNING DOCUMENT

"Each school and district is unique and best knows how to meet the needs of the communities they serve. There are as many different tech plans as there are unique situations. The one thing that all successful initiatives have in common is a committed group of hard working people committed to actualizing the vision of the tech plan they are creating" (Forde, 1999).

Typical parts of a technology plan:

- Setting the vision: desired future state of the organization regarding technology
- Needs assessment: areas needing improvement (human and technology resources) and where the organization needs to be
- Setting goals and objectives: what needs to be accomplished after setting the vision and assessing needs
- Building an implementation plan: specific actions put into writing and timeline set
- Implementation: acceptance of the plan by stakeholders is crucial for success

For links to online examples of technology plans, visit http://www.ncrel.org/sdrs/areas/issues/methods/technlgy/te300.htm. Eight district and three state plans are listed under Illustrative Cases, near the bottom of the Webpage.

6.2 TECHNICAL SUPPORT

Adequate technical support is critical to the success of technology integration. Without appropriate technical support, technology may detract from the learning environment rather than enhance it.

6.2.1 FUNCTIONS OF THE TECHNICAL SUPPORT UNIT

- Applications support, including troubleshooting and upgrading
- Hardware support, including troubleshooting, upgrading, and repair coordination
- Network support involving administration and repair
- Operating-system support involving troubleshooting and upgrading

6.2.2 STRUCTURE OF TECHNICAL SUPPORT

- Help Desk: This unit provides a single point-of-contact: takes calls, handles basic-level troubleshooting, and routes hands-on tasks to support personnel.
- Field personnel: Includes dispatch personnel who provide hands-on support.
- The technical-support coordinator: This individual manages the technical-support organization.

6.2.3 SOURCES OF LABOR FOR THE TECHNICAL SUPPORT UNIT

6.2.3.1 IN-HOUSE

The school directly employs in-house personnel and hiring is done by school administration. This type of support requires more work on the part of the school, but provides more control over personnel hired.

6.2.3.2 OUTSOURCED

Outsourced support is accomplished by either hiring a company to provide technical support or hiring contract individuals from a company specializing in technical support. This option requires less work on the part of the school. Training and competency are the responsibility of the external company.

6.2.3.3 VOLUNTEER SUPPORT

Volunteers might include knowledgeable students from the high-school campus and/or parents. The amount of responsibility given to volunteers depends on levels of expertise. Parents can be invited to attend training that is given to teachers.

6.2.3.4 TECHNICAL SUPPORT COORDINATOR

The technical-support coordinator supervises volunteers and arranges for the training of support personnel and teachers. Librarians can be technical-support coordinators. However, if the librarian is selected, current workload and level of training should be taken into consideration.

6.2.3.5 RATIO OF SUPPORT

According to Beattie (2000), the recommended ratio of support personnel to computers is one to 50. The minimum staffing level would include help-desk personnel, dispatch-support personnel, and the technical-support coordinator. In the future, if laptops are given out to all students at St. Andrew's Middle School, support levels should be adjusted accordingly.

6.2.4 MODEL OF A TECHNICAL SUPPORT TEAM IN A SCHOOL

- In-house support including help-desk personnel and at least one dispatch person
- Help desk staffed by student volunteers who handle dispatching and simple troubleshooting over the phone
- Hired staff personnel serve as hands-on support
- Technical-support coordinator will oversee all support functions
- Network administrator oversees network functions
- Online troubleshooting modules, as well as tutorials on such things as PowerPoint, wordprocessing, Internet navigation, email, etc. should be available.
- Website administrator needed to maintain the school Website if heavy use is expected
- Parent volunteers used to augment the support
- Volunteers should not be used to avoid employing or contracting for professional support personnel.

6.3 PROFESSIONAL DEVELOPMENT

A well planned and well attended teacher-training program is crucial to successful integration of computers. School faculty and staff should work together to decide what types of training will be voluntary and what will be required. Technology goals of the school, both long-term and short-term, should also be agreed upon.

6.3.1 SKILLS ASSESSMENT

An informal assessment of faculty at St. Andrew's Middle School identified the need for the following computer skills:

- Basic laptop and operating system use
- Basic hardware and software troubleshooting
- MS Office applications
- Internet search strategies
- Internet resources

- Email

Based on interviews, students want to acquire the following skills in order to prepare for upper school:

- Keyboarding or typing
- Internet searching and resource assessment
- Windows interface and basic MS Office interface

Skills assessment should be done on a recurring basis. Some resources for creating a skills assessment survey are:
http://itech.fgcu.edu/question.shtml;
http://www.thelearningedge.com/profdev/profneeds.htm;
http://www.zianet.com/msaxton/corona/survey.htm

6.3.2 TRAINING DELIVERY

Once needed skills have been identified, the next step is to determine how training will be delivered. The following is a summary of guidelines and suggestions:

- Just-in-time training generally results in better retention of skills than just-in-case training.
- Training in groups, where several teachers work together to learn a particular tool, seems to aid in skill retention.
- Hiring a staff member exclusively for training is an option, but does not seem to be necessary for success.

6.3.3 MODEL OF TRAINING DELIVERY IN A SCHOOL

Here is a recommended model for delivery of training to teachers and staff members:

- Provide basic training during summer in-service (the weeks before school begins). This training should consist of basic laptop operation, troubleshooting, email, and Internet training.
- Dedicate one or two in-service days (or part of those days) to addressing an identified training need. For these sessions, a guest lecturer might be helpful.
- Provide resources and support for teachers interested in more advanced training.
- Encourage or organize ongoing peer-group workshops during the year where teachers with similar skills can learn an application together (see the New Vista High School model detailed in Section 4).
- Make online tutorials and resources available on the school Website. See the University of Texas Graduate School of Library and Information Science Website for details and examples. (http://www.gslis.utexas.edu/technology/tutorials/)
- Teachers with expertise or experience with applications could be used for occasional technical support or for just-in-time training.

6.4 INSTRUCTIONAL OPTIONS

6.4.1 NEW WAY OF LEARNING

Technology has resulted in an explosion of information and choices. Educators have begun to respond by emphasizing critical thinking skills and problem solving, so that students will be prepared to manage the masses of information they face. Technology provides today's educators with the tools they need to create interdisciplinary real-life learning situations to develop these critical thinking and problem-solving skills. Students pursue a problem or activity by using approaches they already know and by integrating those approaches with alternatives presented by other team members and from research sources. Through trial and error, students balance preexisting views and approaches with new experiences to achieve a new level of learning. The teacher is a facilitator, coach, or co-learner in this process.

6.4.2 NEW WAY TO COMMUNICATE

Resources such as the World-Wide Web and email enable students to communicate and collaborate with students in other schools across the country and around the world. Telecommunication and telecollaboration offer possibilities for learning about another culture, asking questions of an expert in a field, or learning about a career.

6.4.3 NEW RESOURCES

Using technology, students can supervise an archeological dig, visit virtual museums, or monitor weather patterns. Traditionally, these types of opportunities were rarely if ever available in an educational environment.

6.4.4 INSTRUCTIONAL CONSIDERATIONS

Teachers should consider two things before deciding how to integrate technology into the learning experience: the teacher's level of technical skills, and the goals and objectives of the lesson or unit. Gradual integration of technology is recommended in order to allow time for teachers to become comfortable with technology.

6.5 POLICY ISSUES

It is suggested that St. Andrew's Middle School set forth and observe policies and guidelines while implementing and utilizing technology.

6.5.1 PROFESSIONAL DEVELOPMENT AND IMPLEMENTATION

Clear and attainable goals for professional development should be established. For example, plan to learn particular technology skills at appropriate times during the year (e.g., learn PowerPoint by the middle of the semester).

6.5.2 EQUITABLE ACCESS

The school must: ensure that all students have equal access to computer technology; provide help to students with financial need in the deployment of laptops for school-wide use; and ensure that computer facilities and desktops are accessible to students with physical disabilities. Also, while most students have access to computers at home, a few may not have a computer or access to the Internet away from school. Teachers should take this into consideration when assigning homework.

6.5.3 ACCEPTABLE USE

To ensure proper use of your network and computer resources, an Acceptable Use Policy (AUP) for the school's network and for school use of the Internet should be established. This policy should give guidelines for downloading or installing outside software, set security policies, and detail what the school considers proper use of the Internet. Faculty members are expected to provide guidance and instruction to students regarding proper use of the Internet. An AUP defines inappropriate material on the Internet. Options for limiting access include the implementation of filtering software and/or the enforcement of published rules.

The policy should be clear and should be known by all employees and students. For guidelines on creating such a policy, consult *Mastering Network Security* by Chris Brenton.

6.5.3.1 SECURITY

To ensure security of information, use of unique passwords is encouraged. Recommended security policy includes:

- The only individuals with access to the personal accounts should be the student and the technical administrator.
- The use of students' login accounts without their consent is strictly forbidden unless authorized by a staff supervisor.

- Encourage students to memorize rather than write down passwords.

6.5.3.2 DOWNLOADING

File downloading must not be used for commercial resale. Furthermore, files must not be accessed in a networking mode without prior agreement with the suppliers. A statement will be used to describe copyright protection of a file. Students should be prohibited from downloading software onto school computers (does not apply to student-owned laptops). Use of anti-virus software is recommended for all users.

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APPENDIX A

BEST PRACTICES

1.0 INTERNATIONAL SOCIETY FOR TECHNOLOGY IN EDUCATION – STANDARDS FOR BASIC ENDORSEMENT IN EDUCATIONAL COMPUTING AND TECHNOLOGY LITERACY

1.1 PREREQUISITE PREPARATION—FOUNDATIONS

- 1.1.1 BASIC COMPUTER/TECHNOLOGY OPERATIONS AND CONCEPTS
- 1.1.2 PERSONAL AND PROFESSIONAL USE OF TECHNOLOGY
- 1.1.3 APPLICATION OF TECHNOLOGY IN INSTRUCTION

1.2 SPECIALTY CONTENT PREPARATION IN EDUCATIONAL COMPUTING AND TECHNOLOGY LITERACY

- 1.2.1 SOCIAL, ETHICAL, AND HUMAN ISSUES
- 1.2.2 PRODUCTIVITY TOOLS
- 1.2.3 TELECOMMUNICATIONS AND INFORMATION ACCESS
- 1.2.4 RESEARCH, PROBLEM SOLVING, AND PRODUCT DEVELOPMENT

1.3 PROFESSIONAL PREPARATION

- 1.3.1 TEACHING METHODOLOGY
- 1.3.2 HARDWARE AND SOFTWARE SELECTION, INSTALLATION, AND MAINTENANCE

2.0 INTERNATIONAL SOCIETY FOR TECHNOLOGY IN EDUCATION - STANDARDS FOR ADVANCED PROGRAMS IN EDUCATIONAL COMPUTING AND TECHNOLOGY LEADERSHIP

2.1 PREREQUISITE PREPARATION

2.2 FOUNDATIONS

2.3 SPECIALTY CONTENT PREPARATION IN EDUCATIONAL COMPUTING AND TECHNOLOGY LITERACY

2.4 PROFESSIONAL PREPARATION IN EDUCATIONAL COMPUTING AND TECHNOLOGY LITERACY

2.5 SPECIALTY CONTENT PREPARATION FOR EDUCATIONAL COMPUTING AND TECHNOLOGY LEADERSHIP

- 2.5.1 RESEARCH AND THEORIES
- 2.5.2 INSTRUCTIONAL DESIGN AND PRODUCT DEVELOPMENT
- 2.5.3 INFORMATION ACCESS AND DELIVERY
- 2.5.4 OPERATING SYSTEMS
- 2.5.5 SOFTWARE AND HARDWARE SELECTION, INSTALLATION, AND MAINTENANCE

2.6 PROFESSIONAL PREPARATION IN EDUCATIONAL COMPUTING AND TECHNOLOGY LEADERSHIP

- 2.6.1 INSTRUCTIONAL PROGRAM DEVELOPMENT

1.0 INTERNATIONAL SOCIETY FOR TECHNOLOGY IN EDUCATION - STANDARDS FOR BASIC ENDORSEMENT IN EDUCATIONAL COMPUTING AND TECHNOLOGY LITERACY

1.1 PREREQUISITE PREPARATION—FOUNDATIONS

Professional studies culminating in the educational computing and technology literacy endorsement prepare candidates to use computers and related technologies in educational settings. All candidates seeking initial certification or endorsements in teacher preparation programs should have opportunities to meet the educational technology foundations standards.

1.1.1 BASIC COMPUTER/TECHNOLOGY OPERATIONS AND CONCEPTS

Candidates will use computer systems -run software; to access, generate, and manipulate data; and to publish results. They will also evaluate performance of hardware and software components of computer systems and apply basic troubleshooting strategies as needed.

- Operate a multimedia computer system with related peripheral devices to successfully install and use a variety of software package.
- Use terminology related to computers and technology appropriately in written and oral communications.
- Describe and implement basic troubleshooting techniques for multimedia computer systems with related peripheral devices.
- Use imaging devices such as scanners, digital cameras, and/or video cameras with computer systems and software.
- Demonstrate knowledge of uses of computers and technology in business, industry, and society.

1.1.2 PERSONAL AND PROFESSIONAL USE OF TECHNOLOGY

Candidates will apply tools for enhancing their own professional growth and productivity. They will use technology in communicating, collaborating, conducting research, and solving problems. In addition, they will plan and participate in activities that encourage lifelong learning and will promote equitable, ethical, and legal use of computer/technology resources.

- Use productivity tools for wordprocessing, database management, and spreadsheet applications.
- Apply productivity tools for creating multimedia presentations.
- Use computer-based technologies including telecommunications to access information and enhance personal and professional productivity.
- Use computers to support problem solving, data collection, information management, communications, presentations, and decision-making.
- Demonstrate awareness of resources for adaptive assistive devices for student with special needs.

- Demonstrate knowledge of equity, ethics, legal, and human issues concerning use of computers and technology.
- Identify computer and related technology resources for facilitating lifelong learning and emerging roles of the learner and the educator.
- Observe demonstrations or uses of broadcast instruction, audio/video conferencing, and other distant learning applications.

1.1.3 APPLICATION OF TECHNOLOGY IN INSTRUCTION

Candidates will apply computers and related technologies to support instruction in their grade level and subject areas. They must plan and deliver instructional units that integrate a variety of software, applications, and learning tools. Lessons developed must reflect effective grouping and assessment strategies for diverse populations.

- Explore, evaluate, and use computer/technology resources including applications, tools, educational software and associated documentation.
- Describe current instructional principles, research, and appropriate assessment practices as related to the use of computers and technology resources in the curriculum.
- Design, deliver, and assess student learning activities that integrate computers and other technology for a variety of student grouping strategies and for diverse student populations.
- Design student learning activities that foster equitable, ethical, and legal use of technology by students.
- Practice responsible, ethical and legal use of technology, information, and software resources.

1.2 SPECIALTY CONTENT PREPARATION IN EDUCATIONAL COMPUTING AND TECHNOLOGY LITERACY

Professional studies in educational computing and technology provide concepts and skills that prepare teachers to teach computer/technology applications and use technology to support other content areas.

1.2.1 SOCIAL, ETHICAL, AND HUMAN ISSUES

Candidates will apply concepts and skills in making decisions concerning social, ethical, and human issues related to computing and technology.

- Describe the historical development and important trends affecting the evolution of technology and its probable future roles in society.
- Describe strategies for facilitating consideration of ethical, legal, and human issues involving school purchasing and policy decisions.

1.2.2 PRODUCTIVITY TOOLS

Candidates integrate advanced features of technology-based productivity tools to support instruction.

- Use advanced features of wordprocessing, desktop publishing, graphics programs and utilities to develop professional products.
- Use spreadsheets for analyzing, organizing and displaying numeric data graphically.
- Design and manipulate databases and generate customized reports.
- Use teacher utility and classroom management tools to design solutions for a specific purpose.
- Identify, select, and integrate video and digital images in varying formats for use in presentations, publications and/or other products.
- Apply specific-purpose electronic devices (such as, a graphing calculator, language translator, scientific probe-ware, or electronic thesaurus) in appropriate content areas.
- Use features of applications that integrate wordprocessing, database, spreadsheet, communication, and other tools.

1.2.3 TELECOMMUNICATIONS AND INFORMATION ACCESS

Candidates will use telecommunications and information access resources to support instruction.

- Access and use telecommunications tools and resources for information sharing, remote information access and retrieval, and multimedia/hypermedia publishing.
- Use electronic mail and Web browser applications for communications and for research to support instruction.
- Use automated online search tools and intelligent agents to identify and index desired information resources.

1.2.4 RESEARCH, PROBLEM SOLVING, AND PRODUCT DEVELOPMENT

Candidates will use computers and other technologies in research, problem solving, and product development. Candidates use a variety of media, presentation, and authoring packages; plan and participate in team and collaborative projects that require critical analysis and evaluation; and present products developed.

- Identify basic principles of instructional design associated with the development of multimedia and hypermedia learning materials.
- Develop simple hypermedia and multimedia products that apply basic instructional design principles.
- Select appropriate tools for communicating concepts, conducting research, and solving problems for an intended audience and purpose.
- Participate in collaborative projects and team activities.
- Identify examples of emerging programming, authoring, or problem solving environments.
- Collaborate in online workgroups to build bodies of knowledge around specific topics.
- Use a computer projection device to support and deliver oral presentations.
- Design and publish simple online documents that present information and include links tocritical resources.
- Develop instructional units that involve compiling, organizing, analyzing, and synthesizing of information and use technology to support these processes.
- Conduct research and evaluate online sources of information that support and enhance the curriculum.

1.3 PROFESSIONAL PREPARATION

Professional preparation in educational computing and technology literacy prepares candidates to integrate teaching methodologies with knowledge about use of technology to support teaching and learning.

1.3.1 TEACHING METHODOLOGY

Candidates will effectively plan, deliver, and assess concepts and skills relevant to educational computing and technology literacy across the curriculum.

- Design and practice methods and strategies for teaching concepts and skills related to computers and related technologies including keyboarding.
- Design and practice methods and strategies for teaching concepts and skills for applying productivity tools.
- Design and practice methods/strategies for teaching concepts and skills for applying information access and delivery tools.
- Design and practice methods and strategies for teaching problem-solving principles and skills using technology resources.
- Observe in a K–12 setting where K–12 computer technology concepts and skills are being taught.
- Practice methods and strategies for teaching technology concepts and skills in a lab and classroom setting.
- Identify and support implementation and revision of computer or other technology literacy curriculum to reflect ongoing changes in technology.
- Design and implement integrated technology classroom activities that involve teaming or small group collaboration.
- Identify activities and resources to support regular professional growth related to technology.

- Describe student guidance resources, career awareness resources, and student support activities related to computing and technology.
- Compare national K–12 computer or other technology standards with benchmarks set by local school districts and critique each.
- Identify professional organizations and groups that support the field of educational computing and technology.
- Design a set of evaluation strategies and methods that will assess the effectiveness of instructional units that integrate computers/technology.

1.3.2 HARDWARE AND SOFTWARE SELECTION, INSTALLATION, AND MAINTENANCE

Candidates will demonstrate knowledge of selection, installation, management, and maintenance of the infrastructure in a classroom setting.

- Develop plans to configure computer or other technology systems and related peripherals in laboratory, classroom cluster, and other appropriate instructional arrangements.
- Identify and describe strategies to support development of school and laboratory policies, procedures, and practices related to use of computers or other technology.
- Research, evaluate, and develop recommendations for purchasing instructional software to support and enhance the school curriculum.
- Research, evaluate, and develop recommendations for purchasing technology systems.
- Design and recommend procedures for the organization, management, and security of hardware and software.
- Identify strategies for troubleshooting and maintaining various hardware and software configurations.
- Identify and describe network software packages used to operate a computer network system.
- Configure a computer system and one or more software packages.

2.0 INTERNATIONAL SOCIETY FOR TECHNOLOGY IN EDUCATION - STANDARDS FOR ADVANCED PROGRAMS IN EDUCATIONAL COMPUTING AND TECHNOLOGY LEADERSHIP

2.1 PREREQUISITE PREPARATION

As a prerequisite to the advanced program, candidates must document knowledge and competencies contained in the Educational Computing and Technology Literacy matrix.

2.2 FOUNDATIONS

Professional studies in basic educational computing and technology literacy builds a foundation for applying computers and related technologies (hardware and software) in educational settings. The advanced program must document the prerequisite preparation of the candidates or provide instruction to fulfill the Foundations guidelines in the initial coursework.

2.3 SPECIALTY CONTENT PREPARATION IN EDUCATIONAL COMPUTING AND TECHNOLOGY LITERACY

Professional studies in basic educational computing and technology literacy provide concepts and skills that prepare teachers in the specialized and professional content for teaching educational computing and technology literacy and to use technology to support other content areas. Advanced programs must document the prerequisite preparation of the candidates or provide instruction to fulfill the educational computing and technology literacy guidelines in initial coursework.

2.4 PROFESSIONAL PREPARATION IN EDUCATIONAL COMPUTING AND TECHNOLOGY LITERACY

Professional preparation in educational computing and technology literacy prepares candidates to integrate teaching methodologies with knowledge about use of technology to support teaching and learning. Advanced programs must document the prerequisite preparation of the advanced candidates or provide instruction to fulfill the educational computing and technology literacy guidelines in initial coursework.

2.5 SPECIALTY CONTENT PREPARATION FOR EDUCATIONAL COMPUTING AND TECHNOLOGY LEADERSHIP

Professional studies in educational computing and technology leadership prepare candidates to exhibit leadership in the identification, selection, installation, maintenance, and management of computing hardware and software and the uses of computers and related technologies throughout the curriculum.

2.5.1 RESEARCH AND THEORIES

Candidates will identify and apply educational and technology-related research, the psychology of learning, and instructional design principles in guiding use of computers and technology in education.

- Summarize and apply principles and practices of educational research in educational technology.
- Summarize major research findings and trends related to the use of technology in education to support integration of technology in a K–12 environment.
- Apply theories of learning, teaching, and instructional design and their relationship to the use of technology to support learning.
- Describe social and historical foundations of education and how they relate to the use of technology in schools.
- Identify research related to human and equity issues concerning the use of computers and related technologies in education.
- Design a research project that includes evaluating the use of a specific technology in a K–12 environment.

2.5.2 INSTRUCTIONAL DESIGN AND PRODUCT DEVELOPMENT

Candidates will evaluate authoring and programming environments for use in the classroom. They will apply instructional design principles to develop, implement, and test interactive multimedia instructional products using authoring environments.

- Use and apply more than one computer authoring and/or programming environment.
- Describe the characteristics and uses of current authoring environments and evaluate their appropriateness for classroom applications.
- Describe the characteristics and uses of current programming and scripting environments and evaluate their appropriateness for classroom use.
- Apply instructional design principles to the design of screens, text, graphics, audio, and video in instructional products under development.
- Describe and practice strategies for testing and evaluating instructional products designed.
- Apply instructional design principles to develop substantive interactive multimedia computer-based instructional products.

2.5.3 INFORMATION ACCESS AND DELIVERY

Candidates will implement information access and delivery resources in K–12 schools to support the curriculum.

- Identify and use information access and telecommunication tools to support research and instruction throughout the curriculum.
- Use and implement distance learning delivery systems including computer, audio, and video conferencing.

- Create multimedia presentations using advanced features of a presentation tool and deliver them using computer projection systems.
- Install, configure, and use local mass storage devices and media to store and retrieve information and resources.
- Describe issues related to selecting, installing, and maintaining WANs for school districts.

2.5.4 OPERATING SYSTEMS

Candidates will install, customize, and configure the operating systems of computers and computer networks in school settings.

- Identify and describe the major operating systems associated with computing platforms found in K–12 schools.
- Identify and manipulate preferences, defaults, and other selectable features of operating systems commonly found in K–12 schools.
- Use and manipulate networking software to effectively manage the operation of a LAN.
- Evaluate, troubleshoot, install, and maintain computer operating systems for classrooms and laboratories.

2.5.5 SOFTWARE AND HARDWARE SELECTION, INSTALLATION, AND MAINTENANCE

Candidates will identify and implement software in both classroom and administrative environments. They will investigate issues related to school and site planning, purchasing, and technology integration.

- Identify and describe software used in classroom and administrative settings including productivity tools, information access telecommunications tools, multimedia, hypermedia tools, school management tools, evaluation and portfolio tools, and computer-based instruction.
- Investigate and recommend purchasing strategies and procedures for acquiring administrative and instructional software for educational settings.
- Describe evaluation criteria for software and identify reliable sources of software evaluations.
- Identify and implement methods of installation, maintenance, inventory, and management of software libraries.
- Develop and implement ethical and legal procedures for maintaining software libraries.
- Identify and classify adaptive assistive hardware and software for students and teachers with special needs and locate sources to assist in procurement and implementation.

2.6 PROFESSIONAL PREPARATION IN EDUCATIONAL COMPUTING AND TECHNOLOGY LEADERSHIP

Professional studies in educational computing and technology combine leadership skills and concepts with knowledge about use of computers and related technologies in schools. Advanced programs preparing educators for a specialty in educational computing and technology require studies of and experiences with leadership, staff development, and supervisory concepts and skills as they relate to use of technology-based systems in K–12 education.

2.6.1 INSTRUCTIONAL PROGRAM DEVELOPMENT

Candidates will develop curricular plans based on local, state, and national standards for the use of computers and other associated technologies.

- Describe and analyze accepted principles of strategic planning to facilitate curriculum design for teaching with computers and related technologies.
- Identify and use national, state, and local guidelines to develop curriculum plans for integrating technology in the K–12 environment.

2.6.2 TEACHING METHODOLOGY

Candidates will apply effective methods and strategies for teaching the use of technology tools.

- Demonstrate methods for teaching hypermedia development, scripting, and/or computer programming in a problem solving context in K–12 schools.
- Demonstrate methods for teaching at least one modern authoring tool to colleagues and students.
- Demonstrate methods for teaching uses of media-based tools such as television, audio, print media, and graphics.
- Demonstrate methods for teaching social, ethical, and legal issues and responsible use of technology.

2.6.3 STAFF DEVELOPMENT

Candidates will demonstrate knowledge of issues and models related to leadership in staff development. Candidates will plan and design staff development activities for educational settings.

- Plan and design staff development programs.
- Describe and identify resources for staff development.
- Plan and customize staff development based on differing audiences including school and district decision makers.

2.6.4 FACILITIES AND RESOURCE MANAGEMENT

Candidates will demonstrate knowledge of issues related to facilities and resource management.

- Describe and use budget planning and management procedures related to educational computing and technology facilities and resources.
- Identify funding sources available at local, state, or national levels and collaborate on development of a grant proposal.
- Plan, develop, implement, and evaluate strategies and procedures for resource acquisition and management of technology-based systems including hardware and software.
- Identify, describe, and analyze procedures related to basic trouble shooting, preventive maintenance, and procurement of system-wide maintenance services.
- Describe and maintain current information involving facilities planning issues related to computers and related technologies.
- Design and develop policies and procedures concerning staffing, scheduling, and security for managing computers and technology in a variety of instructional and administrative school settings.

2.6.5 MANAGING THE CHANGE PROCESS

Candidate will demonstrate knowledge of strategies for and issues related to managing the change process in schools.

- Evaluate school and district technology plans and recommend improvements.
- Discuss issues relating to building collaborations, alliances, and partnerships involving educational technology initiatives.
- Demonstrate knowledge of effective group process skills.
- Use evaluation findings to recommend modifications in technology implementations.

2.6.6 FIELD EXPERIENCES

Candidates will participate in field experiences that allow them to (1) observe the use of technology to support instruction, the management of technology resources in educational settings, and the evaluation of effectiveness of technology resources for teaching and learning; and (2) apply technology resources to support instruction in classroom settings.

- Observe and compare methods and strategies used in educational technology in a variety of authentic educational settings (e.g., elementary, middle, secondary, adaptive assistive classrooms, labs).
- Develop and teach a series of lessons that apply technology resources to support instruction.
- Document and assess a significant field-based activity involving experiences in instructional program development, staff development, facilities and resource management, or managing change related to technology use in schools.
- Document and assess experiences in implementing a WAN or LAN with Internet connectivity.

3.0 SOFTWARE SELECTION INFORMATION AND TECHNOLOGY RESOURCES

3.1 INFORMATION FOR TEACHERS

3.1.1 SOFTWARE SELECTION GUIDELINES

Choices abound when it comes to children's software. There are simulations, open-ended creativity tools, structured activities, puzzles, tutorials and reference titles; made by over 700 publishers. With all these options, the job of selecting acceptable software can seem overwhelming.

In the Website http://www.childrenssoftware.com/choosing, the six criteria used in evaluating each program has been identified:

- Ease of Use (Can it be used with minimal help?)
- Educational (What can the students learn from this program?)
- Childproof (Is it designed with "student-reality" in mind and the students will have full control over it?)
- Entertaining (Is this program fun to use?)
- Design Features (How "smart" is this program?)
- Value (How much does it cost vs. what it does? Is it worth it?)

Technology and Learning Magazine provides excellent resources and information to teachers and technology administrators making use of technology in the classroom. The October 1999 issue provides tips on choosing software, online resources, and getting ready for technology in the classroom. One article providing useful information is:

- Branzburg, Jeffrey, and Susan McLester. "Advice for picking out great software." *Technology and Learning* 20.3 (October 1999):44.

  This list of guidelines suggests that the teacher should always preview the software, talk with other educators who use software for instruction, and allow the software resources to fit the curriculum rather than the curriculum fitting the software. Furthermore, the authors write, "Remember that it is just one part of your "bag of tricks," just one way you will be teaching your students an idea, concept, etc. Don't expect it to be everything" (Branzburg 1999).

Additional Websites offering guidance on software selection:

- http://www.netc.org/software/eric_software.html
- http://www.childrenssoftware.com/choosing
- http://www.childrenssoftware.com/rating.html

3.1.2 OTHER RESOURCES FOR TEACHERS

The August issue of *Technology and Learning* contains valuable resources, guidelines, and links to technology information.

- "Preparing for Internet Use." *Technology and Learning* 18.1 (August 1997):25.

  This article provides good search engines and Websites for students as well as guidelines for the use of the Internet. A good tip reads, "Make bookmarks you want students to visit. Organize bookmarks into folders, arranged by theme, subject, or unit of study. . . . Kids can go to these bookmarks directly without the need for time-consuming searches" (Tech Learning 1997).

- "Trouble-shooting/Management Tips" p. 24

  This article provides tips on solving problems with technology before they start. The school should preload software before use by the students. The most important guideline states that the basic computer skills should be taught to the students. "Don't make any assumptions about students' computer knowledge" (Trouble-shooting 1997).

- "Acceptable Use Policies: A Sample from Houston" p. 26

  This article provide guidelines on network use in the school. For instance, a school must pay attention to copyright laws, offensive material, and security of passwords.

- "The Computer Lab" p. 29

  This article provides tips on the layout and procedures of a computer lab. The tips even allow for the best use of older machines. The article states that a pre-set schedule should be arranged; for instance, having Mondays set for Math classes, Tuesdays for English, etc.

- "Setting Up Your Room" p.28

  The article states, "If you are new to technology in the classroom, you may be wondering how it can be fit in to your repertoire of teaching activities. The answer is to treat it as you would other resources, and match it to the needs of your students." The article suggests having a few classroom computers as teacher/student workstations and as presentation tools.

3.2 INFORMATION FOR TECHNOLOGY ADMINISTRATORS

Source: Shields, Jean. "Sites for busy administrators." *Technology and Learning* 18.1(August 1997):32.

- Administrator's Resources on the Net <www.colosys.net/admin.html> Resources for technology coordinators and administrators, including links to listservs, online publications and departments of education.

- American Association of School Administrators <www.aasa.org> Legislative news, papers on issues of technology, and an online forum.

- Education Week <www.edweek.org> Resources for many issues in education, including technology.

APPENDIX B

DATA GATHERING TOOLS, AND ANALYSIS SPREADSHEET

1.0 DATA GATHERING TOOLS

1.1 TOOL USED FOR INTERVIEWING FACULTY

Introduction

Thank the faculty member for agreeing to talk with you. Assure the individual that anything they say to you will be confidential. Finally, tell the interviewer that you cannot give them any feedback or solutions to their questions at this time.

Questions

- Ask the faculty member if they are aware of the plans to use computer technology in the classroom. Find out how much they know about the project and our class involvement.
- What is the most important thing we can do to help you use computer technology in your teaching?
- What is the major difficulty you encounter in teaching? Can computer aid in this problem?
- What potential do you feel the implementation of computers has for this school and your class in particular?
- What level are your students at in their curriculum? What level are you teaching them at?

Are there any students that you could recommend that I talk to about the computer project? I would like to find out their needs and expectations as well. (Remember that the interview with students can be done on school grounds without the parents' permission. Otherwise, their permission must be obtained).

Find out the level of training the faculty member has with computer use and software. (The answer to this question may become apparent in your discussion on other questions).

Optional Questions

- You may ask the teacher to sit in on his or her class instead of interviewing individual students.
- Ask the teachers if they are interested in software for teacher training and education.
- You may ask any other questions at your discretion, but it is neither relevant nor necessary to ask them

questions on the politics of the proposed project.
- Ask the teacher if the students stay with the same group of students in their class schedule.

At the end of the interview, ask the staff or faculty the best way to contact them in the future. Ask especially if you may e-mail them with further questions that may arise.

1.2 TOOL USED TO INTERVIEWING MR. MCGHEE

1. Can you provide clarification on the new administrative software package you will be receiving?
2. Can you provide clarification on the current numbers and roles of technology support personnel?
3. What software is already on the computers?
4. What training has taken place, is currently available, and is being planned for in the future?
5. What kind of support budgeting has been done?
6. How can our project team best assist the administration staff?
7. How do you envision technology being used in the classroom?
8. What goals, objectives, or vision do you have for the integration of computers in the curriculum?
9. What specific goals do you have or what outcomes would you like to see from our project?

1.3 TOOL USED TO SURVEY STUDENTS

The interview with students was done by paper survey in class. The detail survey was listed as followed:

(Some of the questions, we give out 5 options for students to choose according to their personal opinions. The 5 options ranks from 1 to 5 with decreasing degree of agreement.)

1. Do you think having computers in the classroom is good or bad? Why?
2. How do you use computers for school now? Give examples from home and at school- computers used for class assignments….
3. Do you use computers during class? If so, how? What problems and benefits do you find in using computers during class?
4. Have you ever found useful information on the Internet for class?
5. What computer skills do you think you'll need for the future (in high school, college, real life)?
6. What is the level of your computer expertise? (1 is novice, 5 is expert)
7. Intergration of technology in our classrooms is important.
8. How often do you use computers?
9. St. Andrew's use of technology in the classroom is right on time.
10. I think the role computers will play in my future is important.
11. My parent(s) feel computers will play an important part in my future.

Additional questions to same students but not on survey

1. Do you think having computers in the classroom is good or bad? Why?
2. How do you use computers for school now? Give examples from home and at school- computers used for class assignments….
3. Do you use computers during class? If so, how? What problems and benefits do you find in using computers during class?
4. Have you ever found useful information on the Internet for class?
5. What computer skills do you think you'll need for the future (in high school, college, real life)?

1.4 TOOL USED FOR INTERVIEWING JOHN GORDON

1. How many technology questions are you getting from the faculty and staff?
2. How are repairs accomplished and is a loaner issued?
3. What is the average cost of repairs to the laptops?
4. What types of problems are typical?
5. What software issues have you had to address?
6. Do you do any of the training of the faculty in the use of the programs on the laptops?
7. How will the students get their laptops (you or teacher) and do they come to you for repairs?
8. Did you set up the wireless access in the buildings and/or are you trained to repair it?
9. How many laptops do the faculty have now?
10. Will there be server space for the entire faculty to have homepages with syllabus?
11. What is the staff desktop computer used for currently?
12. Do you see a need for courses in e-mail and other Internet applications?
13. What do you anticipate the maintenance costs over the long term?
14. Does the school have lightpro's?
15. How much additional staff would you need to accomplish your tasks now and future tasks?
16. What additional equipment do you feel is necessary for this project to succeed?
17. Do the students get to take the laptops home daily?
18. Do the laptops have a slot for a modem card in order for the children to be able to access the Internet?
19. Is the school coax wired with TV's and VCR's in all the classrooms?
20. How many desktops are there in the school?
21. How much memory does each laptop have?
22. How involved are the librarians in the technical aspects of the school?
23. What is the unique area of your technical expertise?
    a. How is your technical expertise integrated in the development of related programs or courses?
    b. What is the schools role in this process?
24. What do you plan to initiate to better meet the technical needs of the school?
25. What are the schools work focus in helping most of faculty and students make good use of the laptop? (training or technical support?)
    a. If training, then what courses do you deem necessary?
    b. If technical support, by which means?
26. What are your difficulties in carrying out the laptop program?
27. Is there any possible ways to overcome them?

2.0 ANALYSIS OF DATA

2.1 DATA SPREADSHEET

Interview Statements Sorted by Key Issue Area	Key Issue Areas
Microscope is shared b/w H.S.	**(H.W. issue)**
Use the computer instead of overheads or the bulletin board by putting an image …students' laptops	**(H.W. issue)**
Need Loaner Laptops	**(H.W. issue)**
Uses computer to create overhead transparencies{printers}	**(H.W. issue)**
Extra set up time; a 45 minute class becomes 40 minutes because of the overhead [projector]	**(H.W. issue)**
Must make sure desks are appropriate for computers; i.e., not slanted	**(H.W. issue)**
Shortage of wireless cards at school	**(H.W. issue)**
Need Loaners	**(H.W. issue)**
Did not know what a light pro was	**(H.W. issue)**
Convert from Mac to laptop	**(H.W. issue)** **(Tech Support)** **(Training)**
Teacher was willing to learn PowerPoint, use in class	**(H.W. issue)** **(Training)**
Teacher has taken PowerPoint class	**(H.W. issue)** **(Training)**
Hidden costs	**(H.W. issue)** **(Training)** **concern
Web sites and software to finish curriculum at home	**(Instructional)**
Slow students catch-up	**(Instructional)**
Text that incorporates web sites	**(Instructional)**
Web as reference tool	**(Instructional)**
Software Curriculum for biology courses	**(Instructional)**
Enhancement resources	**(Instructional)**
Experience equivalent to hands on experiences	**(Instructional)**
Laptop as a reference tool	**(Instructional)**
Web sites to see that there are real life applications	**(Instructional)**
Interactive PE software	**(Instructional)**
Information collecting for health class and game rules	**(Instructional)**
Software implementation to personalize workouts	**(Instructional)**
Make information available via the web	**(Instructional)**
teacher expressed some interest in grammar software	**(Instructional)**
Doesn't want to use computer for drill work	**(Instructional)**
Use web to teach grammar skills (collaborative learning)	**(Instructional)**
tech can improve the students' interests in Latin learning	**(Instructional)**
integrate technology into her class by reference work	**(Instructional)**
requested sites relating to Spain and Latin America	**(Instructional)**
need something can help her teaching	**(Instructional)**
Would like graphing software in place of graphing calculators	**(Instructional)**
Would like list of theorems and postulates with real-life examples connected	**(Instructional)**
Would like resources for tutoring students who are behind and stimulating students ahead	**(Instructional)**
Sees application for computers in project-based curriculums	**(Instructional)**

tech provides enormous resources for culture and historic teaching Latin	**(Instructional)**
Education vs. entertainment (software concern)	**(Instructional)** **concern
The same program be stored for all the laptops	**(policy)**
Computer science teacher for 23 years	**(Skill H)**
Robotics which is taught via computer applications	**(Skill H)**
Comfortable with the computer usage	**(Skill H)**
Uses GradeQuick, MS Word, a robotics application, the Internet, a graphical calculator, and she has MS Office 2000 and either Windows 98 or NT on her laptop	**(Skill H)**
pretty comfortable with tech but doesn't have much experience in classroom tech	**(Skill H)**
Very comfortable with technology	**(Skill H)**
Would like to be trained on the computer	**(Skill L)**
One of them was willing to learn [minimal exp]	**(Skill L)**
Skills word processing, email, min web searching	**(Skill L)**
Need a minimal learning curve	**(Skill L)**
teacher never used her laptop	**(Skill L)**
teacher used email at home (rarely to communicate with other teachers or students)	**(Skill L)**
not worth the time	**(Skill L)**
computer may help math or science, but not language	**(Skill L)**
open to using computer tech only if it won't not get in the way of her teaching	**(Skill L)**
doesn't "want to communicate through internet	**(Skill L)**
Comfortable with computer technology	**(Skill M)**
Cliptures for Macintosh, search online, email, word processor and excel	**(Skill M)**
Both used computers often, mostly for word processing	**(Skill M)**
Kids were very excited about her using her laptop	**(Skill M)**
teacher occasionally used school email program	**(Skill M)**
Using MS Word to teach them how to create outlines	**(Skill M)**
Very comfortable with technology	**(Skill M)**
Knows MS Office, e-mail, how to use search engines	**(Skill M)**
Often uses "recipes" (available on web) for class to make compounds	**(Skill M)**
Most computers used for word processing and Internet research	**(Skill M)**
Have used computers/Internet in most of their classes	**(Skill M)**
teacher liked convenience of laptop	**(Skill M)** **concern
See use for homework and grading	**(Teacher Admin)**
Toughest task was dealing with the paper load (assignments from kids)	**(Teacher Admin)**
Difficult to make time to develop new curriculum ideas	**(Teacher Admin)**
Difficult to find good materials for class	**(Teacher Admin)**
Computers...wanted instead for teacher support	**(Teacher Admin)**
wants to use e-mail for contact with parents and a quick way to post assignments, check students absent	**(Teacher Admin)**
Problem sets that are assigned a skill level w/ability to select questions based on skill	**(Teacher Admin)**
One teacher records her grades on computer, the other doesn't	**(Teacher Admin)** **(Training)**
Want stable network and hardware	**(Tech Support)**
More tech staff	**(Tech Support)**
Network reliability	**(Tech Support)**
Lack of tech support	**(Tech Support)**
technical support	**(Tech Support)**
Hard to get tech support, computer room reserve	**(Tech Support)**
Concerned about the lack of technical support	**(Tech Support)**
Network administrator is at two campuses	**(Tech Support)**

Tech support should be outside the library	**(Tech Support)**
No tech support at M.S.	**(Tech Support)**
Believes there should be a Net Admin and Tech Support at all campuses	**(Tech Support)**
Tech staff needs to be available all the time on campus	**(Tech Support)**
One more person to work with him	**(Tech Support)**
Too much work for only one dedicated tech support person	**(Tech Support)**
Aware of the technical support staff member but didn't know when he was at school	**(Tech Support)**
She tries to answer tech questions	**(Tech Support)** **(Training)**
Would like to display Power Point on classroom TV(s)	**(Tech Support)** **(Training)** **(H.W. issue)**
Time cost in training and problem resolving	**(Tech Support)** **(Training)** **concern
Messing with the technical problems would detract from teaching time	**(Tech Support)** **(Training)** **concern
no technical help, waste class time on tech issue	**(Tech Support)** **(Training)** **concern
Only if excellent training	**(Training)**
Software training [P.P.]	**(Training)**
Suggest In services	**(Training)**
Training for students	**(Training)**
Students to be able to work online	**(Training)**
Not concerned with her learning curve	**(Training)**
Technology to communicate with other league members	**(Training)**
Two teachers wondered if kids knew how to type	**(Training)**
Kids figured out Internet scavenger hunt too quickly	**(Training)**
Teacher interested in software, didn't know of any resources to evaluate	**(Training)**
Two teachers wanted Internet search training	**(Training)**
One teacher didn't think training programs very helpful so far	**(Training)**
Important … to learn how to use computers as tools	**(Training)**
Doesn't want to use PowerPoint for presentation When can write on black board	**(Training)**
Much of the faculty were used to Macs	**(Training)**
Question whether the time taken learning a new tool would be worth it	**(Training)**
Wondered who would do the training necessary	**(Training)**
Teach Web searching	**(Training)**
Wireless cards can plug in to the wall with hard line.	**(Training)**
teach computer skills to the kids on the spot, in the classroom	**(Training)**
students in 8th grade need to prepare in computers to go to high school	**(Training)**
reason for not using the computers is that her subject matter was different from others	**(Training)**
Unable to use "First Class" so developed own spreadsheet for grading	**(Training)**
Extensive faculty training needed Basic skills like how to turn on and shut down a computer Word processing skills: opening, editing, saving, printing Internet skills: email, getting to internet, using search engines	**(Training)**
Need training in "First Class" software	**(Training)**
Tries to train anyone who will listen	**(Training)**
Program of students helping students	**(Training)**
Little knowledge about new Blackbaud administration software	**(Training)**
Everyone has MS Office	**(Training)**

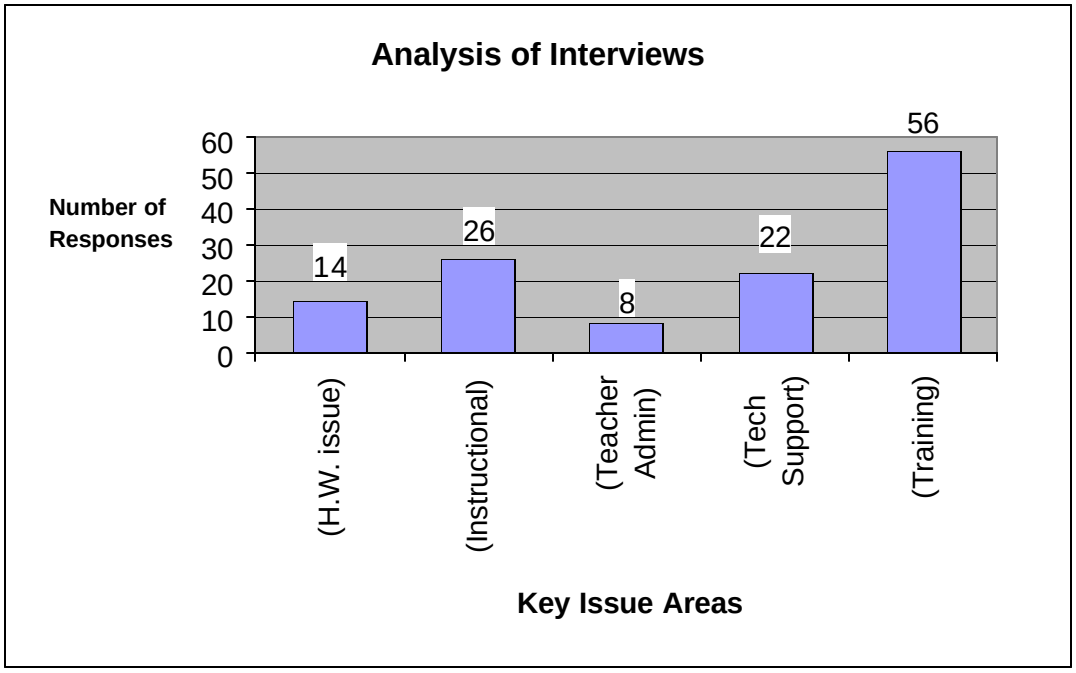
School has license for "Gradebook" grading software	**(Training)**
School uses "First Class" intranet software	**(Training)**
Priority is to get staff proficient and comfortable with technology	**(Training)**
Most wanted typing training	**(Training)**
Did most of research on Internet, but took time to find	**(Training)**
Thought that Internet resources had more information, textbooks more detail	**(Training)**
Wanted training on taking notes while searching Internet	**(Training)**
Received some training on searching, but mostly search engines	**(Training)**
Most felt that Internet sources were trustworthy	**(Training)**
Adequate and excellent training	**(Training)**
only use computers for vocabulary, grammar and historical research,	**(Training)**
Need to know how students may use computers to cheat	**(Training)** **(policy)**
Problems with students playing games or in chat rooms	**(Training)** **(policy)**
Request help with Blackbaud transition issue	**(Training)** **(Tech Support)**
Inconvenient because she has to go to the computer lab	**(Training)** **concern
Learned most of computer skills on own	**(Training)** **concern
Enough memory for downloading web applications	**(Training)*** **(policy)**
Could teach geometry if computer technology is integrated	**concern
Skeptical of how much it will help [net v book]	**concern
Time to learn v time to teach	**concern
Time cost too high	**concern
Technology can be useful in the classroom	**concern
See a need for computer technology	**concern
need time to implement tech curriculum	**concern
Some difficulty teaching grammar	**concern
Enthusiastic about computers in class	**concern
Technology to do things she can't do already (net v. books)	**concern
time required to get comfortable with the laptop	**concern
Computers being purchased without a clear plan	**concern
Students parents bought the laptops	**concern
language software is junk	**concern
Cannot stop students from loading other software	**concern
Hesitant to mess with current methods for teaching basic skills or foreign languages	**concern
Felt computers good for organizing class work (better than binder)	**concern
Preferred typing papers to writing them	**concern
Expected classes to be all laptop soon	**concern
Kids naturally like computers so good to teach with comps	comment
The only classroom part of physical education is the health unit, which lasts only a few weeks	comment
Thought that most if not all kids had home access to computers	comment
Kids are at many different levels	comment
school run by faculty committee, not top-down by principal, kids hate grammar	comment
Computer can save time outside the classroom; information is all in one place	comment
Most comfortable with idea of using computers in science and history	comment
Most seemed interested	comment
6th graders were learning HTML and 8th graders had not learned HTML	comment
Next summer would be a good time for training	suggestion

huge generation gap in using tech. Older teachers might be changed by realizing the value or advantages about applying technology. Motivation is important for teachers to have more effective computer education	suggestion

2.2 ANALYSIS OF DATA

Key Issue Areas	Number of Responces
(H.W. issue)	14
(Instructional)	26
(Teacher Admin)	8
(Tech Support)	22
(Training)	56
(policy)	4
(Skill H)	6
(Skill L)	10
(Skill M)	12
**concern	26
comments	9
suggestions	2

2.3 GRAPH OF RESULTS



APPENDIX C

RESOURCES/CURRICULM SOFTWARE, WEB RESOURCES, GUIDELINES

1.0 WEB RESOURCES FOR USE WITH CURRICULUM

About.com
http://latin.about.com/homework/latin/mbody.htm
An all-inclusive site map for Latin language teachers to visit to get help with lesson plans and ideas for the classroom. This site offers assistant for beginners, researchers, students, and teachers.

AlphaBites
http://alphabet-soup.net/alphabite.html
Activities to teach the alphabet, including ideas for cooking, literature, math, science, social studies and games.

American National Language Resource Center at San Diego University
http://larcdma.sdsu.edu/larcnet/home.html
Contains a searchable database of multimedia language learning aids.
Little or no critical commentary, but does specify learner level, media type, and platform. Don't try this one on a slow connection: unfortunately, the site designers seem to have put more time into the image heavy design than into the content. There doesn't seem to be any consistent editorial policy—the item descriptions are haphazard, and there is no way to evaluate, nor any way to determine how old some of this material is.

Art on the Web: Other Art Links from Boston College
http://www.bc.edu/bc_org/avp/cas/fnart/Artweb_frames.html
A list of links to art from around the world

Assignment: Media Literacy
http://www.assignmentmedialit.com
Integrate media literacy into K-12 instruction. Links to social studies, language arts, science, the performing arts. Developed in coordination with Maryland State Department of Education and the Discovery Channel.

Classroom Connect: Classroom Today
http://www.classroomtoday.com/home.asp
Internet activities for students. A different curriculum topic each week with activities, questions, and explorations. Topics chosen from science and social studies with connections to other curriculum areas. Free trial subscription.

Crayola Creativity
http://education.crayola.com/lessons/
Crayola Art Education * Lesson Plans - A searchable directory of lesson plans that utilize crayola products.

Computer Digest Computer Products Resources
http://www.gy.com/
Commercial site with information on many second-language learning software packages. Some cites are slightly out-of-date.

Dalton School
http://www.dalton.org/departments/nltl
The New Lab for Learning and Technology. Has some good Curriculum

Diccionario General de la Lengua Española Vox / Advanced English: Dictionary Vox
http://www.diccionarios.com/
Almost certainly the best Spanish and Spanish/English English/Spanish dictionary freely available on the web.

Discoveryschool.com
http://discoveryschool.com/schrockguide/
Kathy Schrock's Guide for Educators - A categorized list of sites on the Internet found to be useful for enhancing curriculum and teacher professional growth. Part of Discovery.com

Dartmouth College
http://dante.dartmouth.edu/fldb/
IALL Foreign Language Software Database

Drama Teacher's Resource Room
http://www3.sk.sympatico.ca/erachi
A great resource for grade 4-12 drama teachers with lesson plans, backstage activities, drama links and arts educator seminars.

El Tiempo
http://www.eltiempo.com/
A good way for Spanish students to better their grasp of the language is to spend some time at this site for one of Colombia's daily newspapers. Read about politics, sports, opinion, economics and culture in a week's worth of issues. The site also has sections focusing on technology, travel, health, education and entertainment—even restaurants.

Fitness Connection
http://www.fitconnection.com/
The Internet's premier search engine into the world of health and fitness. With a highly defined and specialized categorical structure, it is our goal to assist web users in finding relevant health and fitness related information to lose weight and get in the best shape of their lives. This includes finding the right exercise program, proper nutrition, and the equipment and gear to accomplish it.

Florida State University
http://multimedia2.freac.fsu.edu/fga/lessonplans.html
Florida Geographic Alliance Lesson Plans - Contains many geography lesson plans, including units for countries around the world.

For Lesson Plans
http://www.forlessonplans.com
Free lesson plans in a variety of subject areas for K-12 teachers. Search for, or submit, lesson plans to this collection.

Frank & Mike's Physical Education Page
http://www.geocities.com/sissio/physical_education.html
Provides information to teachers and coaches for introducing sport skills and activities. Features information on skills, drills,lead up games and links. We are dedicated towards the promotion of PE and it's benefits.

Gateway to Educational Materials
http://thegateway.org
The key to one-stop, any-stop access to high quality lesson plans, curriculum units and other education resources on the Internet.

Geocities
http://www.geocities.com/Athens/Acropolis/3773/
Latin Page - A page designed for K-12 Latin teachers. Lesson plans, games, sounds and assorted stuff.

HCH Logic Puzzles Lesson Plans
http://pages.prodigy.net/bderoes/teaching_hch/hchindex.html
A Unit in Logic using Honeycomb Hotel Puzzles - A resource for teaching deductive logic that is not dependent upon language.

History Channel
http://www.historychannel.com/
This site, produced by the folks at television's History Channel (part of the A&E network), is an excellent resource for a textual history lesson, complete with bibliography. The "This Day in History" feature, which tells you what happened on today's date at some point in history, is interesting and informative; there are quizzes, History Channel television listings and much, much more.

HyperSense
http://www.thoughtful.com/hypersense/
New multimedia scripting program for the Mac.

IALL Foreign Language Software Database
http://dante.dartmouth.edu/fldb/
Extensive database of second-language learning software. Some are reviewed, but not many. However, almost every entry will provide platform, target audience, cost and contact information. Unfortunately, there is no way to tell when the entry was made, so many records are likely to be out of date—a big problem in a field where software is both produced and discontinued at such a fast rate.

Inside the Classroom
http://members.tripod.com/jeana_mcqueen/classroom/classroom.index.html
There are hundreds of lesson plans for all subjects grades K-12.

Language Learning and Technology
http://llt.msu.edu/
Includes detailed, thoughtful reviews of second-language learning software, in addition to research on articles on all aspects of its title subject.

Languages, Linguistics and Area Studies: C & IT Centre
http://www.hull.ac.uk/cti/
Second-language learning software reviews and annotated lists of related internet resources. Reasonably up-to-date.

Lesson Plan Search
http://www.lessonplansearch.com
A lesson plan search engine for teachers that includes Math, Science, Reading, Writing, Social Studies, and more.

Lesson Plans Across the Curriculum
http://members.aol.com/Donnpages/LessonPlans.html
Resources for all subjects.

Lesson Plans-R-Us
http://members.tripod.com/rybug/
This is a site containing a growing data base of lessons ranging from K to 12. Many are interdisciplinary. Lessons may be ordered for a small fee.

Lessons Using Technology
http://www.ed.sc.edu/caw/lessons/lessons.html
Technology Enhanced Lesson Plans which were created by college students on various topics

Library of Congress
http://www.loc.gov/
The Web site for the world's largest library, Library of Congress, is more than just large—it's an excellent resource. Of particular relevance to American history is an area called American Memory, which consists of historical collections for the National Digital Library. These multimedia resources contain documents, photographs, audio, video—all aimed at showcasing the Library's unique American history holdings.

LiveAtThePark.com
http://www.liveatthepark.com
On-line lessons featuring content related to historical sites at national parks and museums. Lessons focus on natural science, geology, history, paleontology, music and art.

McRel.org
http://www.mcrel.org/resources/plus/index.asp
Connections+ - Consists of lesson plans, activities, and curriculum resources linked with corresponding subject-area content standards.

MetaCard
http://www.metacard.com/
A relatively new authoring program in the HyperCard tradition. Very flexible scripting environment. Cross plattform (Mac, PC and UNIX).

Minot Public Schools
http://www2.minot.k12.nd.us/music-mock/music.html
Music Pages - all types of music resources.

Multimedia Applications on a Shoe-String Budget
http://library.advanced.org/50001/
Offers computer curricula which will enable students to become fluent users. It also offers content curricula which attempts to move students away from being consumers of technology-based applications to becoming producers of content. One theme which runs throughout this website is: "Holidays and Celebrations Throughout the Year" including National Hispanic Heritage Month, Native American Month, etc.

Mundolatino.org
http://www.mundolatino.org/prensa/ (accessed Nov. 18, 2000)
Perhaps the best gateway to online Latin American newspapers. Most of them are updated daily.

National Science Teachers Association
http://www.nsta.org/programs/laptop/teach.htm
"Teaching with Laptops"

New York Times
http://www.nytimes.com/learning/teachers/lessons/
An archive of lesson plans across all subject areas.

Perseus Digital Library
http://www.perseus.tufts.edu/
Excellent collection of Greek and Latin texts and culturally and historically relevant information and links. Every word in every text is hyperlinked to English definitions and grammar support.

Purdue University
http://owl.english.purdue.edu/
Handouts for students and teachers about general writing concerns, English as a Second, grammar, spelling, and punctuation, research and documenting sources, professional writing, and writing across the curriculum. This site also includes PowerPoint presentations.

Science Links
http://science.swpco.com/sciencelinks.html
"Science Links" is a one-year multimedia ninth-grade curriculum produced in consultation with a Syracuse University professor who specializes in the teaching of science. "Science Links employs guided inquiry as its major instruction strategy . . . Students are challenged to make connections between the lessons and everyday ilfe and work. They must conduct hands-on experiments, discuss observations with other team members, draw conclusions, and present findings to the entire class. Content and processes are consistent with national Science Education Standards." (Technos, vol. 8, no. 4 winter 1999, p. 11)

Smithsonian Office of Education
http://educate.si.edu/resources/lessons/lessons.html
Classroom ready lesson plans emphasizing inquiry-based learning with primary sources and museum collections in social studies, language arts, science and the arts.

Society of Women Engineers Internet Activities Center
http://www.swe.org/iac/LP/index.html
Hands-on and web-based interactive activities to introduce students Grade 5 and above to engineering concepts.

Southeastern Michigan Learning Coalition Math-Science Lessons
http://www.eecs.umich.edu/mathscience/funexperiments/agesubject/subject.html
Lessons by subject for elementary grades.

Spanish Now!
http://www.transparent.com/ (accessed 11/18/2000)
One of the most frequently reviewed, frequently liked, and frequently seen Spanish language software packages. Provides grammar and vocabulary games and exercises, audio output and input (with a mechanism for evaluating user pronunciation), and readings with contextual help for vocabulary and grammar.

Sportsmedia International
http://www.sports-media.org/
Lesson plans, tips, drills, activities and other teaching aids for the physical education teacher.

Taller Hispano
http://WWW.CORTLAND.EDU/flteach/usafa/taller.html
One teacher's online material for teaching Spanish as a second language.

Teach Music
http://teach-music.virtualave.net/
Music Education Resources - Comprehensive site for music educators. Includes Music Ed Board Room, Music Joke of the Day, Composers of the Month, a site search engine, and many links.

Technology in the Spanish Class
http://www.northstar.k12.ak.us/schools/beh/departments/spanish/technology.html Thoughtful comments from a grade school Spanish teacher on how to use technology to teach Spanish.

Theatre Link
http://www.theatre-link.com/
Your complete guide to all aspects of theatre on the net!

ThinkQuest German language instruction
http://library.thinkquest.org/C007948/
A good example of students creating education websites for other students.

University of North Carolina
http://www.unc.edu/cit/guides/irg-53.html
Spanish Language Resources on the Internet - Index to resources in Spanish, including literature, realia, tools and lessons, further links, and projects.

Web Quests: Science
http://www-sci.lib.uci.edu/SEP/ssi2000/
Instructional 'web quests' on various scientific topics.

Wordreference.com
http://wordreference.com/ (accessed 11/18/2000)
Free, easy download of an electronic version of the Collins Spanish/English English/Spanish dictionary that will work automatically on any web page. This is not a translator—just an automatic dictionary from a reputable publisher.

Yes, I teach
http://www.yesiteach.org/lesson2.htm
Lesson plans sorted by season, month, and holiday.

Youthline's Lesson Stop
http://www.youthline-usa.com/lessonstop/
Within the 7 subject area pages, you'll find about 500 links to web sites organized by topic and grade level, which provide access to thousands of lesson plans.

2.0 GENERAL RESOURCES FOR EDUCATORS

2Learn
http://www.2learn.ca/mapset/smap.html
Canadian site with teacher resources for integrating technology.

A-to-Z Teacher Stuff
http://www.atozteacherstuff.com/
Online lesson plans, thematic units, teacher tips, discussion boards, educational articles & sites, book and literature activities.

AlternativeParenting
http://www.AlternativeParenting.com/Lesson_plans/index.htm
This segment of the Alternative Parenting site is dedicated to providing lesson plans and activity ideas to parents and teachers alike.

An educational version of CNN
http://fyi.cnn.com/fyi/index.html
Aimed at students and teachers with links to lesson plans, resources, etc.

Apple Learning Exchange
http://henson.austin.apple.com/edres/lessonmenu.shtml
Lesson Plans Library - A sizable collection of elementary, middle, and high school lesson plans.

Authorware 5.2
http://www.macromedia.com/macromedia/proom/pr/2000/index_weblearning.fhtml
High-end multimedia scripting program.

Busy Teachers' Web Site K-12
http://www.ceismc.gatech.edu/busyt/ele.html
Links to lesson plans & classroom activities for elementary school.

CanTeach
http://www.track0.com/canteach/index.html
Hundreds of lesson plans for all subject areas. Thousands of links to educational resources. Discussion lists.

Chico High School web page
http://dewey.chs.chico.k12.ca.us/
Chico High School has been serving and updating this website for several years now, and it remains an up-to-date gateway to sites on the web of interest to k-12 students and educators.

Collaborative Lesson Archive
http://faldo.atmos.uiuc.edu/CLA/
A web site repository devoted to the creation and collaboration of educational lessons and curriculum.

Computed Gazette
http://www.computed.simplenet.com/
They described themselves: "ComputED's staff and directors are educators who provide the finest computer education for children and adults in the San Diego area. Inservices are offered to classroom teachers and school districts on how to implement technology in the classroom and select appropriate educational software." The software focuses on typing and math (in different levels). Also some graphic processing programs useful in building up an interesting library.

Computer Lesson Plans for Tired Teachers
http://www.lessonplans.com.au/
Free lesson plans and lesson plan books to support you using computers in the classroom.

Connecting Students Through Themes & Units
http://www.connectingstudents.com/themes/index.htm
Directory of lesson planning resources organized by theme. Each theme lists related websites, books, handouts and complete lesson plans.

Co-op City
http://www.co-opcity.com
A math and science project using architecture and design in the classroom. Includes a description of the project & information to purchase the teaching guide.

Core Knowledge Lesson Plans and Units
http://www.coreknowledge.org/CKproto2/resrcs/index.htm
A collection of high quality collection of preschool through 8th grade units and lesson plans.

Discovery Channel School Lesson Plans K - 12 .
http://school.discovery.com/lessonplans/index.html
A comprehensive list of resources for teachers and educators, ranging from physical science to ancient history.

EdHelper.com
http://www.edhelper.com
Comprehensive database of lesson plans plus education news.

Education Station
http://www.marketcentral.com/education/
How to integrate technology into classrooms.

Educational resources
http://www.educationalresources.com/
This is an educational software company. Click on the "EDUCAST" button to find some good links to lesson plans, educational resources, etc.

Great Teaching Ideas
http://www.successlink.org/great/
SuccessLink - Free lesson plans, units and ideas for teachers. Searchable by subject and grade level. Aligned to the Show-Me Standards.

Hojas e Ideas para la clase de espanol
http://members.aol.com/profesoradebby/actividades.html
A Spanish teacher's resource for worksheets (Hojas) and classroom activity ideas.

Hot Potatoes: Half-baked Software
http://web.uvic.ca/hrd/halfbaked/ (accessed 11/18/2000)
Easy to use web application for creating online educational quizzes and games.

Including Technology
http://members.tripod.com/hamminkj/technology.html
Easy ways to use technology in your classroom. Computer projects elementary students can do with Claris Works, Kid Pix, or Hyper Studio.

Instructional Technology Integration
http://www.sun-associates.com
Resources for K-12 educators on integrating, planning, and evaluating instructional technology.

Integrating the Internet
http://seamonkey.ed.asu.edu/~hixson/index/index5.html
Projects, units of study, and a tutorial to help you plan projects. Includes a good section on grades k-2 appropriate sites, organized thematically.

International Society for Technology in Education
http://www.iste.org/
"The leading organization for educational technology professionals." There are lots of links to resources and proposed standards, etc.

Journey ED magazine
http://www.journeyed.com/
Discounted software for education. Has other resources for educators as well

Learn How to Surf Safely on the Internet
http://www.siec.k12.in.us/~west/proj/surf/surfless.htm
A lesson plan for second and third graders teaching how to surf the Internet properly and safely.

Learner Online
http://www.learner.org/edtech/
Educational Technology Strategies - A variety of research activities and demonstration projects that examine and illustrate the effective use of educational technology for learning at a distance and in traditional classroom situations.

Lesson Plans
http://www.ednet10.net/lessons.nsf/all?openview&count=150
from NETcessities at EDNET10-Region 10-Texas

LessonPlanz.com Search Index
http://LessonPlanz.com
Search or browse thousands of lesson plan resources for all subjects and grade levels including thematic units, lesson plans, worksheets and printable pages, songs & poetry, and more.

Lightspan: Collaborative Projects
http://www.lightspan.com/teacher/pages/projects/default.asp?_prod=LS&_nav=T2_proj
Online service offers the ability for teachers to do collaborative projects. Join one in progress or start your own.

Microsoft in Education
http://www.microsoft.com/education/default.asp
Microsoft in Education has links to instructional resources (with lesson plans and tutorials), classroom teacher network, technology center, and training and certification. Also, "New Research Finds Laptop Learning Yields Better Students and Better Teachers" link to the articles about "Laptop Use and Impact in the Context of Changing Home and School Access".

MysteryNet's Learning with Mysteries
http://www.mysterynet.com/learn/
Lesson plans, mysteries and mystery sites to use, and discussion. For teachers, educators, students, and parents.

Networked Learning Community.
http://learnweb.harvard.edu/ent/home/index.cfm
This online community is designed to help educators develop powerful learning experiences for students through the effective integration of technology.

Nickelodeon's Web site for Educators
http://teachers.nick.com/
Classroom resources and lesson plans to use with Cable in the Classroom programming, Nick News, Blue's Clues.

Northwest Educational Technology Consortium
http://www.netc.org/
Has links to technology integration planning , educational software reviews, etc.

Outta Ray's Head Lessons
http://www3.sympatico.ca/ray.saitz/lessons3.htm
A collection of lesson plans with handouts by Ray Saitz and many contributors; all of the lessons have been used and refined in the classroom.

PBS TeacherSource
http://www.pbs.org/teachersource/
This gives teacher lesson plans, online activities, classroom resources, and professional development projects.

Randy Heck's Lesson Plans
http://www.msu.edu/user/heckrand
Lesson plans for secondary government and history classes, which utilize the Internet and presentation software.

Sand Creek Massacre & Last of the Dogman
http://members.spree.com/sip/wolfsong/SAND_CREEK.htm
Combines historical fact, the Sand Creek Massacre, with role playing, research, and uses the movie Last of the Dogman to instigate dialogue. Very detailed lesson plan, with long list of sources, plus suggested script for mock trial.

TEA Teacher's Tool Bag: TEKS Lesson Plans
http://penick.tea.state.tx.us/TeachersToolBag/Home/TEKSLessonPlans.asp
Lesson plans by subject area, specifically aligned with the Texas Essential Knowledge and Skills(TEKS).
Teachers' Guild Lesson Plan: Careers and Beyond http://www.edsoasis.org/TGuild/Lessons/careers.html
A junior high lesson plan for career investigation.

Teacher Resources/Lesson Plans
http://www.members.spree.com/sip/wolfsong/edfiles.htm
Specific suggestions and links to resources for thematic units including Anne Frank and the Holocaust, and the Iditarod.

Teaching Ideas
http://www.teachingideas.co.uk
Hundreds of teaching ideas, activities, resources and worksheets are available free for primary teachers to use in their classrooms

Teaching Materials Online
http://www.stf.sk.ca/src/srconlin.htm
Contains many quality lesson plans and thematic units written by Saskatchewan teachers. Provided by the Stewart Resources Centre (Canada).

Teaching & More
http://www.geocities.com/Athens/Academy/3416/lessons.html
Lesson Plans - Lesson plans on a variety of subjects and age-levels.

Teachers.net
http://teachers.net/lessons/
Browse our our huge selection of teacher-submitted lesson plans, lessons for all grade levels and subjects.

Teaching with Electronic Technology
http://www.wam.umd.edu/~mlhall/teaching.html
The sites on this page reflect the considerable variety of uses for computing and related forms of electronic technology in teaching.

Teachnet.Com / Brainstorm of the Day
http://www.teachnet.com/
Teachnet.Com: Brainstorm of the Day - Daily tips and creative ideas for busy teachers. Website includes: lesson plans, keypal connection, Teacher-2-Teacher resources, education mailing lists, Ask Dr. Brainstorm, 'how to' projects for the classroom.

TeachWeb
http://www.teachweb.net/Free_Lesson_Plans/
Find or submit lesson plans in a variety of subject areas.

Tech-Bytes : Coalescence of Classrooms and Technology
http://www.tech-bytes.com/
Commentary, ideas, lesson plans and links to help integrate technology into the classroom curriculum. Geared towards people who are fairly new to computers and computer terminology.

Tech tips for teachers
http://www.essdack.org/tips/index.html
Nuts & bolts organizational tips for incorporating technology into the classroom.

The Educational Technology Journal
http://www.fno.org
Educational Technology for Engaged Learning, Educational Technology for Literacy

The Innovative Classroom Lesson Plans
http://www.innovativeclassroom.com/LessonPlans/lesson_plans.htm
Teacher submitted lesson plans in many subject areas.

The Lesson Plans Page
http://lessonplanspage.com
This growing collection of over 650 lesson plans is arranged by grade level and subject area.

The One Computer Classroom
http://www.chtree.com/per/frank/edt610/henderson/wq/onecomputer.html
(WebQuest) -A web-based lesson which provides teachers with advice on how to use a computer in the classroom to enhance both teaching and student learning retention. Includes tips for lesson plan preparation and integration of the computer into the curriculum.

The Teacher's Corner
http://www.theteacherscorner.net
Offers lesson plans, thematic units, calendars, pen pals.

The Teacher's Desk
http://www.knownet.net/users/ackley/lessons.html
Over 250 lesson ideas for fifth and sixth grade teachers at this teacher-created website.

The University of Texas At Austin Education Department
http://www.edb.utexas.edu/edc371/lessonp.htm
A collection of lesson plans and unit ideas.

The WebQuest Page
http://edweb.sdsu.edu/webquest/webquest.html
Use the web in your classroom.

Thematic Units for Primary Grades
http://www.libsci.sc.edu/miller/Unitlink.htm
Each unit is based on appropriate children's literature and addresses an across-the-curriculum approach.

University of Central Florida
http://www.cs.ucf.edu/~MidLink/
This site has links to online student projects, many developed on the basis of online lesson plans.

University of Maryland
http://www.wam.umd.edu/~mlhall/teaching.html
"Teaching with Electronic Technology" A list of links. The following links provide information about conferences, publications, and general discussions of teaching with electronic technology.

Virtual Architecture's Web Home
http://ccwf.cc.utexas.edu/~jbharris/Virtual-Architecture
Created by Dr. Judi Harris, who is an Associate Professor of Curriculum and Instruction at UT. This site was created to assist teachers using Dr. Harris' book on integrating technology.

World School
http://www.wvaworldschool.org/html/lesson/lplans/lplans.htm
Lesson Plans - A searchable collection of lesson plans arranged by subject area, lesson plans are based on specific web resources, each has a correlating list of Instructional Goals and Objectives (West Virginia).

WWW4Teachers
http://www.4teachers.org/
Over a thousand new resources, indexed and organized to help you find exactly what you need. Information about how to facilitate projects, create lessons and build web pages.

3.0 OTHER USEFUL WEBSITE

Alternative Parenting's Lesson Plans
http://www.alternativeparenting.com/lesson_plans/index.htm
Lesson plans in a variety of subject areas for ages infant to 6th grade. For teachers, parents and homeschoolers.

AOL @ School and the Web
http://school.aol.com/teachers/tch_technology.adp
Metasite containing lots of links relating to schools and the internet, many of them useful.

AskERIC Lesson Plans
http://ericir.syr.edu/Virtual/Lessons/
Contains more than 1,000 unique lesson plans which have been written and submitted to AskERIC by teachers from all over the United States. Search or browse.

By a Professor at a University in Belgium
http://www.ipm.ucl.ac.be/marcel/art4.English.html#PART4
A paper concered with "Does information and communication technology require a specific pedagogical approach?"

Columbia University
http://www.ilt.columbia.edu/academic/texts/mcclintock/pp/contents.html
"Power and Pedagogy" (Theoretical paper)

Connections Activities
http://www.tcet.unt.edu/START/actlink1.htm
From Technology Applications Texas Essential Knowledge and Skills (TEKS). Examples, provided by a team of "Teacher Sifters", of instructional activities utilizing web resources.

Educational Software Companies on the Internet
http://www.geocities.com/Athens/8259/softman.html
The following are links to educational software manufacturers. Most, if not all, offer demos of their programs, technical support in either the form of FAQ's and/or e-mail. You can learn of Internet-only offers & specials. Some even offer interactive games & activities for the kids.

Grazing the Net: Raising a Generation of Free Range Students
http://fromnowon.org/text/grazing.html
The theme of this article is the value of raising young people to think, explore and make meaning for themselves.

Integrating Technology in the Classroom
http://www.siec.k12.in.us/~west/slides/integrate/index.html
Slide Show: Discover tips for integrating technology in an elementary classroom using a centers approach.

Interactive Learning Exhibits
http://www.learner.org/exhibits/
This collection of interactive units was developed with funds from the Annenberg Project and the Corporation for Public Broadcasting.

ISTE (International Society for Technology in Education
http://www.iste.org/
One of the main organizations promoting and actively researching the use of computers in schools.

Learning with Technology Software Reviews
http://www.techlearning.com/review.html
Online searchable database of reviews and review articles from Learning with Technology Magazine. Searchable, decent reviews.

Marcia's Kid Pix Page
http://members.aol.com/MrsGoudie/kidspix.html
A detailed list of Kid Pix ideas, templates and related web sites.

Milken Family Foundation: Education Technology
http://www.mff.org/edtech/
Useful set of reports on educational technology from the foundation.

MultiMedia Schools
http://www.infotoday.com/MMSchools/default.htm
Website companion to the print journal, contains tables of contents, abstracts and full text. Software and hardware reviews included.

National Center for Technology Planning
http://www.nctp.com/
check out the "Guidebook for Writing an Effective Technology Plan" downloadable in PDF. This site also has links to technology plans written by various schools all over the country.

Parents, Educators, & Publishers(PEP)
http://www.microweb.com/pepsite/Software/publishers.html
The PEP registry is a comprehensive listing of educational software companies, with direct links to their sites. It does not necessarily imply endorsement of a product or company.

Round Rock ISD
http://www.roundrockisd.org/academics/InstTech/ITProfDev/prof.htm
Round Rock's teacher training efforts. It is located at

StarkNet
http://www.stark.k12.oh.us/Docs/units/
Interdisciplinary lessons and unit plans. A countywide education computer network for Stark County, Ohio,

Software Information Industry Association.
http://www.siia.net
Software reviews.

Students' rights in the electronic age
http://gsulaw.gsu.edu/lawand/papers/sp97/benken.htm
Summary review of legal decisions regarding students' privacy in schools. Concludes that recent decisions have gradually eroded earlier privacy protections in various areas (drug testing, for example), and that the Court has effectively determined that "learning is more vital in the classroom than free speech." The authors conclude that these decisions suggest that the Court would probably not consider students' email to be private.

The National Science Foundation
http://www.nsf.gov/
The National Science Foundation is an independent U.S. government agency responsible for promoting science and engineering through programs that invest over $3.3 billion per year in almost 20,000 research and education projects in science and engineering.

University of Virginia
http://curry.edschool.Virginia.EDU/go/multicultural/
Created by a group of University of Virginia graduate students, this well-developed site includes ideas for multicultural lessons and activities, a reading list, and information about a listserve for those interested in multicultural education.

APPENDIX D

BLACKBAUD

1.0 INTRODUCTION

1.1 HISTORY OF SITUATION

1.1.1 SUMMARY

In conjunction with the school's transition from Apple Macintosh computers to Dell PCs, a new administrative software package (Blackbaud) has been purchased and is being implemented.

1.1.2 BACKGROUND

During a fact-finding interview, the school principal requested that a portion of this report address the integration of the new administrative software package.

2.0 DISCUSSION

2.1 BLACKBAUD SOFTWARE

Blackbaud, Inc. is a software company that produces software for managing fund raising activities, performing accounting for nonprofits, and performing administrative tasks for educational institutions. More specifically, Blackbaud's Educational Administration software automates the processes performed by the Registrar's Office, Admis-

sion's Office, Student Billing and School Store Manager. This report will only address the Registrar's Office and Admission's Office portion of the software.

2.1.1 REGISTRAR'S OFFICE

The Registrar's Office portion of the software package was "specifically designed to meet the administrative needs of a school" with the capability of managing student files, scheduling, grading and more (Blackbaud, 2000). Specific capabilities are as follows:

- Maintains biographical and other important information about your students and faculty.
- Tracks grades and calculates averages for both numeric and letter-marking systems.
- Facilitates scheduling of classes and courses.
- Creates a schedule of classes automatically based on criteria users determine.
- Works with up to 9 terms per year and up to 99 periods per day.
- Determines the honor roll and rank of your student body.
- Prints your report cards and transcripts in your preferred formats.
- Records attendance by student, day, and class.
- Prints a variety of attendance reports and attendance worksheets.
- Stores all achievement and aptitude test score information.
- Maintains a complete record of each student's disciplinary history.
- Stores a school calendar of events displayed in graphical format throughout the system.
- Automates many reports you create regularly.
- Provides enhanced reporting capabilities with a fast query and a powerful, flexible report writer.
- Exports and imports information for use with other software packages.
- Shares information with other Blackbaud Windows-based software packages.
- Helps you find immediate answers to your questions with our extensive online help facility.

Optional Modules provide tools that automate student scheduling and the creation of master schedules. The Parents On-Line to Academics and Records (POLAR) module allows parents to check their child's grades, attendance, conduct and schedule, as well as print report cards and transcripts from home.

2.1.2 ADMISSIONS OFFICE

The Admissions Office portion of the software package "organizes the admissions process and makes recruiting efforts more effective" tracking applicants from initial inquiry to enrollment (Blackbaud, 2000). Specific capabilities are as follows:
Easily store and access:

- Test scores
- Teacher and personal references
- Notes from interviews
- Additional addresses
- Relationships
- Activities and interests
- Educational background records
- Financial aid offers and awards
- Visa number, country of origin, etc. for international students
- And much more

Use the Checklist to manage the admissions process:

- When did you respond to the initial inquiry?
- Has the transcript arrived and been processed?
- Which recommendations are you still waiting for?
- What fees still need to be paid and by when?

Maintain comprehensive records on:

- Educational consultants
- Feeder schools
- Faculty
- Staff
- Other organizations

Integrated contact management features:

- Auto-remind feature keeps you aware of upcoming appointments and meetings
- Store a full range of information on each contact

Correspondence:

- Instantly generate a personalized letter, envelope or label directly from a prospect or applicant record
- Automated, one-step mail merges for notification letters, follow-ups, etc., interface with your Windows word processor
- Create and save mailing lists of feeder schools, consultants, applicant groups and more

Analyze department efforts:

- Perform any type of demographic analysis, such as on ethnicity, religion, and gender, to gauge year-to-year trends
- Which feeder schools and educational consultants provide the greatest number of applicants that enroll?
- Has your yield of inquiries to students increased since last year?
- See how many inquiries resulted from your last open house

Automate the re-enrollment process. Always know:

- How many contracts have been returned?
- Which families need follow up?
- Which students are not returning and why

Easily store online images and documents:

- Transcripts
- Awards
- Certificates
- Photographs
- Newspaper clippings
- Admissions essays
- Recommendations

Status changes for groups of applicants:

- Accepting
- Rejecting
- Enrolling
- Re-enrolling

2.2 TECHNOLOGICAL PROFICIENCY

A basic level of technical proficiency must be established for everyone who will use the software. A concerted effort from both faculty and staff will be necessary.

3.0 RECOMMENDATIONS

Establish Requirements
The faculty and administration need to decide two things:
What individual functionalities of the Blackbaud software will be implemented and when?
Who will be responsible for each portion of the data entry requirements? For example, will teachers input their own grades or will someone in the administration staff input grades?

3.1 TRAINING

The participation of administration staff members in basic computer skills training, geared to their current level of proficiency, will facilitate the exploitation of the capabilities provided by the Blackbaud software.
Included with the purchase of the software is the Blackbaud On-Site Training program. Depending upon predetermined training requirements, as many faculty and staff as are able should attend this training. For those unable to attend the On-Site Training, Blackbaud has Computer-Based Training (CBT) available for purchase. The purchase of the CBT, which is a CD-ROM tutorial teaching package, should be considered only as a backup to the On-Site Training. Finally, those who complete either type of training can be enlisted to teach others.

3.2 IMPLEMENTATION STRATEGY

Gradual implementation of the software is the optimal method, with the Registrar's Office first, and then the Admission's Office. Gradebook will fully integrate with the Blackbaud software. Some faculty are currently utilizing Gradebook, which provides a logical starting point. Analysis of the software's capabilities outlined above will help establish an incremental phasing in of the software. Determining the rate and priority of software integration will have to be established by the participants and school leadership. Methods of integration will be presented as a portion of the On-Site training being provided by Blackbaud, Inc.

3.3 POLICY

Policies must be agreed upon and established for software implementation. For example, if and when Gradebook is to be implemented across the board, the process for entering grades should be clearly established and dictated. If the entire school doesn't participate in each phase of the software implementation, the software will create more administrative effort than it saves.