# THE IMPACT OF THE E-RATE PROGRAM IN ONE SCHOOL DISTRICT: DID A FEDERAL GOVERNMENT PROGRAM INFLUENCE THE ADOPTION OF AN INNOVATION AT THE LOCAL LEVEL?

by

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The Telecommunications Act of 1996 was enacted to address unequal access to technology by K-12 schools and public libraries in the United States. The federal government has since spent over $21 billion in the E-Rate program. The purpose of the study was to document E-Rate expenditures and technology usage patterns and to investigate the effectiveness of the federal diffusion project in influencing technology behaviors in one rural school district in Oregon. Data collected on E-Rate reimbursements and the use of these funds were collected for the school district over a 10-year period.

The amount of bandwidth utilization and the capability of individual school networks increased at each school each year over the 10-year period. The school district also found ways to meet the substantial paperwork requirements imposed by the federal agencies in charge of the program. At the end of 10 years, the school district addressed their long-term connectivity needs by installing and paying for their own district managed fiber network.

The E-Rate program appeared to be successful in supporting diffusion of the technology innovations and was probably necessary for the school district to be able to utilize the Internet and the World Wide Web. Other factors may or may not have been as important as the E-Rate funds in diffusion of the innovations. Recommendations are made for future research.

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Dempsey, D. F. (1990, March). A principal attitude. *NASSP Electronic Learning, 74*(524), 37.

Dempsey, D. F. (1993, June). Principally speaking: Managing change with technology. *NASSP Electronic Learning, 12*(8), 31.

Dempsey, D. F. (1997, December). Professional development for principals and staff with technology. *National Association of Secondary School Principals (NASSP) Practitioner, 24*(2).

Dempsey, D. F. (1999, May). The benefits of creating your own school internet service provider. *NASSP Bulletin, 83*(607), 16-20.

Dempsey, D. F. (1999, September). The principal push for technology. *NASSP High School Magazine, 7*(1), 30-33.

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# DEDICATION

It was not hard to determine whom I should address in this dedication section of this dissertation. It has been my wife Nancy who has encouraged and supported all these years in all of my professional efforts, even when they took me around the world or over to the library in Eugene. Even while she was battling cancer, she continued to encourage me to finish this multi-year project. Without her love and devotion to our family, and me much would never have been accomplished personally or professionally over the last 34 years. I am indebted to her for her never-ending love.

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# CHAPTER I

# INTRODUCTION

## Purpose of the Study

The purpose of this study was to determine if use of the federal E-Rate program by a school district brought about the adoption and use of the innovations of the Internet and the World Wide Web in each of the schools in one rural school district in the state of Oregon. I needed to document E-Rate expenditures and broadband connectivity usage patterns to investigate the effectiveness of the federal diffusion project in influencing technology behaviors in this school district. Adoption or lack of adoption of the innovation, and the use of federal funding to sponsor adoption of an innovation, has possible implications for future efforts to diffuse new technologies in rural educational settings.

## Background for the Study

During the early 1980s, public schools in the United States were the subject of nearly 30 national reports. These reports, issued by commissions, task forces and individuals, announced to the American people that our nation was "at risk" if we didn't improve our schools and better prepare our students for the changing and increased demands of global competition in the next century (Cetron, 1985). *A Nation at Risk* (National Commission on Educational Excellence, 1983) and the *SCANS Report* (U.S.

Department of Labor, 1991), in particular, argued that technology would play a major role in the future and was one way to resolve many of education's problems and prepare the nation's workforce to be competitive in an increasingly global economy (Schofield, 2002). The use of technology in our schools was seen as a key ingredient for improving our schools and our competitiveness as a nation.

Educators across the country responded to these many reports over the next 20 years. During the 1980s and 1990s, school districts in the United States spent billions of dollars on the purchase of personal computers and on the installation of local and wide area computer networks (Peslak, 2004). For example, in 1983, there was one computer for every 125 students in U.S. public schools. By 1998, there was one computer for every six students (National Center for Education Statistics, 2000).

However, as schools across the country purchased millions of computers, few schools were using these computers to access the Internet in classrooms, and many schools did not have the funds or technological expertise to buy computers or participate in technological expansion in the classroom at all. In 1994, only 35% of the public schools in the country had access to the Internet. Another key measure of Internet access is the proportion of instructional rooms connected to the Internet. In 1994, only 3% of instructional rooms were connected to the Internet (Cattagni & Farris, 2001) and only 38% of the nation's schools were using networks for student instruction (Educational Testing Service, 1996).

In 1993, Daniel Burrus proposed what a school of the future could look like:

> Every school in the country will be linked with fiber optics and use digital imaging. Teachers and students will swap books, periodicals, course outlines, and pictures. Students will tap into the Library of Congress or the Smithsonian and use them as national education utilities. (1993, p. 246)

Two years later in his book, *The Road Ahead,* technology entrepreneur Bill Gates discussed how he believed technology was changing the world. Gates argued that the Internet and the resultant "information highway" was the most important single development in the world of computing since the IBM PC was introduced in 1981. "As more and more computers are connected to high-bandwidth networks, and as software platforms provide a foundation for great applications, everyone will have access to the most of the world's information" (Gates, Myhrvold, & Rinearson, 1995).

Gates argued that schools must alter their focus of education from the institution to the individual. The ultimate goal would be to move from getting a diploma from a school at one point in time to gaining technology-driven knowledge that would be practiced as lifelong learning. This shift in knowledge would become a constant throughout an individual's entire life. Technology would offer educational opportunity that was not necessarily related to school classrooms and educational institutions. He also said that it was going take a massive amount of money to give every school in the nation equal access to information.

In 1995, the National Telecommunications and Information Administration issued the first of four reports documenting the existence and particulars of what was called the "digital divide" in America. Affordable access to computers and computer networks was not available to all students; that potentially weakened the nation in terms of having a competitive workforce, but also separated people with access to information technology and those without it into groups more and less employable (Servon, 2002). This kind of data and growing political support for equal access to technology in public schools and public libraries led to proposals made by the Clinton Administration in 1996 to address school and library connectivity. The "digital divide" became the rallying cry in Washington, DC, in 1995 and 1996 as efforts towards adopting a legislative solution to this dilemma were debated by Congress.

School districts and local schools started to address the issue of the "digital divide" on their own while Congress debated the issue. One example of this is illustrated by the efforts taken by the Sisters School District in Sisters, Oregon, in 1995. The school opened in 1992 and, during the construction, the district had the funds necessary to install an internal local area network (LAN) using coaxial cable. The advantage of using coaxial cable to an Ethernet network was the ability to transmit data at much higher rates. Two years later it was found that the cost and accessibility for Internet bandwidth that was needed for the growing school enrollment was not being met by the current Internet Service Provider. Five educators in the district felt that the best solution to address the problem was to find a way to create their own Internet Service Provider in the school. This group created a business plan and one of the teachers was able to secure a loan from a local patron for $50,000 to start the ISP. The ISP was started not only to provide more cost-effective Internet bandwidth to the school, but also to provide the students with an opportunity to run a high-tech business. The students were trained in how to operate a business in addition to learning how to set up computers and install computer modems in local residences. The idea was to sell enough subscriptions for Internet service to local patrons so that the cost of the Internet connection to the school and school district would be minimal. The ISP was named *OutlawNet* and within 2 years had over 500 subscribers to the service (Dempsey, 1999).

While the Sisters School District had the vision and financial resources to address their Internet bandwidth needs, the same could be not said about other schools and school districts in Central Oregon or the state of Oregon. To start addressing this type of "digital divide," Norma Paulus, then Oregon State Superintendent of Education, called upon the Oregon Association of Educational Service Districts (ESDs) to connect all schools in the state to the Internet. In 1995, the Oregon Public Education Network (OPEN) was created to enable all of Oregon's K-12 schools to participate in a coordinated information network that would allow students and educators to reach technology-based classes and resources. OPEN's goal was to access and use local successful regional networks that were already in place so that each school could have access to a wide range of networks and educational services targeted for Oregon students and educators (OPEN, 2006).

Efforts like Sisters School District and OPEN started to connect schools to the Internet and nationally 50% of the schools were connected by 1996. Yet only 14% of the classrooms were connected to the Internet. This problem of classroom connectivity to the Internet was due to the fact that only 38% of the schools had LANs for student instruction. Students attending poor and high-minority schools had less access to LANs than students attending other schools (Coley, Cradler, & Engle, 1997).

Eventually, the E-Rate program was enacted as part of the Telecommunications Act of 1996 as a new component of the universal service program that had been created in the past to ensure affordable telephone service in rural communities. By including subsidy for Internet services in the revised telecommunications plan, Congress was recognizing the growing importance of the Internet to improve educational access to critical information, especially in rural areas where other forms of access to data were potentially more limited than the forms of access available in more metropolitan areas. The act provided up to $2.25 billion annually in discounts on telecommunications, Internet access, and internal networking processes to public and private schools and libraries in the United States (Arfstrom & Sechler, 2007).

Noting the historic nature of the bill, President Clinton stated that the legislation would "stimulate investment, promote competition, and provide open access for all citizens to the Information Superhighway" (Messere, 1996).

The Federal Communications Commission established the rules for the E-Rate program in 1997 and provided oversight and review through the Schools and Libraries Division of the Universal Service Administrative Company (USAC). USAC started providing E-Rate discounts in 1998. This federal program has now been in place for 10 years and has impacted nearly 100% of public and private schools in the United States.

The United States Government had used many different vehicles to attempt to diffuse innovations like the Internet into society in the past (Rogers, 2003). Some have been more successful than others. Was this particular effort successful? How were these dollars used to implement this technology in each school? What is the status of the technology being used now compared to its past use? Has the use of the dollars provided by this federal program been successful in diffusing a new technology in an educational setting? These questions brought me to this study.

In the following pages, I have organized this dissertation report of my research study in to six chapters. Chapter I is an introduction to the topic and the purpose statement for the research project. Chapter II is an overview of the development of the technology and the federal E-Rate procurement process, which is so embedded in this study. Chapter III provides a theoretical framework for the study and I review prior empirical research studies on related topics. Chapter IV is an outline of the methodology planned for this research study. Chapter V is a report of findings. Chapter VI is my conclusions and recommendations for changes in future practice, for future research, and for contributions to innovation theory.

# CHAPTER II

# OVERVIEW OF TECHNOLOGY HISTORY

Most dissertations move from the introduction of the topic in Chapter I to an overview of related theory and research in Chapter II. In this dissertation study, however, there is enough related background definitions and history of development of technology needed for the study to warrant a separate chapter. In addition, an understanding of the complete process that a school district must follow to qualify for E-Rate funding is included in this chapter. Thus, before turning to the theoretical framework for this study, I review definitions and history in this chapter as background for the remaining chapters.

> If the prospect of flattening – and all of the pressures, dislocations, and opportunities accompanying it – makes you uneasy about the future, you are neither wrong nor alone. When civilization has gone through a major technological revolution, the world has changed in profound and unsettling ways. (Friedman, 2005, p. 8)

In his book *The World is Flat*, Friedman shared with the world his belief that the world as we knew it was flattening due to at least 10 different forces. Friedman believes that the second force that helped flatten the world is the new age of connectivity. This new age of connectivity happened due to a convergence of events that took place in the space of a few years in the early 1990s. These events were the emergence of the Internet as a low-cost global connectivity tool, the creation of the World Wide Web that allowed individuals to post their own digital content for anyone to access, and the spread of commercial Web browsers which allowed users to retrieve documents or Web pages stored on a Web site and display it on their own computer screen (Friedman, 2005).

Friedman's book illustrates how fast things have changed in the world in a relatively short amount of time. Some of these changes were spurred by efforts by our own government as to whether it was helping fund the original creation of the Internet or funding schools and libraries so they could connect to the Internet and the World Wide Web via the E-Rate program.

In 1994, the first high profile survey by the United States Federal Government to address the "have and have not" issue for access to electronic information was initiated by the National Telecommunications and Information Administration within the Department of Education. The poorest households were found to have the least amount of penetration for telephones, computers and modems (Compaine, 2001). The information from this study-helped lead to the introduction and eventual passage of the Telecommunications Act of 1996.

## The Telecommunications Act of 1996

The purpose of the Universal Service Section (Section 254) of the Telecommunication Act of 1996 is to help schools and libraries obtain access to state-of-the-art services and technologies at discounted rates. Under this section, all telecommunication carriers serving a geographic area shall, upon a bona fide request for any of its services, provide them to elementary schools, secondary schools, and libraries for educational purposes at rates less that the amount charged for similar services to other parties (Aufderheide, 1999).

By providing financial resources to local school districts, the Congress was providing incentive to schools and districts to join the "Information Age." With the passage of the Telecommunications Act of 1996, school districts were given hope that they would have access to a certain amount of federal dollars to help build their computer network infrastructure and give them an economical way to access the Internet and the World Wide Web. Local school districts were expected to use these federal dollars, and their own local resources, to connect all of their schools to the Internet and the World Wide Web. During the first nine years of the program, the Universal Service Administrative Company distributed over $21 billion to telecommunication and Internet service providers (ISPs) for schools and libraries (USAC, 2006).

## E-Rate

The USAC was created by the Federal Communications Commission to implement the Telecommunications Act of 1996 (USAC, 2006). This support provided by USAC is commonly referred to as *E-Rate support*. The E-Rate program is a federal universal funding mechanism, which addresses the technology gap by defraying connection costs at public education institutions (Servon, 2002). The purpose of this support is to provide affordable telecommunications and Internet access services to connect schools and libraries to the Internet. This financial support goes to service providers that offer discounts on certain services to eligible schools, school districts, libraries, and any consortia of these entities.

The financial support provided by the E-Rate program uses a sliding scale of reimbursement based on the local school district's free and reduced lunch rate. The E-Rate program created a framework for allowing schools to receive discounts for telecommunication and Internet access but it did not dictate how school districts would go about creating computer networks or access to the Internet. The program did not mandate any minimum of connectivity to the Internet for each school. This lack of general direction from USAC allowed for variance in the level of Internet and World Wide Web connectivity to and within schools in this country.

The federal government chose the E-Rate program as the vehicle to diffuse the new technology of the Internet and the World Wide Web to school districts and libraries in the United States. The program procedures that a school district must follow to receive a discount or reimbursement are quite extensive and as such have actually led to cottage industries of providers who complete the paperwork for contracted school districts. The following is a description of the different steps a school district must take to qualify for funding via the E-Rate program.

## Process to Receive Funds

Each school district and library must go through a systematic process to request and then eventually receive discounts for telecommunications services they wish to use to bring the Internet and the World Wide Web to their schools and libraries. There are many time-consuming steps in this process. The steps include determining school district qualifications, preparing a technology plan, opening the competitive process (Form 470), seeking discounts on eligible services (Form 471), confirming the receipt of services (Form 486), and invoicing for services (Forms 472 and 474) (USAC, 2006). See Appendices B through F for examples of these forms.

## School District Qualification Process

In general, a school is eligible for Schools and Libraries support if it meets the following eligibility requirements:

- Schools must provide elementary or secondary education as determined by state law;
- Schools may be public or private institutional or residential schools, or public charter schools;
- Schools must operate as non-profit businesses;
- Schools cannot have an endowment exceeding $50 million.

## Technology Plan

The first step for most schools and school districts to apply for E-Rate discounts is to prepare a technology plan. This plan sets out how the Internet and the equipment to connect computers will be used to achieve specific curriculum reforms or library service improvements. The technology plan is to guide planning and investment, both for E-Rate funds and for the other district resources needed to take advantage of technology. USAC requires that the technology plan must contain the following five components:

- Clear goals and a realistic strategy for using telecommunications and information technology;
- A professional development strategy to ensure that staff knows how to use these new technologies;
- An assessment of the telecommunication services, hardware, software, and other services needed;
- A sufficient budget to acquire and support the non-discounted elements of the plan – the hardware, software, professional development, and other services that will be needed to implement the strategy;
- An evaluation process that enables the school or library to monitor progress toward the specified goals.

Before discounted services begin, a Schools and Library Division (SLD) certified technology plan approver must authorize school district technology plans. School districts access certified approvers online via the USAC website or the Oregon State Department of Education.

## The FCC Form 470

The next step in the E-Rate process is to start a competitive process for the different services desired. After the technology plan has been developed and the school district has identified the products and services needed to implement the plan, the school district submits to the SLD a Form 470, *Description of Services Requested and Certification*. This form can be submitted either online or via a paper process. The SLD posts completed forms on the website to notify telecommunication service providers that the school district is seeking the products and services identified in Form 470.

School district applicants must wait at least 28 days after the Form 470 is posted to the website and, if applicable, at least 28 days after a Request for Proposal (RFP) is publicly available, and consider all bids received before selecting the service provider to supply the services desired. In addition, school district applicants must comply with all applicable state and local procurement rules, regulations, and competitive bidding requirements.

There are several specific rules that the school districts must follow in regards to the Form 470.

- The school district cannot seek discounts for services in a category of service on the Form 471 if those services in those categories were not indicated on the Form 470.
- The Form 470 is completed by the entity that will negotiate with potential service providers.
- The Form 470 cannot be completed by a service provider who will participate in the competitive process as a bidder.
- The school district is responsible for ensuring an open, fair competitive process and selecting the most cost-effective provider of the desired services.

- The school district must determine whether to receive discounts on bills or reimbursements for services paid in full.

The school district must save all competing bids for services to be able to demonstrate that the bid chosen is the most cost-effective, with price being the primary consideration. These bids must be saved for at least 5 years after the last date of service delivered in case of an audit or any other inquiry (USAC, 2008).

After the SLD has successfully posted a Form 470 to or on the website, the applicant is sent a Form 470 Receipt Notification Letter that provides important information, including the "Allowable Vendor Selection/Contract Date," which is the earliest date the school district can select a service provider, execute a contract, and submit a completed Form 471.

## The FCC Form 471

Having selected a service provider, the school district is ready to complete the Form 471, *Services Ordered and Certification*, which is the actual request for funding. Because the amount of funding available each year is capped at $2.25 billion on a national level and demand in most years has significantly exceeded funds available, FCC rules prescribe a filing window. All Form 471 documents filed during this time are treated as if simultaneously received. Once the filing window opens, the school district can submit the Form 471 either online or on paper.

The Form 471 is used to calculate the discount percentage to which the school district is entitled. The E-Rate discount is based on the percent of the local school district population eligible for the National School Lunch Program. The Form 471 lists the individual funding requests, which must be separated by service category and service provider. There are several specific rules that the school districts must follow in regards to Form 471.

- All window-filing requirements must be met in order for an application to be considered with all others received in that timeframe.
- School districts are required to pay the non-discount portion of the services for which they receive discounts. The funding necessary to pay this portion must be budgeted and approved before submission of the Form 471.
- Funding requests must be limited to the cost of eligible services to be delivered to school districts for eligible purposes. If 30% or more of a request is ineligible, the entire request will be denied.
- There are a number of important certifications on the Form 471. School districts must be sure they can truthfully and correctly make these certifications. The SLD checks the accuracy of the certifications made by applicants and denies funding if one or more of the certifications is found to be untrue. False statements on the Form 471 (and other FCC forms) can result in civil and/or criminal liability.
- The Form 471 cannot be processed without the required attachment(s), which must contain detailed information about the products and services ordered so that the SLD can verify eligibility.

Once these rules and steps have been met, a Form 471 Receipt Acknowledgment Letter is sent to the school district that provides important information to the applicant and the service provider, including a summary of the data from the Form 471 (USAC, 2006).

## The Funding Commitment Decision Letter

As soon as the Form 471 has been reviewed, the SLD issues one or more Funding Commitment Decision Letters (FCDLs) to both the school district and the service provider, such as Qwest, setting out its decisions for each funding request. If a school district believes any of its funding requests have been incorrectly reduced or denied, the district can appeal the SLD decision(s), either to the SLD or to the FCC.

## The FCC Form 486

In order to help the SLD ensure that it pays service providers only for services that have actually been delivered, the school district submits the Form 486, *Receipt of Service Confirmation*, listing each separate funded request for which the delivery of services has begun. The Form 486 also tells the SLD that the applicant's technology plan has been approved, and informs the SLD of the school district's status of compliance with the Children's Internet Protection Act (CIPA) (USAC, 2006).

## The Invoice (FCC Form 472 or FCC Form 474)

The SLD must receive an invoice in order to pay the discounted amount on services for which funds have been committed from each telecommunications provider that is approved during the E-Rate process. If school districts receive discounts on their bills from service providers, the service providers must submit the Form 474, *Service Provider Invoice*, to receive payment for the discounts they have provided. If school districts wish to request reimbursement for services for which they have already paid in full, they must submit the Form 472, *Billed Entity Applicant Reimbursement*. The SLD bases the billing mode for each funding request – discounting or reimbursement – on the first type of invoice it processes for payment (USAC, 2006).

## Retention of Records and Audits

All E-Rate applicants must maintain their records for at least 5 years after the last date of service delivered to be able to comply with audits and other inquiries or investigations. The USAC and the FCC visit a sample of applicants to ensure that services have been delivered in compliance with FCC rules.

The SLD provides a table-based list of deadlines for the E-Rate program. The following table (Table 1) lists these events and deadlines.

Table 1

*E-Rate Deadlines*

| Form or Event | Deadline or Dates |
|---|---|
| Funding Year | July 1 through the following June 30 (non-recurring services through the following September 30). |
| Form 470 | Posted at least 28 days before the filing of the Form 471, keeping in mind (1) the timeframe for compliance with all competitive bidding requirements and (2) the Form 471 application filing window opening and closing dates. |
| Form 471 window | Early November to early February preceding the start of the Funding Year (exact dates for each funding year will be posted on the website). |
| Form 471 | Received or postmarked no later than 11:59 PM EST on the day of the close of the Form 471 application filing window (exact date is be posted on the website). |
| Form 486 | Received or postmarked no later than 120 days after the date of the Funding Commitment Decision Letter or 120 days after the Service Start Date, whichever is later. |
| Form 472/474 | Received or postmarked no later than 120 days after the date of the Form 486 Notification Letter or 120 days after the last date to receive service, whichever is later. |
| Appeals | Received or postmarked no later than 120 days after the date of the Form 486 Notification Letter or 120 days after the last date to receive service, whichever is later. |

The E-Rate application process includes 11 steps, from the technology plan through actual invoicing for the services being used to provide Internet to the school district. Figure 1 displays in a USAC process flowchart the 11 steps in the process.

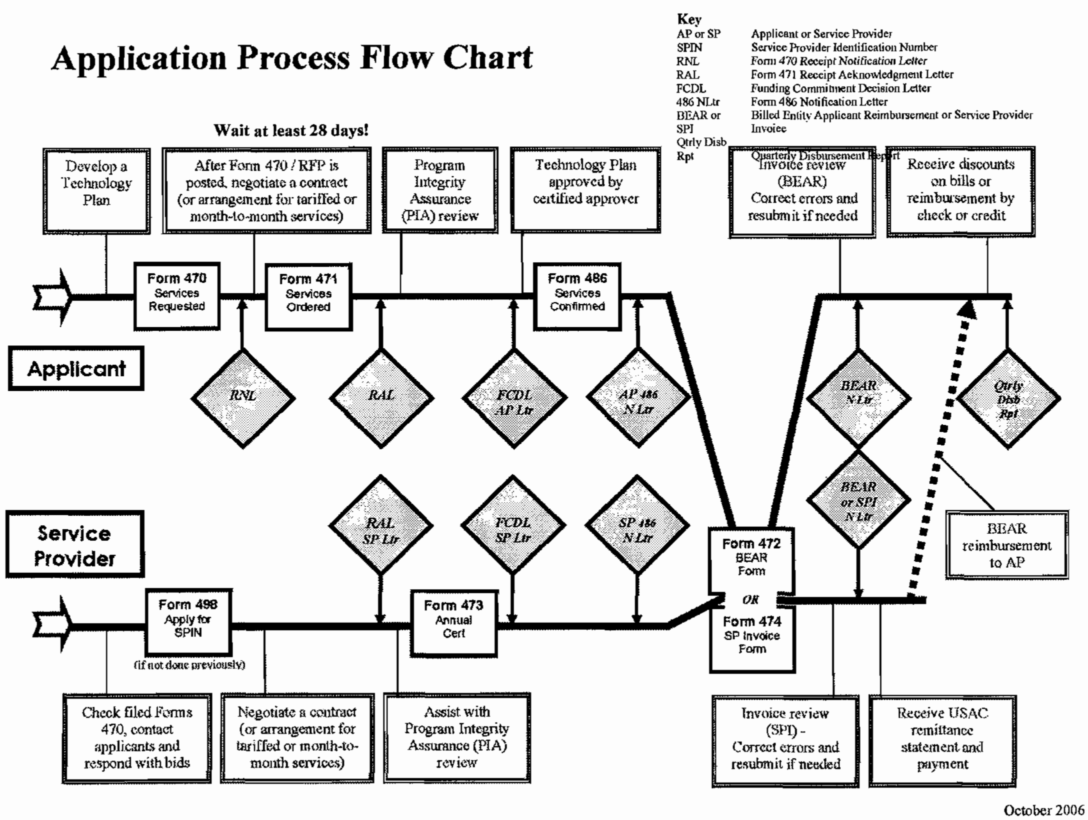


*Figure 1.* Application process flowchart

Service Providers Process

While each school district is required to complete an extensive process to receive discounts for telecommunications, Internet access, and internal connections, USAC works in conjunction with service providers to make sure these discounts are passed on to program participants. The telecommunication companies participate in a 9-step process that runs concurrently with the school district E-Rate process. Following are the nine steps the provider must go through:

1. Obtain a Service Provider Identification Number

2. Search school district requests for service
3. Respond to school district requests for products and services
4. School district selects service provider
5. Assist school districts with application review
6. Receive funding commitment decision letter
7. Begin providing services
8. File annual certification
9. Invoice

*Service Provider Identification Number*

To participate in the Schools and Libraries Program, service providers must obtain a Service Provider Identification Number (SPIN) from USAC. The *Service Provider Identification Number and Contact Information Form* (Form 498) is used to collect contact, remittance, and payment information for service providers that receive support from the Schools and Libraries program administered by USAC. USAC will assign a Service Provider Identification Number to each company that registers by filing a Form 498. The SPIN is used by USAC as a means of identification and tracking records for the company (USAC, 2006).

*Search School District Requests for Service*

Since there is a prescribed timeline that must be followed each year by school districts to receive E-Rate funds, service providers know when they can go to the USAC website to search for those school districts in their service area that have requested a specific service. After USAC posts school districts' 470 forms, the service providers can search and download information on these forms so they can consider bidding on these requests.

*Responding to School District Requests for Products and Services*

School districts must conduct a fair and open competitive bidding process by which they determine the services they order for discounts. To be sure that a fair and open competition is achieved, service providers such as Qwest or local cable companies must hold neutral marketing discussions with school districts so as not to taint the competitive bidding process. The school district should not have a relationship with the service provider prior to the competitive bidding process that would unfairly influence the outcome of a competition, furnish the service provider with "inside" information, or allow the service provider to compete unfairly in any way. The school district must be in a position to accept bids once its Form 470 is posted on the website for 28 days. The school district must take an affirmative role in the evaluation of such bids. The school district may not delegate this evaluation role to anyone associated with a service provider.

When responding to Forms 470 or RFPs, service providers must comply with all appropriate state or local procurement rules and/or regulations and competitive bidding requirements. Service providers must also comply with any specific requirements detailed in an RFP (USAC, 2006).

*School District Selects Service Provider*

Once a school district has selected a service provider, the services for telecommunications services must be provided either through a month-to-month arrangement or by contract. USAC has determined that tariffed and month-to-month services do not require a contract, although school districts and service providers may enter into a contract for these services. USAC assumes that internal connections and basic maintenance for internal connections will be provided under contract. Contracts must be signed and dated by the school district prior to certifying the Form 471. Service providers must give applicants the choice between receiving discounted bills and paying their customer bills in full and requesting reimbursements from USAC through the service provider. In both cases, USAC will pay the service provider. Service providers are encouraged to make the appropriate arrangements with applicants before the applicant files Form 471 (USAC, 2006).

*Assist School Districts with Application Review*

After a school district submits Form 471, USAC issues a Form 471 Receipt Acknowledgment Letter (RAL) to both the applicant and the service provider(s). The RAL provides details of the information the school district provided on its Forms 471. It is sent out before USAC reviews the Form 471, so it does not reflect any USAC decisions on eligibility or funding commitment levels.

USAC reviews the Form 471 for accuracy and compliance with program rules. Although filing application forms is the school districts responsibility, service providers can assist applicants by providing certain information for the form. Service providers can also assist applicants with identifying ineligible products and services, which should not be included in funding requests.

After the Form 471 is submitted, service providers can provide details as requested on the products and services contained in the funding request as it is being reviewed by USAC. School districts can seek assistance from service providers in completing their Form 471. (USAC, 2006)

*Receive Funding Commitment Decision Letter*

USAC issues support decisions in the form of Funding Commitment Decision Letters. These letters contain important information about the school districts' requests for support and USAC's decisions. The FCDL provides background information about the next steps to be taken, a notice on funds availability, and an explanation of the terms found in the enclosed Funding Synopsis for the service providers.

School districts receive one or more FCDLs for each Description of Services Ordered and Certification Form (Form 471) with details of the decision on each funding request by the Funding Request Number (FRN) assigned to each funding request. (USAC, 2006)

*Begin Providing Services*

Service providers cannot provide services before the start of the funding year, which begins on July 1 and ends the following June 30. After the school district files the Receipt of Service Confirmation Form (Form 486) to indicate that the provision of services has begun, the service provider will receive a copy of the Form 486 Notification Letter. This letter contains the *Service Start Date*, which is the earliest date that USAC will provide discounts for services.

The Form 486 Notification Letter also contains detailed information about each funding request. As with the Funding Commitment Decision Letter, service providers may receive information from multiple applicants in the same Form 486 Notification Letter. The service provider letter also contains more information about each individual Funding Request Number than the applicant letter (USAC, 2006).

*File Annual Certification*

Service providers must file the *Service Provider Annual Certification Form* (Form 473) each year that they provide services under the program. The service provider certifies that the invoices it submits to USAC will be based on bills already submitted to school districts and will exclude any charges already invoiced to USAC. Additionally, the service provider certifies that it acknowledges USAC's authority to request additional documentation to support any invoices for a period of 5 years following the submission of the invoices.

The certifications on the Form 473 relate to the entire funding year. USAC does not pay invoices – the Service Provider Invoice Form (Form 474) submitted by the service provider or the Billed Entity Applicant Reimbursement Form (Form 472) submitted by the applicant – unless USAC has a Form 473 on file for the funding year featured on the invoice (USAC, 2006).

*Invoice*

The final service provider step in the E-Rate application process consists of the service provider invoicing USAC using a Service Provider Invoice (SPI) form (Form 474) or by the school district using a Billed Entity Applicant Reimbursement (BEAR) form (Form 472). FCC rules require USAC to pay universal service support to service providers and not directly to applicants. Two invoice methods and program forms exist in this final step:

- Service Provider Invoice (Form 474)
- Billed Entity Applicant Reimbursement Form (Form 472)

USAC encourages service providers to work with school districts to include a provision in contracts or service agreements specifying whether customer bills will be the total cost of services or only the customer's non-discount share. Service providers may provide school districts with discounted bills and submit the SPI to request payment from USAC for USF support to be paid. Service providers and school districts may jointly submit the BEAR when the applicant has paid the entire cost of services to the service provider. In all cases, USAC pays support to the service provider. USAC will base the invoicing mode (SPI or BEAR) for a Funding Request Number on the first invoice that is successfully processed for that FRN. Once established, that invoice mode must be used for all other invoices on that FRN. USAC will not process invoices for a funding year before a Service Provider Annual Certification Form (Form 473) is on file for that funding year. The SPI may be filed either on paper or online (USAC, 2006).

While the steps to qualify for E-Rate funding for a school district are extensive, once they are completed they are the key to providing the much-needed financial resources for a school or school district to access the Internet and the World Wide Web. These dollars are used to reduce costs for transport to the Internet via an Internet Service Provider and providing funds for a district to build their own internal infrastructure to transmit the information from the Internet and the World Wide Web. So what is the Internet and the World Wide Web that the E-Rate program was created to diffuse to schools in 1998?

## The Internet and the World Wide Web

The Internet is a worldwide system of computer networks, which is primarily public, cooperative, self-sustaining, and accessible to hundreds of millions of people worldwide. Physically, the Internet uses a portion of the total resources of the currently existing public telecommunication networks. Information is transported from one computer to another computer via this system of computers and computer networks (Barker, 2006). Internet connectivity means that a computer that a person is using has the ability via a set of telecommunication providers to communicate with other computers and access information that is stored in an electronic format. Technically, what distinguishes the Internet is its use of Transmission Control Protocol/Internet Protocol (TCP/IP) to communicate between computers via telecommunications systems such as copper phone lines.

The ability to access different resources via the Internet and the World Wide Web is tied to the speed of the connection to each computer. Connection speeds range from 24k per second for a dial-up connection to one gigabyte per second for a state of the art fiber connection. The higher the connection speeds, the more varied resources students and staff can access quickly.

An example of one resource students and teachers can access via the Internet and the World Wide Web is streaming video. This medium is an educational resource that is replacing traditional videotapes used in the classroom. Previously, a videotape machine and a television would be needed to show students a video. Streaming video via the Internet allows the student the convenience of access to video clips or segments when he or she needs to use them directly on his/her computer. The classroom teacher can use the streaming video as a classroom presentation resource with the use of a video projector. The projector takes the video signal from the computer and broadcasts it to the entire class of students on a projection screen.

Essentially, streaming video cannot be used effectively via a dial-up connection. To prevent a disjointed flow of video to the desktop computer, the connection to the Internet via an individual computer needs to be faster than 24k. A more effective connection for the use of streaming video in the classroom would be a T1 line provided by a telecommunication carrier. This T1 connection transmits data at a burst rate of 1.5 million bits per second (bps) and allows students to use streaming video effectively. This statement holds true if the total number of computers in the school connected to the Internet via the T1 line does not reduce the flow of the streaming video content to below 50k. In other words, there cannot be a large number of computers utilizing the T1 line at the same time. If the number of computers accessing the computer network is high, the flow of streaming video is restricted on the network and the video becomes too slow for appropriate usage.

However, what if a school is limited to one T1 line connection for their 400 students and they have at least 50 computers in the school being used at any given time? Is streaming video really an option for students in that particular school? If this educational resource is to be used effectively in a classroom, the internal school network and its connection to the Internet must be robust enough to handle multiple students accessing streaming video and other Internet content at the same time.

Before discussing the implementation of the E-Rate program in a Central Oregon school district, it is important to understand how the Internet came into existence, what it actually is, and what the Internet and the Worldwide Web can be used for by students and staff. The origin of the Internet was spawned out of ideas presented in memos by J. C. R. Licklider, a professor at the Massachusetts Institute of Technology (MIT), in 1962. He conceived of the social interaction of people using a network. In 1964, Leonard Kleinrock, also of MIT, published the first book on *packet switching*. He believed that information could be transmitted by existing telecommunication lines by *packetizing* data rather than by *circuit switching* (Leiner et al., 2006).

The next step in the evolution of the Internet was the actual testing to see if one computer could talk to another computer. This testing led the innovators to the conclusion that they needed to find a way to use Kleinrock's theory on packet switching instead of the current circuit-switching model used by the existing phone system (Leiner et al., 2006). The packet-switching theory is fundamental to the development of computer networking and the Internet. It is the concept of breaking large computer files into small chunks, or packets, for transmitting via a network of many computers rather than via dedicated circuits. The packets that comprise a file do not necessarily travel along the same path. Routers control the flow of information and determine the most efficient way to get a packet to its destination. Packet switching makes the Internet efficient and resilient. Even the largest files are sent in small packets, so there are no big files clogging the network. Moreover, because there are multiple alternate routes that packets can take to reach a destination, the breakdown of one computer along the route will not stop a transmission (Leiner et al., 2006).

By 1967, MIT professor Lawrence Roberts had published a paper on his ideas of the computer network concept and his plans for the Advanced Research Projects Agency Network (ARPANET). The Advanced Research Projects Agency of the U.S. Department of Defense became the major influencing and funding source for the creation of networking and, eventually, the Internet (Hauben, 1996).

Kleinrock continued his work at the University of California, Los Angeles (UCLA), and because of his continuing work on packet switching, was chosen as the first node for ARPANET. The second node on ARPANET was a computer at the Stanford Research Institute. In October of 1969, the first host-to-host message was sent from UCLA to Stanford. Eventually computers were added to ARPANET at the University of California, Santa Barbara, and the University of Utah. By the end of 1969, these four computers became the genesis of the Internet, as we know it today.

In 1972 the first demonstration of electronic mail, or email, occurred and was a harbinger of future people-to-people communication via computers and computer networks. While email was the largest use of ARPANET for the next 8 to 10 years, it did lead to the eventual creation of the World Wide Web.

My first experience using ARPANET was in 1975 while working for the Army Corps of Engineers in Rock Island, Illinois. While working for the Corps as a geologist, I was collecting measurements on berms on the down-river side of the Saylorville Dam north of Des Moines, Iowa. I would collect this data and then transmit the information via a computer in Rock Island to a mainframe computer at UCLA, which in turn would analyze this data and tell us via formula how much the berm was compacting as earth was added to it.

During the 1960s and continuing into the early 1970s, most school districts used mainframe computers for financial purposes and student information uses, such as attendance and scheduling. Users were connected by "dumb" terminals and the communication between the dumb terminal and the mainframe computer was not part of a network such as ARPANET.

The use of ARPANET was expanding nationally and was being used more and more for personal electronic communications. The creation of the personal computer, the Internet, and the World Wide Web were the key elements of the technology explosion.

The idea of the personal computer had been on the drawing boards since the 1950s but did not become a reality until the mid 1970s with the invention of the integrated circuit and the microprocessor. The miniaturization of electronic circuitry enabled computer manufacturers to combine the essential elements of a mainframe computer onto tiny silicon computers chips, which helped increase computation performance and decrease cost. The first microprocessor was created by Intel in 1971. By 1975, the first personal computer kit was created by Micro Instrumentation Telementry Systems in New Mexico and was called the Altair 8800. The operating software for the Altair was created by Harvard students Bill Gates and Paul Allen, and their eventual company, Microsoft, was started that same year in New Mexico. The Tandy Corporation was the next company to create kits to build one's own personal computer. Two years later, Steve Jobs and Steve Wozniak created the first personal computer with a color screen and a user-friendly keyboard (Yost, 2005).

It was during this time that personal computers began being purchased by school districts. Often, microcomputers were bought by teachers. These educators may have been responsible for the use of the mainframe computer that was used in the school district, or they may have purchased the machine for their computer science class so their students could learn to build and program one of the first personal computers. At that time, the goal in the schools was not to use the personal computer for improving instruction or "surfing the web," but to give students exposure to a new technology that was affordable. Schools were exposed to the invention of personal computer software such as VisiCalc (an electronic spreadsheet) and other software programs that allowed one to use the computer like a typewriter. Educators started to offer advanced computer classes to students exposing them to discrete mathematics and Boolean algebra. This type of class would enable students to understand how a personal computer worked, in particular the microprocessor and integrated circuit board. During this period, there were no high school textbooks on the topic. Personal computers were starting to drive changes in K-12 and higher education computer information science programs and electives.

My experience with microcomputers in the 1970s and 1980s is very similar to the experience of many other educators across the country at the time. Personal computers were affordable for schools. Districts bought these computers and educators allowed their students to use them for word processing, spreadsheets and, eventually, skill building software programs. An example of this type of software was one written to teach students keyboarding skills.

During the infancy stage of personal computer use in the schools, communication was the primary function of the computer, and met users' needs as such. However, as technology needs grew, users wanted more than electronic mail. This push drove innovators to search for other uses, not only of the personal computer but also of computer networks. School districts looked for ways to have computers in their schools share common peripherals, such as printers, and storage of information in a centrally located device. They yearned to replace the storage of information on computer floppy disks. This demand for a multi-access digital communication system led to the creation of Ethernet. Ethernet was created at the Xerox Palo Alto Research Center (PARC) Laboratory in 1972 and became the genesis of similar Ethernet local area networks for personal computers (Hutchinson, Mariani, & Shepherd, 1985).

The invention of the Ethernet network and the demand in business and education to share storage and peripheral devices not only led to the use of these networks in schools, but also to the creation of interface cards that would allow the personal computer to communicate via the Ethernet network to other computers and peripherals. In 1983 while I was Principal of Wood River Jr. High School, I installed a Corvus Ethernet Network. Our school was the first to implement this type of technology in a school in the state of Idaho. It connected a classroom set of Apple computers together via twisted pair cable so that each computer could communicate with each other and store information on a common storage device. This type of network allowed software companies to write programs that could be uploaded and used by the individual personal computer users. This innovation was monumental. Schools no longer needed multiple copies of a program on a floppy disk that had to be loaded manually onto each computer.

While the expansion of LANs and the fledgling Internet continued to grow, the need for a way to access data that was stored in different computers in different geographical areas drove innovators to look for a new way to organize and communicate information. Tim Berners-Lee was working for the Centre European pour la Recherché Nucleaire (CERN) in 1980 and was looking for a way to access data he had in separate locations. He worked on a way to do this for some time at CERN but left without much success. In the meantime, CERN became involved with the Internet and Transmission Control Protocol/Internet Protocol (TCP/IP) and by 1989 was the largest Internet site in Europe. Berners-Lee came back to CERN in 1989 and got involved in a computer culture that was dealing with distributed computing and object-orientated programming. Object-orientated computing was a product of the NeXT Company that was founded by Apple founder Steve Jobs (Feizabadi, 1996).

In March of 1989, Berners-Lee wrote a proposal for CERN on information management that led to his idea of the World Wide Web as a worldwide information infrastructure. The initial World Wide Web program was developed in November of 1990 using NeXT's object-oriented technology. The program was a browser which also allowed *WYSIWYG (What You See Is What You Get)* editing of World Wide Web documents. The first World Wide Web server was also developed and implemented on NEXTSTEP. The software was ported to other platforms in 1991 and released to the public. Berners-Lee and his team at CERN paved the way for the future development of the web by introducing their server and browser; the protocol used for communication between the clients and the server; Hypertext Transfer Protocol (HTTP), the language used in composing web documents; Hyper Text Markup Language (HTML); and the Universal Resource Locator (URL) (Feizabadi, 1996).

Once these concepts became available to others around the world in the public domain it was not long until user friendly, point and click graphical user interfaces were created for the web. Marc Andreesen and his peers at the University of Illinois created the first graphical user interface (GUI) in 1994 and it was named Mosaic. Andreesen moved to California in 1994 and, with several others, started a small software company that began to market Mosaic. This company eventually became Netscape (Griffin, 2000).

The invention of the World Wide Web by Berners-Lee, followed by release of the Mosaic browser which was relatively user friendly, are two of the main reasons for the successful explosion of the use of the Internet and the World Wide Web over the last 10 to 12 years.

In 1994, no one could have predicted the explosion in use of the Internet via the World Wide Web. It was as if a perfect technological eruption had occurred where several key events were triggered at the right time that allowed for this explosion of technological use. The price of personal computers continued to fall while their calculating speed and memory size grew dramatically. Internet Service Providers began to pop up around the world. They provided business and individual computer users with connectivity to the Internet and the World Wide Web via local telecommunication infrastructures. The advances in graphical user interfaces that made it easier for folks to communicate with each other and access information from other computers around the world caused people in all fields of study and business to look for ways to use this tool for productivity and educational purposes.

Educators, such as me, used an Internet Service Provider such as America Online in the late 1980s and early 1990s for information research for students. At this time, the Internet and the World Wide Web were still difficult to use. The user needed to be able to understand complex programs and search algorithms to find information. Something had to change so the computer would be a more user-friendly resource. To that end, researchers and computer programmers started to experiment with different ways to make it easier for people to find information on the World Wide Web. The first Web search engine invented was called Wandex. This defunct search engine created an index collected by the World Wide Web Wanderer, a web crawler developed by Matthew Gray at MIT in 1993. One of the first "full text" crawler-based search engines was WebCrawler, which came out in 1994. Unlike its predecessors, it let users search for any word in any webpage, which became the standard for all major search engines since. It was also the first one to be widely known by the public. In 1994 Lycos (which started at Carnegie Mellon University) was launched, and became a major commercial endeavor. Soon after, many search engines appeared and vied for popularity. These included Magellan, Excite, Infoseek, Inktomi, Northern Light, and AltaVista. Yahoo! was among the most popular ways for people to find web pages of interest, but its search function operated on its web directory, rather than full-text copies of web pages. Information seekers could also browse the directory instead of doing a keyword-based search (Wall, 2007).

Search engines simplified the process of gathering information. Educators found that the classroom computer could now be used for more than just personal productivity software or for student or financial purposes.

School districts began to purchase subscriptions to access the Internet and the World Wide Web via ISPs. They found that they could use their internal local area Ethernet computer networks to allow students and staff to access all kinds of information. Schools continued making huge investments in personal computers, internal computer networks, and software that was specifically focused on educational purposes. Communication via these LANs in a school, regional networks between schools, and metropolitan area networks within a school district, all allowed for instantaneous sharing of information, especially via email. This effort occurred inconsistently in Central Oregon, the state of Oregon, and the United States in general. If a school or school district had the vision, expertise and the money, they could provide their staff and students with access to the ever-increasing resources being added to the World Wide Web.

Reports on the status of technology in U.S. schools in 1995 and 1996 showed definitively the inequality in access to technologies such as the Internet and the World Wide Web. It was this type of information that the authors of the 1996 Telecommunications Act used to justify funding telecommunication connectivity and internal computer network equipment purchases for all schools in the nation. It also became a way for the United States to diffuse a new technological innovation to all of the educational institutions in the nation

## Research on Internet Connectivity and Networks

While studying the impact of the federal E-Rate program on schools in one school district in Oregon, it became important to understand what Internet connectivity is and is not. It is also important to understand the speed of connections to the Internet. In addition to understanding how the desktop computer in a classroom connects to the Internet and World Wide Web, there has to be an understanding of how different types of computer networks operate in a school setting.

Computers have a common language that they use to communicate with each other via the Internet. When a computer is connected to the Internet, the computer accesses a copy of the TCP/IP language, as does every other connected computer regardless of their particular operating system. When your computer utilizes this language, it can communicate with other computers. TCP/IP is a two-layer program that handles the delivery of information and the information itself. The higher layer, Transmission Control Protocol (TCP), manages the assembling of a message or file into smaller "packets" that are transmitted over the Internet and received by a TCP layer on the receiving computer that reassembles the packets into the original message. The lower layer Internet Protocol (IP) handles the address of each packet so that it gets to the right destination (Cisco Systems, Inc., 1996).

The speed or the rate that information is being transmitted from computer to computer is dependent on a number of different variables before the information ever reaches a school network or an individual computer in a school. The Internet relies on many of the same facilities as the telephone network but uses the power and versatility of digital technology to convert a telecommunication infrastructure originally designed for voice calls. At the most fundamental physical level, the Internet and the telephone network consist of transmission pipe including copper wire and fiber optic cables. Also included are switches that route calls from one such pipe to another. The pipes are further subdivided into the loops that connect customers to switches, and high capacity trunk lines that connect switches to other switches. The fundamental building blocks of most telecommunication networks are loops, switches, and transport (Nuechterlein & Weiser, 2005).

The last mile of connection to a home or a school is referred to as the *loop*. These are the wires a company uses to connect its customers to the nearest switch and the rest of the world. The most traditional form of loop is the twisted pair of copper wires used to establish a connection with a telephone company’s switch. Telecommunication companies use fiber optic cables to carry large amounts of communication from copper wires between their central offices or switching stations. This is because fiber optic cables can carry many more different signals at that the same time than a copper cable.

Switches are then used by the telecommunication companies to direct a voice or data transmission from one loop or transport link to another en route to the call's destination. There are two kinds of switches: circuit and packet. Packet switches are used to transport information via TCP/IP. This type of circuit is able to transport information much faster than a traditional circuit switch. This in turn means that many different types of packets of digital information can be sent down the transport line to the loop line connected to the local school.

Telecommunication companies have spent billions of dollars on fiber optic cable deployment. In fact, in many cities and between many large communities there was an over-deployment of fiber optic cables in hopes of meeting the predicted increase in demand for digital communication forms. This over-deployment of fiber cable led to bankruptcy of companies such as WorldCom and Global Crossing. While billions were spent on connecting large communities to fiber optic cable, there was little investment within most rural communities. Most of the last mile loop facilities to schools, business and homes remained copper wire (Nuechterlein & Weiser, 2005).

This fact meant that large amounts of information could be transmitted across the nation via fiber optic cable, but then was slowed down or bottlenecked when it was sent to a local school, home or business. The analogy I have used for years to explain this phenomenon is to imagine having a fire hose full of water that is connected to the central office or switch of the phone or cable company, but the hose from the switch to the school or home was a garden hose. The amount of information that was being sent over the copper wires to the school was slowed dramatically.

The speed that different mediums transport phone calls or digital data is dramatic and important when trying to understand its importance when connecting a school to the Internet and the World Wide Web. This is true whether it is the connection to the school or the connections within a school. Inside a school, most computer networks are a collection of autonomous computers connected via a single technology. Just as there are different mediums for transporting data to the schools, there are different mediums used in connecting school computers and peripherals together within a school. This connection can be by copper wire, fiber optic cable, coaxial cable, satellite signals and infrared signals (Tanenbaum, 2002).

The peripherals that are tied to a school network can be anything from multiple printers to several servers. In a typical LAN, one computer is the file server where the software is stored that controls the network. There are many different forms of school networks, just as there are many different ways or mediums for telecommunication companies to transport data to and from a school. Most schools use either twisted pair, coaxial, or fiber optic cabling for their internal school networks. The signals carried over the network might be electrical if you are using copper wiring or they could be optical signals as is used in fiber optic cable (Kosiur & Angel, 1995).

For many years, the cost of the cable was the driving force behind the decision on which type of network to use in a school or school district. Using Ethernet to communicate via copper wire was the choice for most schools due to its low cost of installation and maintenance. In the early 1990s, most schools could only install copper or coaxial cable networks; however, the cost of coaxial cable kept many schools from purchasing these types of networks, even though the transmission rate over coaxial cable is so much greater. When the computer network at Sisters High School was installed in 1992, they were able to install the more costly, higher speed, coaxial network because there were sufficient funds available in the school building bonds reserve. At that time, the first fiber optic cable networks were commercially available to schools. However, the cost and the lack of technical support for this type of network kept Sisters High School and many school districts from installing fiber optic networks.

An understanding of the different types of external and internal computer networks is only relevant if there is a complete understanding of the different rates of transmission of data over different types of networks and how that relates to the use of the Internet and the World Wide Web by teachers and classroom students. As was noted previously, there are several types of networks available for use in a school. The four main types of computer networks are twisted copper, coaxial cable, fiber optic, and wireless.

Each of these different types of networks transmits data at different rates of speed. In the U.S., *kbps* stands for kilobits per second (thousands of bits per second) and is a measure of *bandwidth* (the amount of data that can flow in a given time) on a data transmission medium. Higher bandwidths are more conveniently expressed in megabits per second (*Mbps*, or millions of bits per second) and in gigabits per second (*Gbps*, or billions of bits per second) (BytePile.com, 2002).

A traditional copper phone line to a school or a home transmits data a rate of 56k or 56,000 bps. Since many individuals and schools find this connection too slow to effectively use the Internet, many install higher speed connections to their school or home.

To increase the speed of a connection to a school, many will have T1 lines installed between the telecommunications central office and their school. This is called the last mile connection between a company such as Qwest and the school itself. T1 lines have connection speeds up to 1.54 Mbps or 1,540,000 bps. If a school is fortunate enough to be connected to a coaxial cable provided by a cable company, the connection rate to the school could be up to 53 Mbps. Moreover, if a school is actually connected to fiber optic cable that is provided by a telecommunications company or a cable provider, their connectivity rate could be up to at least 1 GB (gigabyte), which is 1,000-million bps transmission rate.

The last mile connection to a school can range from 24k to 1 GB depending on the type of connection. However, just as it is important for the school to have a high speed connection to the Internet and the World Wide Web, it is equally important to have a high speed internal school network connecting the computers in the school. The speed that data is transmitted on an internal school network is determined once again by the type of medium that is being used for the network and the design of the network.

The speed of the internal network is important when an individual computer, or a group of individuals on computers, is trying to access information via the Internet and the World Wide Web. Some of the first computer networks in schools used twisted copper wires for transmission of data. An example of this type of network was *AppleTalk*. AppleTalk was created by the Apple Corporation to allow different types of Apple computers to talk to each other and peripherals at a speed of 230 kbps. In the late 1980s I was Principal at Homer High School in Homer, Alaska. During this same time, our school became a beta site for Apple Computer network cards for their Apple IIe computers and their AppleTalk network. We were directly involved in the research conducted by the company to see how this new network technology might work in operating a school of 400 students.

Currently most schools use an Ethernet network that can transmit data from 10 Mbps up to 1 Gbps or 1 gigabit. The speed of the Ethernet network is driven by the type of transmission material, whether coaxial or fiber optic and the speed of the switches used to transmit the data. If a network is using a form of optical fiber for the network medium and high-speed optical switches, there is the possibility that data can be transmitted at very high speeds.

While the speed of the connection to and within the school is determined by the medium over which the data is being transmitted, it is important to understand why it might be important for a school to have a high-speed last mile connection and a high-speed internal network. The pressure is great to be able to access many different types of information on the World Wide Web via the Internet. When one adds in the factor of multiple computers on the schools network, the combination of the two is a driving factor in the necessity of access to high-speed computer networks and Internet connections. While the World Wide Web is the universe of network-accessible information, it comes in many different forms and formats. These different types of forms and mediums are transported at different rates over the Internet. For example, a teacher or student may wish to view a video clip on a specific subject. This clip may run from a few seconds to several hours, depending on the length of the clip and the ability of the computer network to transmit the video. Most video clips can be transmitted at rates of 20 to 400 kbps. The LAN in the school and the one connecting the LAN to the Internet must have a consistent rate of data transfer. The consistency allows the video to run smoothly on the user's computer.

For example, if a student clicks on a video he or she wishes to view, it will take a certain amount of consistent data transfer for the video to seem fluid and not stop and start throughout the viewing of the video clip. If we assume the transfer rate for a video clip to view efficiently without any interruptions or hesitations is 200 kbps, then that one computer on a school network must be robust enough to handle 200 kbps for the video clip plus any other data transfer that is going on at any given time. For example if a school has a 56k connection to the school and the video clip needs to be transferred at a rate of 200 kbps, when the student clicks on the video clip to view it, it will seem disjointed because the transmission rate that is needed is not adequate to allow it to be viewed without hesitations. The same analogy can be used when a school has a T1 connection. If the school has a connection that allows transfer rates of up to 1.5 Mbps and an internal school network that allows transfer rates of at least 1.5 Mbps then theoretically at least seven students could be accessing a video clip at a transmission rate of 200k per second.

The reality in a school is that there are usually many different computers connected to the internal school network and in turn connected to the last mile connection to the school. Some activities, such as sending and receiving an email, may only take a few kbps for just a few seconds. A phone call using Voice over Internet Protocol (VoIP) may take anywhere from 8k to 64k for each call. In addition, if someone is trying to video conference over the school network and the school Internet connection, then the transfer rate needed may be anywhere from 400k to 1 Mbps.

Thus, the number of computers on a network accessing different mediums requiring different data transfer rates determines the type of computer network and Internet connection needed in a school. It does not take much imagination to see that as more and more students and teachers access materials via the World Wide Web and the Internet during a school day, the demand for more and more bandwidth for connectivity purposes increases exponentially. For the classroom computer to be used as an educational tool students must be able to use it for a wide range of purposes. Each one of those purposes requires different data transfer rates. The ability to meet all of those needs to transfer data is directly related to the speed of the school network and the Internet connection. Table 2 on the following page exhibits the different mediums and their transmission rates.

Table 2

*Data Transmission Rates*

| Technology | Speed | Physical medium | Application |
|---|---|---|---|
| Regular telephone service (POTS) | Up to 56 Kbps | twisted pair | Home and small business access |
| Dedicated 56Kbps on frame relay | 56 Kbps | Various | Business e-mail with fairly large file attachments |
| AppleTalk | 230.4 Kbps | Twisted pair | Local area network for Apple devices; several networks can be bridged; non-Apple devices can also be connected |
| satellite | 400 Kbps (Direc PC and others) | RF in space (wireless) | Faster home and small enterprise access |
| frame relay | 56 Kbps to 1.544 Mbps | Twisted-pair or coaxial cable | Large company backbone for LANs to ISP. ISP to Internet infrastructure |
| DS1/T-1 | 1.544 Mbps | Twisted-pair, coaxial cable, or optical fiber | Large company to ISP; ISP to Internet infrastructure |
| IBM Token Ring/802.5 | 4 Mbps (also 16 Mbps) | Twisted-pair, coaxial cable, or optical fiber | Second most commonly-used local area network after Ethernet |
| Digital Subscriber Line (DSL) | 512 Kbps to 8 Mbps | Twisted-pair (used as a digital, broadband medium) | Home, small business, and enterprise access using existing copper lines |
| cable modem | 512 Kbps to 52 Mbps (see "Key and explanation" below) | Coaxial cable (usually uses Ethernet); in some systems, telephone used for upstream requests | Home, business, school access |
| Ethernet | 10 Mbps | 10BASE-T (twisted-pair); 10BASE-2 or -5 (coaxial cable); 10BASE-F (optical fiber) | Most popular business local area network (LAN) |
| DS3/T-3 | 44.736 Mbps | Coaxial cable | ISP to Internet infrastructure; Smaller links within Internet infrastructure |
| OC-1 | 51.84 Mbps | Optical fiber | ISP to Internet infrastructure; Smaller links within Internet infrastructure |
| Fast Ethernet | 100 Mbps | 100BASE-T (twisted pair); 100BASE-T (twisted pair); 100BASE-T (optical fiber) | Workstations with 10 Mbps Ethernet cards can plug into a Fast Ethernet LAN |
| T-3D (DS3D) | 135 Mbps | Optical fiber | ISP to Internet infrastructure; Smaller links within Internet infrastructure |
| OC-3/SDH | 155.52 Mbps | Optical fiber | Large company backbone; Internet backbone |
| OC-12/STM-4 | 622.08 Mbps | Optical fiber | Internet backbone |
| Gigabit Ethernet | 1 Gbps | Optical fiber (and "copper" up to 100 meters) | Workstations/networks with 10/100 Mbps Ethernet plug into Gigabit Ethernet switches |
| OC-192/STM-64 | 10 Gbps | Optical fiber | Backbone |
| OC-256 | 13.271 Gbps | Optical fiber | Backbone |

(Bytepile, 2002)

We have now come full circle in our efforts to understand why the E-Rate program was created by the federal government. They were looking for a way to encourage and financially support schools and libraries to upgrade their internal networks and connections to the Internet so that students, staff and patrons had access to materials available on the World Wide Web. Many schools did not have the financial means to purchase the needed equipment for the school network, nor could they afford the high-speed connection costs to the Internet. The E-Rate program has allowed school districts a vehicle to implement the high-speed networks and purchase the high-speed connections to allow their constituents' access to the World Wide Web via the Internet.

# CHAPTER III

# LITERATURE REVIEW

## Overview of the Theoretical Framework

Some authors have defined diffusion as the spontaneous spread of new ideas. Amendola and Gafford compared the process of innovation with the diffusion of innovation as the extent and speed at which the economy proceeds to adopt a superior technique (Amendola & Gafford, 1988). Another pair of authors believes that innovation is not an instantaneous event, but a time-based process involving several stages (Dodgson & Bessant, 1996). Everett Rogers believes that diffusion is the process in which an innovation is communicated through certain channels over time among members of a social system. He also describes an innovation as an idea, practice or object that is perceived as new by an individual, group or an organization. The word diffusion includes both the planned and the spontaneous spread of new ideas (Rogers, 2003).

The effort to diffuse an innovation, such as the Internet and the World Wide Web into the K-12 school environment, is not unique to our federal government. Several U.S. government agencies have a division devoted to diffusing technological innovations to the public or to local governments (Rogers, 2003).

Worldwide, many governments have attempted to implement innovations that they have believed would have a positive effect on the members of their society (Rogers, 2003). These efforts have ranged from the improvement of water quality in Egypt to nosmoking ordinances in states and cities in the United States. Federal agencies in the U.S. have often provided funds to a university-based researcher to study how best to diffuse a new technology that the government feels the public should adopt (Rogers, 2003).

The diffusion of innovation is nothing new to schools in the United States. In many schools, a number of change efforts are usually going on simultaneously and most schools average at least one innovation per year (Rutherford & Murphy, 1985). Sometimes a diffusion of an innovation can take a very long time. For example, it took almost 50 years for an innovation like kindergarten to be adopted in 95% of school systems in the United States (Hord, 1987).

I chose Rogers' framework for studying the diffusion of innovation because it seemed the cleanest and most used method to study a federal effort to diffuse a new technology. Rogers' book lists many examples of different diffusion efforts of innovations. He includes at least three specific examples that can be used as a comparison to my study of the impact of the E-Rate program in diffusing the Internet and the World Wide Web to schools. I will review the Rogers model as it relates to my study of one rural school district in Central Oregon in diffusion of the technological innovation of the Internet via the federal government's E-Rate program.

## Rogers' Theory

The diffusion of innovation perspective was pioneered by French Sociologist Gabriel Tarde in the early 1900s. According to Tarde, inventions diffuse from their geometrical center as waves or concentric circles (Macauley, 2002).

It was not until the mid-twentieth century that the study of the diffusion of innovation started to become a serious field of study in the United States. One of its main catalysts was the 1962 book, *Diffusion of Innovations,* by William Rogers. His book was an effort to describe a general diffusion model and to push for greater awareness of patterns of change about various research traditions.

Research and thought on the diffusion of innovation has been going on since the early 1900s with Tarde leading the way and then followed by H. Earl Pemberton. Pemberton suggested that gradual cultural diffusion of an invention resembled a mathematical bell-shaped curve (Grubler, 1997). In the 1950s, Bryce Ryan and Neal Gross took the work of Pemberton and looked at the different channels through which innovations are communicated. Everett Rogers began his research at Ohio State University where he studied the diffusion of agricultural innovations among Ohio farmers. Rogers was influenced by the work of Ryan and Gross and studies that looked at the diffusion of driver's education, kindergarten, and an antibiotic drug called tetracycline. Rogers found similarities in these new studies with his study of farmers in Ohio. These similarities were that different sources or channels were used by adopters at different stages in the innovation-decision process.

Rogers' model of diffusion has three major core elements: the stages of adoption, the identification of major players' roles, and the reaction observed between the two. Rogers defined diffusion as the process by which innovation is communicated through certain channels over time among members of a social system. Rogers defines innovation as "an idea, practice, or object that is perceived as new by an individual or another unit of adoption" (Rogers, 2003, pg.12). Rogers also introduced the concept of the innovation decision process which an individual or organization, such as a school district, goes through in the diffusion of an innovation.

Rogers defines diffusion as the "process by which (1) an innovation (2) is communicated through certain channels (3) over time (4) among the members of a social system" (Rogers, 2003, p. 11). In Rogers' fifth edition of his book, he also looks at the rate at which individuals adopt an innovation. The following section reviews these four elements in greater depth.

*Innovation*

The attributes of an innovation, such as the Internet or the World Wide Web, are perceived differently by different people. This phenomenon helps explain why there are different rates of adoption of a particular innovation. These characteristics include relative advantage, compatibility, complexity, trialability and observability. Innovations that are perceived by individuals as having these characteristics will be adopted more rapidly than other innovations or inventions (Rogers, 2003).

Rogers' reports that 20 years after his initial dissertation other researchers started to define the concept of reinvention, which is the degree to which an innovation is changed by a user in the process of adoption and implementation. Many people who adopt an innovation want to be able to customize the innovation to meet their unique needs and spur the reinvention of an innovation (Rogers, 2003).

*Communication Channels*

Rogers defines communication "as the process by which participants create and share information with one another in order to reach a mutual understanding" (Rogers, 2003, p. 18). While interpersonal communication channels and mass media are important in the diffusion of certain innovations, most people decide for themselves about an innovation based on the evaluation of someone like himself or herself. How well an innovation is communicated is impacted by whether the individuals who are communicating have much in common and are considered *homophilous*, as opposed to *heterophilous*, which refers to two or more individuals who interact that have different attributes. Communication that is more effective occurs when individuals are homophilous or are more like each other. The actual adoption of an innovation such as the Internet should be impacted more by interpersonal communication than by mass media, particularly in a school district.

*Time*

"Diffusion is a process that occurs over time, so there is no way to avoid including time when one studies diffusion" (Rogers, 2003, p. 126). The dimension of time involved in the adoption of an innovation such as the Internet is:

> (1) The innovation-decision process by which an individual passes from first knowledge of an innovation through its adoption or rejection, (2) the innovativeness of an individual or other unit of adoption compared with other members of the system, and (3) an innovation's rate of adoption in a system,

usually measured as the numbers of members in the system who adopt the innovation in a given period of time." (Rogers, 2003, p. 20)

Individuals vary in the time they may take in deciding whether to adopt or reject an innovation. A person may take years to adopt an innovation while the next person might quickly move from learning or knowledge of the innovation to full implementation.

### *Innovation-Decision Process*

Rogers (2003) focused on a 5-step process in the innovation-decision process to include, (a) knowledge, (b) persuasion, (c) decision, (d) implementation, and (e) confirmation. As with many innovations in education, different school districts are in different places in the 5-step innovation-decision process. By the time of the actual implementation of the E-Rate program in 1998, all of the school districts in Central Oregon had knowledge of the E-Rate program and the Internet. Most had already gone through the persuasion step and the decision to connect their schools to the Internet due to the efforts of their local ESDs and OPEN.

The first stage of the innovation-decision process is knowledge. Knowledge is gained when an individual or a group of decision-makers learns of an innovation's existence and gains some understanding of how it functions. Rogers identifies three types of questions that affect the diffusion of an innovation. These questions are, "What is the innovation?", "How does it work?", and "Why does it work?" (p. 173). The first question is tied to the awareness or knowledge of the innovation, or that the innovation exists. The question of *how* it works is asked so that a person can use an innovation properly. The question of *why* it works may be asked but, depending on the complexity of the innovation, may not be as important as the first two knowledge questions.

The second stage of the innovation-decision process is persuasion. This stage occurs when an individual forms a favorable or unfavorable attitude towards the innovation. "At the persuasion stage the individual becomes more psychologically involved with the innovation" (Rogers, 2003, p. 175). An individual will review an innovation and determine whether applying or using this innovation in their current or future situation will be beneficial to them as a person. "The main outcome of the persuasion stage in the innovation-decision process is a favorable or unfavorable attitude toward the innovation" (p. 176).

The next stage is the decision. The decision occurs when an individual engages in activities that lead to the adoption or rejection of an innovation (Rogers, 2003, p. 20). An important part of this stage is for the person making the decision to try out the innovation at least on a partial basis. If an individual were to try to use the Internet in a school and found it to be somewhat advantageous, he or she might move towards an adoption decision. If the individual found that using the Internet was not what he or she expected or wanted, the innovation could be actively rejected or passively rejected by the individual never trying to use the innovation at all.

The fourth stage is implementation, when an individual actually uses an innovation. The actual implementation stage can go on for a prolonged period depending on the innovation that is being adopted. During this time, reinvention is likely to occur as different individuals try to fit the innovation into their own unique set of circumstances.

The process of reinvention provides a general picture that innovation is not a fixed entity. The people that use an innovation "shape it by giving it meaning as they learn by using the new idea" (Rogers, p. 188).

Confirmation is the last stage of the innovation-decision process. This occurs when an individual seeks reinforcement of the decision made to adopt the innovation. A person may change their mind about adopting an innovation if they are exposed to conflicting messages about the innovation or do not believe the innovation will work to meet their individual needs. An individual may also make a decision to reject an innovation after they have already adopted it. At the same time, it is possible for someone to adopt an innovation that they previously rejected. Rogers believes that these five aforementioned steps occur in this time-ordered sequence. The length of time required to pass through this process is called the *innovation-decision period.* My study of the adoption of the Internet in the Crook County School District will allow me to review the decisions that were made concerning adoption during a 10-year innovation-decision period.

### *Categories of Adopters*

Rogers (2003) defines innovativeness as the degree to which an individual is relatively earlier in adopting new ideas than the other members of a system (p. 22). He uses categories for identifying different types of adopters of an innovation. These five categories include: (a) innovators, (b) early adopters, (c) early majority, (d) late adopters, and (e) laggards.

Innovators are venturesome and their interest in new ideas leads them to communication outside of their normal social circles. They are people who are daring and risky and do not mind the occasional setback from trying something new. The innovator plays the role of gatekeeper in the flow of new ideas into a system such as a school (Rogers, p. 283).

Early adopters are more a part of the mainstream local social system than the innovator. They have the highest degree of opinion leadership. The early adopters help trigger the critical mass when they adopt an innovation because they are respected by their peers. "The early adopter knows that to continue to earn the esteem of colleagues and to maintain a central position in the communication networks of the system, he or she must make judicious innovation-decisions" (Rogers, 2003, p. 283). Early adopters are the folks who make a decision to adopt an innovation and in effect mark it with their individual stamp of approval.

The third group of people in a social system to adopt an innovation is called the early majority. These folks have frequent interactions within their peer group but do not hold the same opinion-leadership position as the early adopters group. This middle group is a key link between the early adopters and the late majority. The innovation-decision period for this group is longer than the first two groups but they have a deliberate willingness to try to adopt an innovation. The early majority "follows with deliberate willingness in adopting innovations, but seldom leads" (Rogers, p. 284).

The fourth group is known as the late majority and skeptics in a system. Skeptics adopt a new concept or innovation after most people has already done so. Pressure from peers is needed to move this skeptical group to adopt a new idea but many times this may also be done due to economic necessity.

The final group in Rogers' model is known as the laggards. These are the folks who are last to adopt an innovation. Laggards tend to be suspicious of innovations and change agents and limit their interactions with those who share their traditional values. They do not adopt an innovation until they know it will not fail.

Diffusion research has shown many differences between earlier and later adopters of innovations. These differences include socioeconomic status, personality variables and communication behaviors. These differences can be used to devise strategies in which communication channels can be used to address different adopter categories.

*Social System*

The fourth and final element of diffusion of an innovation is the social system. "A social system is defined as a set of interrelated units that are engaged in joint problem solving to accomplish a common goal" (Rogers, 2003, p. 23). "A system has structure that is defined as the patterned arrangements of the units in a system, which gives stability and regularity to individual behavior in a system" (p. 37).

Individuals who are able to influence others' attitudes or behavior in adopting an innovation are considered opinion leaders. "A change agent is an individual who attempts to influence client's innovation-decisions in a direction that is deemed desirable by a change agency" (Rogers, p. 38). Rogers distinguishes between four types of innovation-decisions. The four types are: (a) optional innovation decisions, where a person chooses to adopt or reject an innovation that is made by the individual independent of others in the system; (b) collective innovation decisions, made by consensus of a group to adopt or reject an innovation; (c) authority innovation decisions, where the choice to adopt or reject an innovation is made by a few people in the system who have status, power, and technical expertise; and (d) contingent innovation decisions, where the group bases their decision only after a prior innovation decision was made.

Rogers (2003) believes that "a social system is involved in innovations consequences because certain of these changes occur at the system level in addition to those that affect the individual" (p. 30). Consequences are the changes that occur to an individual or to a social system because of the adoption or rejection of an innovation like the Internet. Finally, Rogers believes there are three different consequence classifications, which are: (a) desirable versus undesirable, (b) direct versus indirect, and (c) anticipated versus unanticipated.

## Diffusion of Innovations in Schools

During the time from the 1950s to the 1970s, there was massive infusion of money and effort to improve schools and the curriculum taught to the students. Much of the research being completed delved into the question of why these new programs that spent so much time and money were not being as successful as expected. During this time, the many different studies on the effectiveness of particular innovations in schools seemed to lack an understanding of what happens when an innovation is introduced in a school. There seemed to be a complete lack of understanding of the process of change that is needed for successful implementation of an innovation in an educational environment (Hord, 1987).

The work of people such as Hord (1987) and Hall (2001) focused on the process of change in schools instead of the innovation itself. By having an understanding of the change process and its own definitive steps in a school setting, one could frame a process to make sure that the adoption of an innovation would move from adoption to institutionalization. Work completed at the University of Texas in the early 1970s in the study of change in schools led to the creation of the Concerns-Based Adoption Model (CBAM). CBAM is an empirically based conceptual framework, which outlines the developmental process that individuals experience as they implement an innovation. This work recognized that change in a school environment is a process occurring over time, which is essential for successful implementation of an innovation. CBAM is a set of tools for planning, facilitating, monitoring, and evaluating change in schools (Hord, 1987).

The first set of diffusion studies completed in schools was due to the efforts of Paul Mort of the Teachers College at Columbia University. For almost 50 years, starting in the 1920s, he and his students completed over 100 studies of the adoption of finance reforms by local schools. Mort was able to document that the cost per pupil was most closely related to relative speed and success of adoption of an innovation. He also noted there was a 25-year time lag from the adoption of innovations by early adopter schools to laggard schools (Rogers, 2003).

Researchers such as Berman and Laughlin used Mort's studies to examine top-down change efforts by the federal government, which were aimed at the changing practices of school administrators and teachers in the United States (Berman, 1975). They found that adoption of an innovation was more dynamic than previous research indicated. The work of the Teachers College led to the establishment of the federal National Diffusion Network that was the clearinghouse for research on school practices for 20 years. Funding for the National Diffusion Network ended in 1996.

There are several studies mentioned in Rogers' fifth edition of the Diffusion of Innovation that can be used for comparison with this new effort to diffuse the Internet and the World Wide Web in schools and libraries. These studies include the diffusion of modern math in Pittsburgh, the worldwide diffusion of kindergarten and the adoption of new communication technologies. Each of these studies focuses on a different facet or part of the diffusion process and as such can be used to compare what I find in the Crook County School District as they use the federal E-Rate program to diffuse the innovations of the Internet and the World Wide Web.

Richard Carlson's study on the diffusion of modern math among school administrators focused on the role of opinion leaders in the diffusion of modern math among school administrators. His work found that the initial adopter superintendent was too innovative to serve as the role model for the other regional superintendents. Most of the superintendents waited to adopt the modern math curriculum until the opinion leaders of a six-member group favored the innovation (Rogers, 2003).

Another study included in Rogers' latest edition is the worldwide diffusion of kindergarten. Rogers speaks to the fact that it took kindergartens about 50 years to be adopted by schools in the United States based on the work of Paul Mort. The new programs of driver's training and modern math took only 18 and 6 years respectively to be widely adopted. He tied this difference to the change agencies, which were the insurance companies and car manufacturers for driver's training, and the National Science Foundation and the U.S. Department of Education for modern math. What interests Rogers about the worldwide diffusion of kindergarten was not particularly how long it took to be adopted but how it was re-invented around the world and connected to national values (Rogers, 2003).

The other study mentioned in Rogers' fifth edition that has some relevance to the diffusion of the Internet and the World Wide Web in schools and libraries in the United State is the adoption of new communication technologies. Rogers mentions three studies dealing with new technologies. One study dealt with a Finnish company that found that a great deal of time and effort was required by employees to learn how to use the personal computer. This learning required up to 20 to 25% of the employees' time at work. Another study by Igbaria and others found that allowing employees to play games on a computer reduced their anxiety of using the computer in the work place. Finally, Volvo did a study on the use of email in the corporation starting in the 1980s. As in many other diffusion studies, they found that a considerable period of time was required for the diffusion process. The innovation process did not occur quickly even when the administration was highly supportive of the effort (Rogers, 2003).

I focused my literature search on the studies of diffusion of technology in schools and school districts and on the Federal E-Rate program. While there is not an extensive amount of research, particularly in the arena of the adoption of the Internet and the World Wide Web, I did find some studies that helped frame this dissertation research.

## E-Rate and Technology in Schools

The E-Rate program has been operating for 10 years in the United States. Several initial studies were completed on this program in early 2000 and 2001. The first major study on the effectiveness of the E-Rate program was published in 2007.

One of the first reports on the E-Rate program was published in September of 2000 as part of an evaluation contract with SRI International by the U.S. Department of Education. In the first two years, the E-Rate program distributed over $4 billion, with 85% going to K-12 public schools. There were approximately 13,000 public school districts, 70,000 public schools, 5,000 private schools, and 4,500 libraries participating in the second year of the program (Puma, 2000).

In 1999, the Benton Foundation funded a study of the impact of the E-Rate program in four Midwest city school districts. Schools districts in Chicago, Illinois; Milwaukee, Wisconsin; Cleveland, Ohio; and Detroit, Michigan, were picked for this initial study. The study found that while each district followed a different path when it came to planning for, applying for, and using E-Rate funds, there were several common themes that were evident in their study. These seven themes were: (a) network infrastructure deployment accelerated and Internet access improved dramatically; (b) E-Rate funding enabled school districts to leverage existing financial resources; (c) professional development needs are increased geometrically; (d) school districts are highly dependent on E-Rate funding; (e) the E-Rate program has led to changes in school district planning processes; (f) the E-Rate process taxes relationships with vendors; and (g) building basics delay the deployment of information technology (Carvin, 2000).

Of these seven themes, the one that had the most hidden costs was the building basics problems. The E-Rate program does not support electrical upgrades and most computer hardware. Many schools had to find internal resources to address electrical needs in their schools to add internal computer network equipment such as routers, switches and hubs.

In July 2003 the Education and Library Networks Coalition issued a report titled: *E-Rate – A Vision of Opportunity and Innovation*. Their findings found that the E-Rate program was continuing to have a major impact on bringing the Internet and the World Wide Web to schools around the nation. Between the initiation of E-Rate in 1998 and 2001, Internet access in public school instructional classrooms in rural areas rose from 57% to 89%. Internet access rates in minority classrooms skyrocketed between 1998 and 2001, rising from 37% to 81% (Harris & Associates, 2003).

In 2006, Austan Goolsbee and Jonathon Guryan reported in the *Review of Economics and Statistics* the results of their empirical study on the impact of the E-Rate program in the state of California. Using new data on school technology usage in every school in California from 1996 to 2000 as well as application data from the E-Rate program, the researchers found that the subsidy did succeed in significantly increasing Internet investment. Overall, by the final year of the sample, there were approximately

68% more Internet-connected classrooms per teacher than there would have been without the subsidy (Goolsbee & Guryan, 2006).

## The Federal Government and USAC as the Change Agent

As Rogers has said in the multiple editions of his book, our federal government has created many different programs over the years to diffuse innovations in our nation. The Telecommunications Act of 1996 created a vehicle to diffuse the technologies of the Internet and the World Wide Web to schools and libraries. The Schools and Libraries Program of the Universal Service Fund, commonly known as E-Rate, is administered by the USAC under the direction of the Federal Communications Commission (FCC), and provides discounts to assist most schools and libraries in the United States to obtain affordable telecommunications and Internet access. It is one of four support programs funded through a universal service fee charged to companies that provide interstate and/or international telecommunications services.

The Schools and Libraries Program supports connectivity – the conduit, or pipeline, for communications using telecommunications services and/or the Internet. Funding is requested under four categories of service: telecommunications services, Internet access, internal connections, and basic maintenance of internal connections. Discounts for support depend on the level of poverty and the urban/rural status of the population served and range from 20% to 90% of the costs of eligible services. Eligible schools, school districts and libraries may apply individually or as part of a consortium. Applicants must provide additional resources including end-user equipment (e.g., computers, telephones, etc.), software, professional development, and the other elements that are necessary to utilize the connectivity funded by the Schools and Libraries Program (USAC, 2006).

During the first three chapters of this dissertation, I have discussed how the E-Rate program came into existence and what the purpose of the program was for K-12 public and private schools and public libraries in this country. As the federal government attempted to infuse the innovation of the Internet to these bodies throughout the country, the decision was made by the federal government to use the Schools and Libraries Program of the Universal Service Administrations Company (USAC) as the change agent for this national effort. Rogers' work on the diffusion of innovations is the framework I have chosen to study the success of the E-Rate program in one rural school district in Central Oregon.

# CHAPTER IV

# METHODOLOGY

The case study methodology that was used in this research is driven by the topic of study. The questions being asked and the study of the diffusion of an innovation in an educational setting led to the selections of a qualitative research method. Data was collected though document analysis, archival records research, direct observation and participant-observation. The data collected was from multiple sources of evidence and was used to create a case study database, which provided a chain of evidence that provided connections between the questions that were being asked and the conclusions that were drawn at the end of the study.

## Research Questions

Research questions used in this study were based on the theoretical framework of the diffusion of innovations in an educational environment. These questions were framed around the use of the E-Rate program and the subsequent use of the Internet in multiple schools in one rural Oregon school district.

1. What was the status of Internet connectivity and networking in each school in the district before the passage of the Telecommunications Act of 1996?
2. How much money has the school district received from the USAC since the start of the E-Rate program?

3. How has the school district used these dollars to provide Internet access to schools and classrooms?
4. What is the status of Internet connectivity to and within each school in the Crook County School District?
5. What is the status of networks in each school in the district?
6. What is the current use of the Internet in each school?
7. Did the use of E-Rate funding at each school have a direct impact on the level of use of the Internet in each school?
8. Did the diffusion of the Internet via the E-Rate program in the Crook County School District parallel or diverge from predicted results based on past research of the diffusion of innovations in a K-12 educational environment?

Field research included analysis of data related to funding received by the school district via the E-Rate program since its inception in January 1998 and up to December 2007. Research included documenting the type of expenditures made with E-Rate funding or district funding made available due to telecommunication discounts provided by the E-Rate program. Additional research included an in-depth analysis of current Internet connectivity of each school in the school district in Central Oregon. A complete review of the school district's computer network from 1998 until 2008 was undertaken to determine what changes occurred during this time and how they related to the E-Rate program and Internet Access.

### *Assumptions*

As I studied the impact of the E-Rate program on a school district in Central Oregon, I made several assumptions that were tied to the diffusion of innovation, which would hold true throughout the study. The first assumption was that there was a relationship between the use of the E-Rate support program by the school district and its increased use of the Internet. Second, I believed that my study of the current level and use of Internet connectivity to each school in the local school districts would provide necessary empirical data. This data would demonstrate that the E-Rate program had achieved its intended goal as defined by the original federal legislation. Finally, I felt that the diffusion of the Internet into each school district via the government's E-Rate program would be similar to other technological innovations that have been adopted in the K-12 educational setting.

## Choosing Qualitative Research

The purpose of this study was to assess the impact of the E-Rate program in one Central Oregon school district. There are several ways of doing social science research like this study. Each strategy has strengths and weaknesses depending on specific conditions, such as the type of research question being asked, the control the investigator has over the events, and the focus of the study (Yin, 2003).

Studying a national government effort such as the E-Rate program begs the questions of how and possibly why the program did or did not work in a specific area of the country such as Central Oregon. Did this diffusion of an innovation in education via a government program parallel or diverge from similar efforts in this country? A case study lends itself very well in trying to determine why or how a program has or has not worked. This is because case studies have a distinct advantage when a "*how*" or "*why*" question is being asked about a contemporary set of events over which the investigator has little or no control (Yin, 2003.) Understanding how an individual school district used the revenue it received from the E-Rate support program tells us how the program was implemented in this local school district.

## Research Design

Initially, to investigate these questions, I created a multiple case study. I believed at first that each school in one school district would have a direct impact and/or say in how the Internet and World Wide Web might be integrated into their school with the use of the E-Rate program. I came to find in my initial investigations that this was not the case and the decisions for each school were made by one or two persons in the district office of the Crook County School District. Therefore, to continue my investigation of these questions, I decided to create a single case study.

The overall design followed guidelines provided by Yin (2003). A single case study does not provide a sound basis for broad educational practices. In this specific study, a case study was appropriate because several specific conditions were present. There are three conditions in which case study design is called for: (a) research questions with a "*how*" and a "*why*" focus, (b) the study is of a contemporary event, and (c) the study has a lack of control by the researcher over the phenomenon being studied (Yin, 2003).

The research questions that are used were "*what*" (descriptive), "*how*," and "*why*," and were appropriate in this case study because they could only be answered by the people involved in the original implementation and use of the Internet and the World Wide Web in the individual school district.

The E-Rate program is a contemporary phenomenon. To understand whether this federal program was successful in diffusing a new technology in a school district it is necessary to determine how individual schools were connected to the Internet, how the internal LANs were implemented, what amount of money was spent to make this happen, and to determine whether the E-Rate program was successful (in this case study) in diffusing a new technology such as the Internet.

This study was a single case design and a Type I case study as defined by Yin (2003). It should be noted that this researcher was involved in the diffusion of this new technology either directly or indirectly in many school districts in several states. With my experiences starting an ISP in one school district and my involvement with OPEN as an ESD Superintendent, I have the credibility and expertise that was welcomed by participants. I believe this credibility led to staff and others to be direct and thorough in their responses to my questions and requests for information.

While this credibility and expertise might be welcomed, it can be a source of bias in this type of research. Being a participant-observer provided me with a special mode of observation. I was not merely a passive observer. In some cases, I was involved in meetings and discussions about the connection of the Internet to schools in Central Oregon and in the use of the E-Rate program. I believe any possible concerns about bias were addressed by the use of multiple sources of evidence collected in this study and the chain of evidence that it provided.

Case studies can be messy, ambiguous, time-consuming and creative all at the same time. The data collection and the analysis are not always neat nor do they proceed in a linear fashion. But this type of study can provide general statements about the relationships between different categories of data (Marshall & Rossman, 1995). While some of the data were available via public resources such as the federal government, some of it came from the participants that were involved in the decisions on how to use the E-Rate dollars to attempt to diffuse a new technology in their school district. This included the school district superintendent, the district technology director and the business manager for the school district. Collecting some of the data from these folks allowed me a glimpse into the educator's perspective, as he or she was directly involved in the E-Rate program itself.

In this case study, criteria was used that would demonstrate the credibility of the methods used and the findings that were discovered. This was because most case study findings are not judged by traditional quantitative notions of validity and reliability (Gall, Gall, & Borg, 1999).

The first criterion was the *chain of evidence*. In good case study research it should be relatively easy for any reader to follow the chain of evidence from the purpose statement to the research questions to the analysis of the findings and, finally, to the case study conclusions (Yin, 2003).

Another reason for using a case study model was that the E-Rate program has been in existence for 10 years. During that time, people and conditions have changed in the various schools in the school district. Case studies use fieldwork so that researchers can interact with the participants involved, in the setting in which the decisions were made, and infer concepts from phenomena that are observed.

## Site Selection

There are currently eight school districts in Central Oregon. These districts range in size from Ashwood, with three students, to the Bend-La Pine Schools, with a current enrollment of over 15,000 students. The other school districts in Central Oregon include Black Butte, Sisters, Redmond, Culver, Madras, and Crook County. In the state of Oregon, 38% of school districts have enrollments of less than 500 students. An additional 38% of the school districts have between 500 and 3,000 students. School districts with student enrollments of 3,000 to 10,000 make up 18% of the school districts. School districts with more than 10,000 students make up only 6% of the total number of school districts.

In Central Oregon, two school districts have fewer than 500 students, two school districts have between 500 and 3,000 students, three districts have between 3,000 and 10,000 students, and one district has more than 15,000 students.

I chose the Crook County School District for this case study because it was more representative in student enrollment for school districts in Oregon than the other school districts in Central Oregon. Crook County School District enrollment has just over 3,000 students and is rural in nature. Since most of the school districts in Oregon are rural and have 3,000 or fewer students, I believed studying this school district would have more potential comparability to 76% of the districts in the state than to the 24% of the districts that are much larger and urban in nature.

## Sources of Data

I collected national, state, and local data on E-Rate reimbursable expenditures for each school over a 10-year period, from January 1998 to December 2007. This reimbursable expenditure data was collected from the Universal School Administrative Program, the Oregon State Department of Education and the local school district. Physical assets, such as routers and switches, and maps of LANs were collected in conjunction with the High Desert ESD, which provides Internet connectivity to the school district. I collected data and schematics on the network design for each school district as it ties into the ESD regional educational network. I also collected longitudinal data on the amount of Internet bandwidth used by the school districts over the 10-year period. The final document collected was the most recent revision of the school district technology plan that was submitted for E-Rate purposes to the Oregon Department of Education.

## Data Collection

Primary data collection took place over a 10-week period lasting approximately from August 1 to October 15, 2007. School district data was collected with the help of the district's technology director, business manager, and superintendent. Other data was collected online via federal and state sources tied to the E-Rate program.

## Analysis

Construct validity was addressed in the study by using multiple sources of evidence during the data collection process to triangulate and corroborate the use of E-Rate funding dollars by the school district. This also helps establish the chain of evidence. This data was collected from the business office of the school district, from the Oregon Department of Education, the Schools and Library Corporation and the Umatilla Morrow ESD. Data on bandwidth utilization for each school was collected for each school year over a 10-year period. The draft data on each school was reviewed and revised where necessary by key district staff, as a form of member checking.

## Validity/Reliability

Multiple techniques ensured the validity and reliability of data collected and the subsequent analysis. Triangulation of the multiple data sources ensured rigorous and systematic data analysis. Data was gathered using multiple sources of information to compare usage of the E-Rate program in the district. The replicability of this study relied on systematic data collection and reporting and on the reliability of the instrumentation used (Rossman & Rallis, 1998). This included the creation of trackable decisions with copies of paper forms, audit trails, logs, memos and/or emails.

Time series analysis was used as an analytical technique in this case study, which strengthens internal validity. This allowed for tracking changes in the school district network and bandwidth utilization over time, which can be a major strength in case studies (Yin, 2003). External validity was addressed by using Rogers' theory on the diffusion of innovation in this case study. This allows analytical generalization to be used to generalize a set of results to some broader theory.

Finally, reliability was addressed making the collection of data from multiple sources as operational as possible and creating a case study spreadsheet of the data collected.

### *Implications*

The United States has spent over $21 billion as part of the E-Rate program during the last 10 years. The purpose of this research was to determine the impact of this type of financial investment in one rural school district in Central Oregon in relation to the original intent of the federal legislation. The original intent of the legislation for schools was to improve the workforce and provide additional educational opportunities to students. Does this type of federal intervention in telecommunications really work in a rural setting in Central Oregon? Did the diffusion of the Internet via the E-Rate program parallel or diverge from other past government efforts to diffuse innovations in K-12 schools in the United States? This study shows whether this type of federal program was successful in the diffusion of a new technology in one rural school district in Oregon.

## Summary

Change is a common thread throughout schools in the United States. The process of diffusion and change in schools can be studied within the framework of Rogers' work on diffusion of innovation. The data collected from USAC and the Crook County School District, along with other sources, is used to determine if the Telecommunications Act of 1996 was successful in diffusing the Internet to one rural school district in the state of Oregon.

# CHAPTER V

# DATA REPORTING AND ANALYSIS

This case study on the diffusion of the Internet and the World Wide Web via the federal E-Rate program in the Crook County School District brought to the forefront data that I believe can be used not only to compare this district with other rural school districts but with other types of diffusion efforts mentioned in Rogers' (2003) book on the diffusion of innovations. Between 1995 and 2001, OPEN was able to facilitate Internet connectivity to almost all schools in the state of Oregon via a network of Educational Service Districts providing network connections, usually via Qwest and local ISPs. Funding for this effort was initially provided by the local school districts and ESDs. I personally attended and was involved directly in many meetings and discussions on how local ESDs were contracting with telecommunication carriers to provide direct connections to local school districts and their schools via the local ESD. The local ESD would work with the local districts on providing the network management for the connections to the schools and the Internet via the ESD. This included cost sharing regionally for necessary network equipment such as routers, switches and servers, and for technical staff to manage the regional and school district computer networks.

Between 1995 and 2001 these local and regional networks were enhanced by state legislation that built upon OPEN's statewide network to provide video conferencing for educational purposes via dedicated T1 lines to all the high schools in the state. The 1999

Oregon Legislature enacted Senate Bill 622, a telecommunications act that provided funds, through QWEST Communications, to the Oregon Department of Education (ODE) for the purpose of building connectivity infrastructure and providing videoconferencing hardware for all of Oregon's high schools and Education Service Districts (OAESD). A dedicated frame relay video network was deployed and included schools and ESDs as they were installed to the Network and equipped with videoconferencing equipment. Video conferencing systems were provided to all 287 Oregon high schools and ESDs on an as-ready basis. The network installation process began in May, 2000, and was completed December 31, 2001. The result was the completion of the *Oregon Access Network*, one of the first statewide IP video networks in the nation and one of the largest of its kind. Another result of the legislation was the completion of a statewide data network for all Oregon schools, bringing high-speed Internet access to every school building in the state. This completed the OPEN development of high-speed connectivity for K-12 schools, bringing a direct connection to the data network for every remote or underserved area in the state (Bunn & Campbell, 2002).

The success of OPEN for most of the schools in the state was tied not only to direct funding by the legislature but also to the advent of the E-Rate program, which started to distribute money to telecommunication providers via local school district connections in 1998.

While OPEN was successful in achieving its initial mission, it was not long before large differences between the quality and speed of Internet connections in and out of schools became a problem in Central Oregon and across the state. Certain schools in parts of rural Oregon were connected to the Internet but may have had only a 56k connection. In other parts of the state, particularly urban areas, it was not uncommon for schools to connect to cable or fiber networks that provided network connections at speeds of 10 megabits (Mb) to 100 Mb with the potential of connections up to 1,000 Mb or more. This meant that while all schools were connected to the Internet, they each did not have access to the same level and quality of materials available on the World Wide Web. This inequality was an example of the digital divide. In 1996, approximately 50% of the schools in the United States had access to the Internet (Coley, Cradler, & Engle, 1997).

Administrators in the Crook County School District decided in 1998 to use the E-Rate program to help discount their connectivity costs via the OPEN network as evidenced by their initial E-Rate application filed during this year. In addition, they decided to use the funding program to build out their school district wide area network and their individual school networks. Before they could move forward with the E-Rate process that is described in Chapter II, they had to complete and submit a technology plan to the State of Oregon and determine their discount rate via the federal discount matrix used by the federal E-Rate program.

The school district administration submitted their district technology plan to the State Department of Education and received approval of the plan. The plan had to meet the minimum requirements of the E-Rate program. A copy of the Crook County School District Technology plan, which has been revised since 1998, is attached as an addendum to this dissertation (Appendix A). The district's plan met federal requirements and was approved by the State of Oregon. The plan had to meet specific goals, which were specified in their technology plan. Excerpts from the plan follow which demonstrate how the district was meeting required guidelines for approval of their technology plan.

*Clear goals and a realistic strategy for using telecommunications and information technology.*

Crook County School Districts technology plan goals are as follows:

- The district will enhance technology and support by researching, developing, and maintaining infrastructure and programs that support the needs of the staff, students, and community.
- To provide the best possible use of technology the district will acquire, upgrade, and replace hardware and software to enhance administrative and instructional needs.
- To improve the utilization of technology in the classroom and to enhance student achievement, the district will provide staff development.
- To enhance student achievement the district will provide curriculum and best practices for instruction using technology.
- To develop, enforce and monitor policy development for staff, students, and community.

*A professional development strategy to ensure that staff knows how to use these new technologies.*

- Develop hiring criteria that will include competency in technology skills.
- Develop and distribute a survey yearly to determine staff development needs.

- Provide staff development in the use of administrative hardware and software (Schoolmaster, Windows, Mastery in Motion, Schoolmaster Grade book, Follett, Microsoft Office, Renaissance Learning, etc.) as needed.
- Provide staff development in the use of educational hardware and software (PLATO, Accelerated Reader, STAR, Office, Web-based resources, etc.) as needed.
- Provide opportunities for staff to attend conferences related to the use of technology in the classroom.
- Provide a technology staff development consultant to teachers and to coordinate training through the curriculum department that schedules activities throughout the year.

*An assessment of the telecommunication services, hardware, software and other services needed and a sufficient budget to acquire and support the non-discounted elements of the plan – the hardware, software, professional development, and other services that will be needed to implement the strategy.*

Both of these goals are addressed in the Technology Replacement and Upgrade Proposal section of the most recent technology plan submitted.

- Based on the numbers reported on the Oregon Fall Report, Crook County has 730 networked computers available to staff and students. The enrollment as of March 2006 is 3145 students in grade K through 12. In addition, the district provides one computer in every classroom and, beyond that, a ratio of one (1) computer for every five (5) students.

- Using 700 computers as the basis for determining replacement cost and placing the district on a 5-year cycle, Crook County School District would replace 120 computers (20%) per year at the cost of approximately $700 per computer.
- Replacement Priorities: In December 2005, the district technology committee recommended the following priorities for use of the replacement fund. The committee endeavored to look to upgrade high school and middle school labs on a two-year rotation—60 computers with Windows 2000 (or greater) and Office 2000 (or greater). (Computers will be recycled to elementary schools.)
- Recycled computers will be distributed on an equal basis with no more than 50% being dedicated to teacher use, therefore assuring a minimum of 50% being dedicated to student use.
- Develop elementary labs/classrooms to maintain a 5 to 1 ratio (approximately 75+ student computers per building).
- Replace teacher computers at the rate of 20% per year using building funding, technology funding, and federal funding when available.
- Assess the specific needs of personnel to determine the placement of replacement computers, as reflected in individual building technology plans.
- As funds become available:
    - Purchase projectors, scanners, cameras, and laser printers as per building technology plan.

  - Purchase wireless access points to provide access throughout the building as per building technology plan.
  - Maintain two networked computers per classroom at the elementary schools.
- Network Upgrade/Replacement:
  - Networking Equipment must be upgraded on a 5-year cycle. Currently routers and switches are being replaced for a total cost of $120,000.
  - We are considering a change to wireless access/fiber. The approximate costs of this conversion would be $ 250,000.
  - Switches and routers currently being purchased are Voice over IP compatible. There will be an additional cost of $ 75,000 for purchasing Voice over IP telephones.

*An evaluation process that enables the school or library to monitor progress toward the specified goals.*

- The district technology department and technology coordinator will use the above indicators for twice-yearly meetings (December and May).
- Using the Plan/Do/Study/Act process of continuous improvement, the technology department in conjunction with building principals will determine needs and revisions for maintenance, acquisition, staff development, curriculum and instruction, and policies.
- Recommendations for purchasing and revisions to the plan will be made each March prior to budgeting.

The next step for the Crook County School District was to determine what the discount rate was going to be for the E-Rate program. This was determined by using the E-Rate discount matrix and gathering free and reduced lunch rates for the school district. When a school district is applying for E-Rate discounts on eligible services via Form 471, the school district must calculate the percentage discount that the district is eligible to receive. Table 3 explains how school districts determine their district discount rate.

Table 3

*Discount Matrix*

| INCOME<br>Measured by % of students eligible for the National School Lunch Program | URBAN LOCATION<br>Discount | RURAL LOCATION<br>Discount |
|---|---|---|
| If the % of students in your school that qualifies for the National School Lunch Program is… | …and you are in an URBAN area, your discount will be… | …and you are in a RURAL area, your discount will be… |
| Less than 1% | 20% | 25% |
| 1% to 19% | 40% | 50% |
| 20% to 34% | 50% | 60% |
| 35% to 49% | 60% | 70% |
| 50% to 74% | 80% | 80% |
| 75% to 100% | 90% | 90% |

Every school or library in the United States is located in either a rural or an urban area, based on Metropolitan Statistical Area (MSA) data. School districts must determine if each school or library is rural or urban in order to properly calculate its percentage discount. Calculations for percentage discounts are always based on data – including rural or urban status – at the level of an individual school or library building (USAC, 2006). The USAC determined that the entire Crook County and, in turn, the Crook County School District qualified as a rural school district for the E-Rate program.

In addition to establishing whether a school district is either rural or urban, a school district must calculate their free and reduced lunch rate for the school district to determine their actual E-Rate discount. This portion of the formula must be calculated based on federal free and reduced lunch program statistics. The overall rate of the school district determines the final E-Rate discount based on the previous table. Table 4 shows the free and reduced lunch rates for the Crook County School District from the 1999-2000 to the 2006-2007 school years. This information was collected initially by the school district, reported to the state of Oregon and then sent to the federal government for final confirmation on the districts free and reduced lunch rate for each year.

Table 4

*Free and Reduced Lunch*

| School | Membership | Free lunch eligible | Reduced lunch eligible | % Eligible for free and reduced lunch |
|---|---|---|---|---|
| | | 1999-2000 | | |
| Cecil Sly Elem. School | 455 | 162 | 72 | 51.4 |
| Crook County High School | 983 | 150 | 53 | 20.7 |

Table 4
*Continued*

| School | Membership | Free lunch eligible | Reduced lunch eligible | % Eligible for free and reduced lunch |
|---|---|---|---|---|
| Crook County Middle School | 711 | 226 | 99 | 45.7 |
| Crooked River Elem. School | 459 | 158 | 62 | 47.9 |
| Ochoco Elem. School | 363 | 147 | 58 | 56.5 |
| Paulina Elem. School | 44 | 24 | 4 | 63.6 |
| Powell Butte Elem. School | 187 | 38 | 19 | 30.5 |
| | | 2000-2001 | | |
| Cecil Sly Elem. School | 448 | 144 | 61 | 46% |
| Crook County High School | 970 | 193 | 47 | 25% |
| Crook County Middle School | 746 | 242 | 102 | 46% |
| Crooked River Elem. School | 447 | 181 | 65 | 55% |
| Bochco Elem. School | 387 | 196 | 49 | 63% |
| Paulina Elem. School | 42 | 13 | 6 | 45% |
| Powell Butte Elem. School | 158 | 29 | 14 | 27% |
| | | 2001-2002 | | |
| Cecil Sly Elem. School | 436 | 155 | 74 | 53% |

Table 4
*Continued*

| School | Membership | Free lunch eligible | Reduced lunch eligible | % Eligible for free and reduced lunch |
|---|---|---|---|---|
| Crook County High School | 1017 | 188 | 61 | 24% |
| Crook County Middle School | 717 | 208 | 101 | 43% |
| Crooked River Elem. School | 437 | 162 | 59 | 51% |
| Ochoco Elem. School | 366 | 210 | 62 | 74% |
| Paulina Elem. School | 33 | 19 | 2 | 64% |
| Powell Butte Elem. School | 148 | 30 | 14 | 30% |
| | | 2002-2003 | | |
| Cecil Sly Elem. School | 450 | 193 | 56 | 55% |
| Crook County High School | 971 | 195 | 87 | 29% |
| Crook County Middle School | 727 | 253 | 94 | 48% |
| Crooked River Elem. School | 431 | 187 | 63 | 58% |
| Ochoco Elem. School | 383 | 210 | 50 | 68% |
| Paulina Elem. School | 30 | 11 | 2 | 43% |
| Powell Butte Elem. School | 141 | 34 | 9 | 30% |

Table 4
*Continued*

| School | Membership | Free lunch eligible | Reduced lunch eligible | % Eligible for free and reduced lunch |
|---|---|---|---|---|
| | | 2003-2004 | | |
| Cecil Sly Elementary School | 458 | 186 | 68 | 55% |
| Crook County High School | 1016 | 248 | 102 | 34% |
| Crook County Middle School | 701 | 254 | 87 | 49% |
| Crooked River Elementary School | 461 | 190 | 61 | 54% |
| Ochoco Elementary School | 387 | 211 | 36 | 64% |
| Paulina Elementary School | 36 | 16 | 5 | 58% |
| Powell Butte Elementary School | 148 | 28 | 12 | 27% |
| | | 2004-2005 | | |
| Cecil Sly Elementary School | 480 | 206 | 55 | 54% |
| Crook County High School | 1040 | 249 | 101 | 34% |
| Crook County Middle School | 677 | 279 | 86 | 54% |
| Crooked River Elementary School | 376 | 158 | 63 | 59% |
| Ochoco Elementary School | 417 | 229 | 53 | 68% |
| Paulina Elementary School | 33 | 19 | 4 | 70% |

Table 4
*Continued*

| School | Membership | Free lunch eligible | Reduced lunch eligible | % Eligible for free and reduced lunch |
|---|---|---|---|---|
| Powell Butte Elementary School | 143 | 20 | 14 | 24% |
| | | 2005-2006 | | |
| Cecil Sly Elementary School | 515 | 225 | 65 | 56% |
| Crook County High School | 1001 | 251 | 89 | 34% |
| Crook County Middle School | 726 | 322 | 118 | 61% |
| Crooked River Elementary School | 390 | 176 | 46 | 57% |
| Ochoco Elementary School | 413 | 226 | 53 | 68% |
| Paulina Elementary School | 33 | 18 | 3 | 64% |
| Pioneer Secondary Alternative High School | 57 | 21 | 3 | 42% |
| Powell Butte Elementary School | 160 | 33 | 15 | 30% |
| | | 2006-2007 | | |
| Cecil Sly Elementary School | 544 | 205 | 74 | 51% |
| Crook County High School | 925 | 214 | 92 | 33% |
| Crook County Middle School | 716 | 256 | 88 | 48% |
| Crooked River Elementary School | 395 | 176 | 52 | 58% |

| School | Membership | Free lunch eligible | Reduced lunch eligible | % Eligible for free and reduced lunch |
|---|---|---|---|---|
| Ochoco Elementary School | 433 | 202 | 45 | 57% |
| Paulina Elementary School | 28 | 20 | 0 | 71% |
| Pioneer Secondary Alternative High School | 129 | 38 | 3 | 32% |
| Powell Butte Elementary School | 152 | 31 | 10 | 27% |

The overall rate, calculated on an annual basis for the Crook County School District, as based on the free and reduced numbers, ranged from 35% to 49%. Based on the table used by USAC and the determination that Crook County School District qualified as a rural school district, the school district discount rate for the E-Rate program was 70%.

Once the school district knew its discount rate for the E-Rate program and had their technology plan approved, they then had to move forward with the systematic process described in Chapter II for the E-Rate program. The success of this particular process in this school district was also tied to the commitment of staff such as the school district technology director, school district business manager and, in some cases, the superintendent of the school district. In the Crook County School District, the technology director was responsible for the creation of the district technology plan that was supported by key staff members who had an understanding of the Internet and instructional and informational technology in general.

The technology director became responsible for the entire E-Rate process in the district but needed support from the business manager to complete his work. The superintendent was involved in approving the district technology plan and approving the process and activities that the technology and business staff was required to complete during a funding cycle. The Crook County technology director and business manager were involved in the same regional meetings I attended where decisions were made on how the regional network would be designed and operated by the High Desert ESD. This information was needed as the school district applied for E-Rate discounts on connections from their individual schools back to the ESD Network Operation Center. The technology director and business manager in Crook County School District were responsible for all steps in the E-Rate process, including:

1. Determine school district eligibility.
2. Develop and get approval of a district technology plan.
3. Start a competitive bidding process.
4. Calculate school and district discounts via free and reduced lunch rates.
5. Determine district-eligible services.
6. Submit the district's application for program support
7. Wait on an application review from USAC.
8. Get the funding decision from USAC.
9. Begin the actual services.

10. Invoice USAC for these services.

This process was extremely time consuming the first year of the E-Rate program for school districts. Many districts looked to their local educational service districts, as did Crook County, for help and support during the E-Rate process. Because of the amount of time and energy needed to complete the E-Rate process and the concerns that individual districts had about completing the process, districts began to use services provided by local ESDs to help them complete the process. In 1998, the Crook County School District began using the Umatilla-Morrow Education Service District (UMESD) to provide this service.

The UMESD provides this E-Rate management services to over 50 school districts in Oregon and Washington. UMESD files school district and library E-Rate applications in accordance with Schools and Libraries program rules. This included, but was not limited to, Forms 470, 471, 486, 472 and 500. The ESD also works with problem resolution and program integrity assurance as necessary.

## E-Rate Management

The Crook County School District chose to outsource their E-Rate management because the UMESD service was considered cost-effective and the district had confidence that someone was auditing the district to make sure key forms filed were sent in on time. This information was collected during conversations with the district technology director and business manager as I collected copies of their different E-Rate forms. In addition, the ESD became the point of contact for the district for help with E-

Rate forms as well as with USAC. UMESD has been involved with E-Rate since its inception. The partnership the Crook County School District has with UMESD allows the following activities to occur as a part of the E-Rate process:

- The school district develops a technology plan and provides the UMESD with telecom bills and external connection survey.
- UMESD files Form 470 on behalf of the school district.
- Vendors respond with bids within 28 days.
- Service provider is selected.
- UMESD files Form 471 on behalf of the school district
- SLD reviews request and issues funding commitment letters to UMESD on behalf of school districts and to vendors.
- UMESD files Form 486 on behalf of the school district
- UMESD files Form 500: Problem Resolution and PIA. Using Universal Service funds, the service providers provide discounts or reimbursements to the school districts.

The business manager's key role in this E-Rate process was working with the technology director to determine existing telecommunication services that could be part of the E-Rate program and the current annual costs for these services. In addition, the business manager would work with the technology director to determine what new services or equipment was needed, what the costs would be for these services, and finalize an analysis of how much the school district would need to budget for these services and how much would be paid for by USAC.

The technology director needed to create a long-term vision as part of the technology plan that had to be submitted. This long-term vision included goals and a strategy for using telecommunications and information technology. This meant that the plan needed to include how each school was going to be connected to the school district wide area network and the type of connection. In addition, a road map had to be created as to what hardware, software, and other services were needed to complete the school district wide area network and the internal networks in each school.

Along with the technology plan and a business plan, a budget had to be created to acquire items not covered by the E-Rate program such the hardware, software, professional development, and other services that would be needed to implement the strategy. Data was collected that dealt with the telecommunication services that were requested for each school to implement the Internet via their technology plan. This information was submitted to USAC and was included in each Form 470 that was filed by the district by UMESD.

## The Schools

With an adopted technology plan and a decision to expand the Internet to all the schools in the district, the E-Rate became a cost effective way for the school district to diffuse the Internet to each school. The Director of Technology worked with staff from the High Desert Education Service District (HDESD) to tie each school into the district wide area network, which was connected to the Oregon Public Electronic Network. Plans were made and adopted for the types of connections to each school, the types of networks that would be installed in each school to which individual computers would connect and allow students to search the World Wide Web via the Internet.

In the fall of 1996, Crook County High School was connected to the Internet via a frame relay connection back to the Network Operations Center (NOC) of the HDESD in Bend, Oregon. Expansion of the network was not started until 1998 when the E-Rate program became available. With a discount rate of 70%, the school district knew that connecting each of their schools to the Internet would cost them only 30 cents on the dollar for direct connectivity. They also knew that they would receive a similar discount for some purchases necessary for them to create their wide area network and their internal networks in each school. The school district technology plan had to address the following in each school:

- Type of cabling to use for connection within each of the schools.
- Types of computers to use to transmit data via internal network in each school.
- Resources to shared across different operating platforms;
- Electronic mail.
- Internet access.
- Purchasing of software licenses.
- Shareware and freeware that could be used.

The implementation of a computer network in each school that was tied to the district wide area network and in turn was connected to the Internet was driven by the size of the school, number of students, numbers of classrooms and offices and expected number of computers to be connected to the local area network. Following is the general location, grades served, and enrollment currently in each school in the Crook County School District.

- *Cecil Sly Elementary* is in the center of the city of Prineville and serves Grades K-5 with a current enrollment of 515 students.
- *Crook County High School* serves 1,000 students in Grades 9-12 and includes the entire geographical area of Crook County and the rural, eastern portion of Deschutes County.
- *Crook County Middle School* serves 726 students in Grades 6-8. The school serves the entire County of Crook except for the communities of Powell Butte and Paulina and the rural, eastern portion of Deschutes County.
- *Crooked River Elementary* is in the center of the city of Prineville and serves Grades K-5 with a current enrollment of 390 students.
- *Ochoco Elementary* is in the northwest part of the city of Prineville and serves Grades K-5 with a current enrollment of 413 students.
- *Paulina School* is located in the community of Paulina and serves the eastern portion of Crook County. This community school is 50 miles east of the city of Prineville. The school serves Grades K-8 with a current enrollment of 32 students.
- *Pioneer Secondary Alternative High School* is in the center of the city of Prineville and serves students who have not completed high school or passed

the GED and are between the ages of 14 and 21. The school was started in 2005 and has a current enrollment of 110 students.

- *Powell Butte Elementary School* serves the rural community of Powell Butte, which is 15 miles west of the city of Prineville. The school serves Grades K-8 with a current enrollment of 160 students.

## Network Design Over a 10-Year Period

In 1998, the Crook County School District was in the infancy of their efforts to provide Internet connectivity to schools in their community. In 1998, the schools in the city of Prineville were connected to the Internet via cable provided by Crestview Cable Company. This included Crook County High School, Crook County Middle School, Ochoco, Crooked River, and Cecil Sly Elementary schools. Paulina and Powell Butte Schools were on dedicated 56k lines provided by Qwest and CenturyTel. The school district had a frame relay going from the high school to the High Desert Network Operation Center in Bend. In addition, the district had a frame relay connection to Linn Benton Lincoln (LBL) ESD's IBM AS400. The school district subscribed at the time to a student and financial information product provided by the ESD. The cable connections to each school provided by the cable company were providing minimum levels of connectivity. The connection speed to each school was less than 1mg, and the district-aggregated bandwidth to the Internet was less than 1mg and was being provided by a frame relay connection. During this time period, the school district began to implement their technology plan, which called for them to build local area networks in each school using Cat (Category) 5 cabling. The district also decided to use an Ethernet as a way to communicate data over their Cat 5 cabling. RJ9 connection drops were installed into classrooms and offices, which allowed individual computers to connect via Ethernet cabling to the school local area network. Figure 2 is a diagram of the design of the Crook County wide area network during the 1998-99 school year.

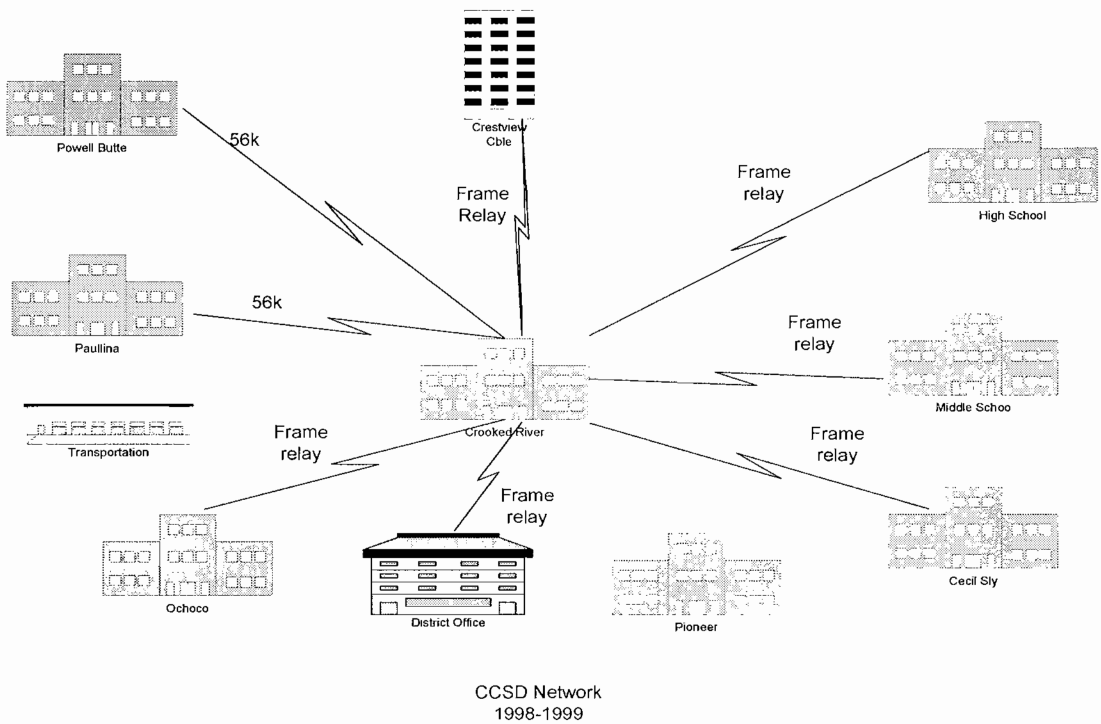


*Figure 2.* Crook County School District network 1998-1999.

During the 1999-2000 school year, the district continued with the same connections for each school until the equipment for Crestview Cable became inoperable. The cable company opted not to replace the equipment and the school district was without a wide area network or any direct connections to the Internet for several months.

Only those schools that were not on the Crestview Cable connections continued to be connected to the Internet.

## Network 2000

At this point in time, the Crook County School District chose to purchase all new routers and switches and install frame relay connections to each school except Paulina School. These T1 connections were provided by Qwest or CenturyTel. This gave each school up to a 1mg connection to the district office server, which was connected to the Internet via the High Desert ESD. It was not long before the district had to increase their connection to the ESD and, in turn, the Internet due to increase demand at each school. The demand for more bandwidth was being driven not only by additional student and teacher use in the schools but by outside factors. Due to the increase of bandwidth to each school site, the district had to increase their connection bandwidth to the ESD with a T1 connection in 2000.

During the 2001-2002 school year, the state of Oregon began its Technology Enhanced Student Assessment (TESA), an online state assessment system. Increased bandwidth due to online testing became an issue at each school, which led the school district's decision to change their frame relays to point-to-point T1 lines at each school.

For the next few years, the school district continued to use point-to-point T1 lines for most of their schools except for Paulina School. The school district was starting to see increased, sustained bandwidth use of the Internet as measured by the HDESD Network Operation Center. The school district needed to increase their connection from their school district wide area network to the NOC in Bend. Following a recommendation of the systems engineer of the HDESD, the school district purchased an Optical Carrier (OC3), which provided 3mb ATM (Asynchronous Transfer Mode) service to the NOC in Bend on one of the T3s that is part of the OC3. The second T3 was channelized to T1s, which reduced the cost by about half for transport via Qwest.

## Network 2005

In 2005, the school district increased the Paulina School to a T1 line and dropped the frame relay connection to LBL ESD since they were no longer using the connection for student and financial information systems. During the next few years, the district increased their bandwidth to the Internet from the school wide area network from three to 10mg due to increased use of the Internet in the schools. This increase in bandwidth was being driven by more and more student and staff use of the World Wide Web via the Internet. Another factor in the increase in bandwidth was the additional numbers of computers tied to the schools' local area networks, the district wide area network and eventually the Internet. The number of computers grew from 700 in 1998, to 900 in 2007. During the 2007-2008 school year, the school district budgeted to increase their connection to the HDESD NOC and in turn the Internet to 16mg. This increase means that in a 10-year time period the district connection speed and demand for the Internet went from less than 1mg in 1998 to 16mg in 2007. See Figure 3.

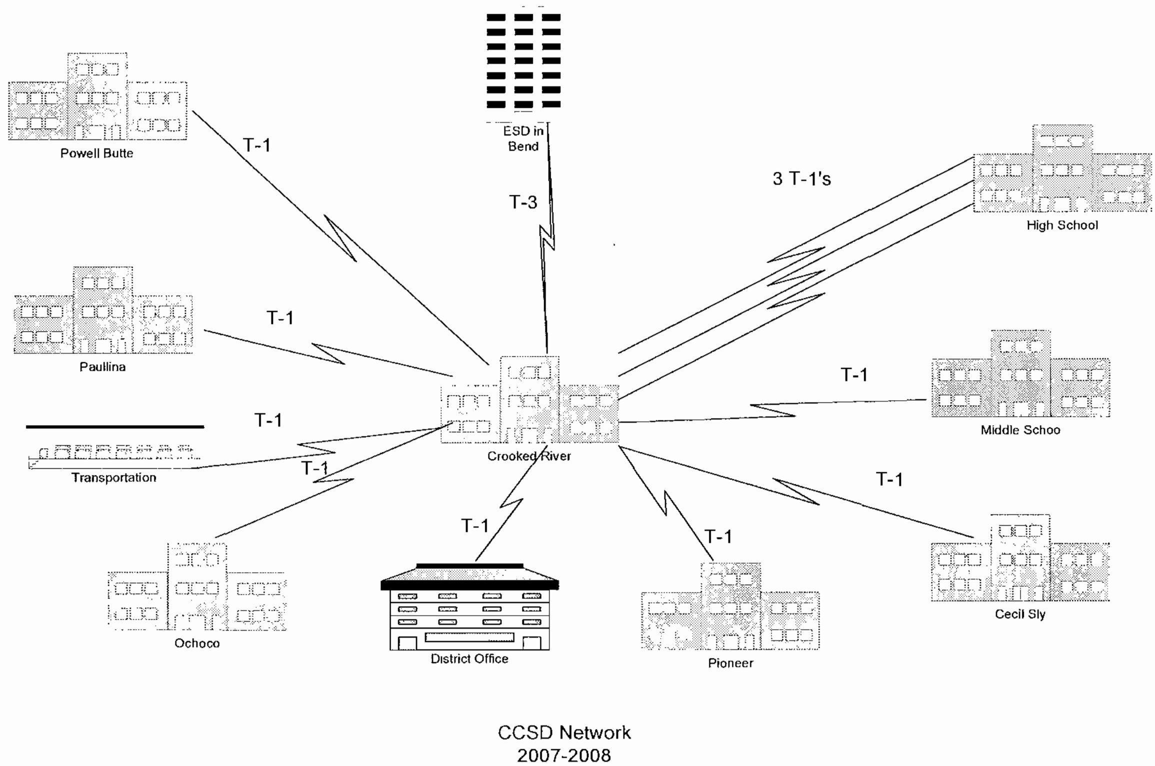


*Figure 3.* Crook County School District network 2007-2008.

Crook County School District's connection to the Internet is expected to dramatically increase during the 2008-2009 school year with the completion of the district's own fiber optic network that has been built by Bend Broadband. Figure 4 shows the current design of the Crook County School District network for the 2008-2009 school year and the near future.

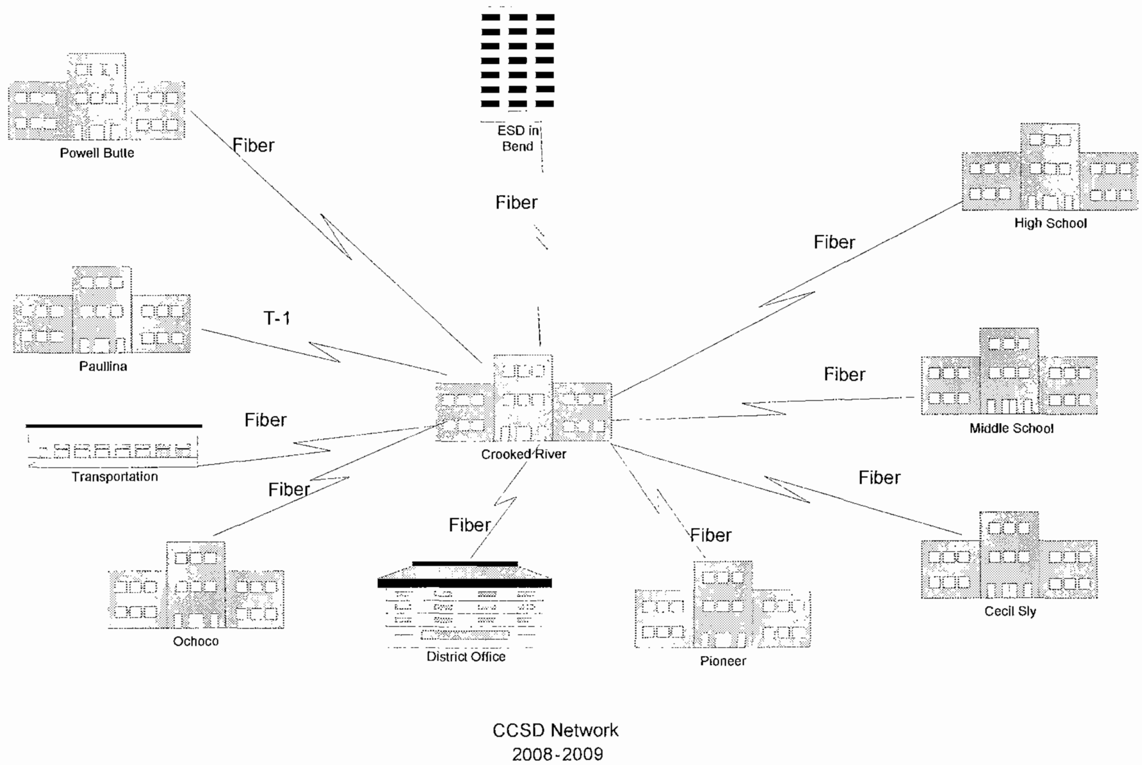


*Figure 4.* Crook County School District network 2008-2009.

## E-Rate Reimbursement

The school district started accessing universal service fund dollars via the E-Rate program in 1998. Table 5 displays the amount of E-Rate funds requested, how much the district qualified for and how much they received during this 10-year time period. These amounts include funds for Internet connectivity, general telecommunication such as regular phone lines, and internal connection equipment for local area networks and the school district wide area network.

Table 5

*E-Rate Reimbursements*

| FY | Req. FRNs | Funded FRNs | 486 on file | Requested amount | Total committed | Total disbursed |
|---|---|---|---|---|---|---|
| 2007 | 6 | 6 | 6 | 93,522.10 | 93,522.10 | 11,166.46 |
| 2006 | 6 | 6 | 6 | 89,283.16 | 88,265.24 | 87,196.89 |
| 2005 | 6 | 6 | 6 | 111,106.43 | 111,106.43 | 82,241.09 |
| 2004 | 16 | 15 | 15 | 100,717.61 | 97,877.91 | 73,863.99 |
| 2003 | 16 | 15 | 15 | 98,302.66 | 94,880.92 | 43,972.83 |
| 2002 | 14 | 12 | 12 | 55,126.51 | 49,581.06 | 35,856.15 |
| 2001 | 19 | 15 | 14 | 225,270.45 | 61,131.68 | 52,921.43 |
| 2000 | 5 | 2 | 2 | 80,142.20 | 50,400.00 | 4,057.60 |
| 1999 | 1 | 1 | 1 | 42,600.00 | 42,600.00 | 34,868.55 |
| 1998 | 1 | 1 | 1 | 42,600.00 | 34,851.60 | 33,259.33 |

Table 5 illustrates the amount of E-Rate reimbursement each year from 1998 until 2007. The relative increase each year is a reflection of increased connectivity to each school in the district and to the Internet. In addition, the gradual increase is also a reflection of the district's effort to upgrade and build the local area networks in each school and complete the construction of their wide area network.

One of the interesting facts that became apparent after studying the E-Rate reimbursements was that there was a year in which the amount of actual reimbursement was much lower than any other year in the 10-year period. During the 2000 school year, the amount that was actually reimbursed was $30,000 less than the previous year and almost $48,000 less than the next school year. In confirming the accuracy of all of the data on the E-Rate reimbursements, I contacted the Umatilla Morrow Education Service District, the Oregon Department of Education, and the Universal Services Administration Corporation. This research confirmed that the statistical information on reimbursements were correct. This led to further questioning to find out why the 2000 school year reimbursement was so much lower than the year before and the year after. The reason for the lower reimbursement is that both the school district and the ESD both did not follow up with a form that needed to be completed by the service provider. Because neither agency followed up to verify that all forms had been submitted in a timely fashion, the school district did not receive their full discount for services they had qualified for during that school year. When I shared this information with the school district technology director, business manager and superintendent, none of them knew that this had occurred or the reason for the discrepancy.

In 2007, 10 years after the start of the E-Rate program, the data indicate that the impact of the program has been dramatic. The school district has received $460,000 in federal dollars to pay for Internet connectivity and to create their own internal computer networks. This amount does not include additional dollars the school district may have spent on their network, computers and software during this time period. But the demand for more bandwidth to the schools forced the school district to choose to build their own fiber network without E-Rate funding. This network is owned by the district, will provide 1 GB connection to each school, and will be tied into the HDESD NOC via a Bend

Broadband fiber connection. The cost for this build-out was over $250,000 and was funded by one-time dollars from the district's general fund. This means that in the future the only discount that the school district will be able to apply for via the E-Rate program will be the connection from their network to the ESD Network Operations Center. This is provided by Bend Broadband and is billed on a monthly per-megabit usage rate.

In a 10-year period, the Crook County School District went from a low speed connection from their cable company for four sites to a full-blown fiber network for the entire school district with a minimum Internet bandwidth usage of 16-20mg on a daily basis. During this period, the school district created an approved technology plan, applied for E-Rate funding and received funding at a 70% discount rate. The district also decided to contract out the E-Rate funding process and paperwork to the Umatilla Morrow ESD during this same time.

# CHAPTER VI

# ANALYSIS, CONCLUSIONS AND RECOMMENDATIONS

In this study, I investigated one school district's use of the federal E-Rate program to adopt the innovations of the Internet and the World Wide Web using a diffusion of innovation theoretical framework. The purpose of this study was to determine whether the E-Rate program was successful in facilitating one school district to allow their staff and students to access the "Information Highway" by using funding from the program to discount telecommunication costs and to build a needed technological infrastructure.

In Chapter IV, I listed several questions that I hoped would be answered about whether this new federal program was truly successful in diffusing an innovation. The following are the answers to the first 7 questions based on the information I collected during my research.

*Q.1. What was the status of Internet connectivity and networking in each school in the district before the passage of the Telecommunications Act of 1996?*

There was no connectivity at any of the schools in Crook County until OPEN was created in 1996. Between the time of the passage of the Telecommunications Act of 1996 and 1998 when the E-Rate program was initiated, Internet connectivity and networking was provided via OPEN and the High Desert ESD. Funding for this effort was provided by the local school district and the High Desert ESD.

*Q.2. How much money has the school district received from the USAC since the start of the E-Rate program?*

The district has received over $459,000 via the E-Rate program since 1998.

*Q.3. How has the school district used these dollars to provide Internet access to schools and classrooms?*

The district used the funds to discount their telecommunication charges from Qwest, CenturyTel and other providers. They also used the money to help purchase needed network equipment such as routers, switches and servers to build their own school wide area network in addition to individual school area networks.

*Q.4. What is the status of Internet connectivity to and within each school in the Crook County School District?*

As of the 2008-2009 school year, the school district has a fiber connection to every school in the district except for Paulina Elementary School. The district also has a fiber connection back to the High Desert ESD Network Operation Center that is co-located in the Bend Broadband facility in Bend, Oregon. They are currently using E-rate funding to discount charges for Internet connectivity for 16mg of bandwidth.

*Q.5. What is the status of networks in each school in the district?*

Each school has a high-speed network based on Cat 5 cabling and is connected by district wide standardized equipment bought from Cisco Systems.

*Q.6. What is the current use of the Internet in each school?*

Each school except for Paulina Elementary has the ability to transmit data at a rate of 1GB. The network design for Crook County School District consolidates all of their traffic to Internet to one spot in the district that is then connected to the High Desert ESD NOC in Bend. At the current time, the total bandwidth demand for the Internet is 16mg and growing. In comparison, their total bandwidth demand to the Internet in 1998 was 1mg.

*Q.7. Did the use of E-Rate funding at each school have a direct impact on the level of use of the Internet in the school district?*

Analysis of the E-Rate forms filed and the amount of money received by the district for telecommunications discounts show that the district became increasingly dependent on higher reimbursement rates from the federal program as their demand for bandwidth increased. Statements made by the technology director, superintendent and business manager in conversations during regional meetings confirmed that they believe they would not have the current network structure or design, or the capability to increase Internet usage without the E-Rate funding provided by the federal government.

The final question that I asked early on in this research was whether the diffusion of the Internet via the E-Rate program in the Crook County School District paralleled or diverged from predicted results based on past research of the diffusion of innovations in a K-12 educational environment. In respect to Rogers' (2003) model of the diffusion of innovation, the federal E-Rate program became the change agent for the implementation and adoption of the Internet in this school district. This meant that the primary change agent was from outside the school district and, in this specific case, from outside the world of education. This is just another example of the federal government being the initiator of an innovation.

For each school, I looked at the data collected on E-Rate reimbursements and the type of Internet connectivity to each school. I also examined the amount of bandwidth that was being aggregated by the district wide area network and was being transmitted to the Internet via a connection to the High Desert ESD. This meant that some of the data that was collected at this point in my study came in what Rogers describes as "the beginning of the conversion stage" of diffusing a new innovation. Data collected in the last few years was related to a time when the innovation was fully adopted and may actually have been re-invented or, in the case of the Crook County School District, led to the current installation of a fiber optic network. Success of the diffusion of the Internet into the Crook County School District was tied to the district and the service provider's ability to complete specific regulatory forms over a prescribed time period on an annual basis.

I believe that the diffusion of the Internet to schools and libraries occurred relatively quickly compared to some other studies quoted by Rogers. It only took 4 years for classroom Internet access to increase from 3% to 93% on a national level (National Center for Education Statistics, 2005). In several of the Rogers' studies that I used for comparison, the adoption rates for innovations ranged from 6 to 50 years. In the Crook County School District, it took only 2 years for the district to go from having one Internet connection at the High School to achieving a connection to all of their school. Moreover, it only took 9 years for the district to realize their dream. In this brief time span, Crook County Schools were able to convert their vision into a reality. They accomplished their mission by building their own district wide fiber network while also maintaining ownership.

In Rogers' fifth edition of *Diffusion of Innovations,* he comments on several diffusion studies that have relevance to this study. These studies included the diffusion of modern math in Pittsburgh, the worldwide diffusion of kindergarten, and the adoption of new communication technologies. Each of these studies spoke to different factors that affect the diffusion of an innovation.

The study on the adoption of new math speaks to the role of the opinion that leaders hold in the adoption of an innovation. The second study spoke to re-invention of the innovation of kindergartens by different nations. The other studies dealt with the diffusion of new communication technologies. One of these latter studies dealt with a Finnish company who found that a great deal of time and effort was required by employees to learn how to use a new technology; specifically, the personal computer. Another study found that allowing employees to play games on a computer reduced their anxiety toward their usage of the computer in the work place. Finally, Volvo did a study on the use of email in their corporation starting in the 1980s. They found that a considerable period of time was required for the diffusion process. The innovation process did not occur quickly even when the administration was highly supportive of the effort.

My study on the diffusion of the Internet via the E-Rate program paralleled some of the studies mentioned in Rogers' 2003 book. In this study, it became very obvious early on that all the decisions on whether to adopt this new technology and to use the E-

Rate program were limited to just a few key decision makers in the school district. The responsibility for executing the technology decision was shared by the superintendent and technology director. This decision-making model kept some key stakeholders, such as building principals and the teaching staff, out of the adoption process. This choice may have delayed the full implementation and use of the Internet and the World Wide Web in Crook County. Skepticism and/or anxiety is less likely to occur when more players on a team are involved in the decision-making process. Many of the staff in this district were not involved in the decision. This may have led to staff being more resistant to the change and slowed the process in achieving the eventual adoption of the new technologies. I learned that increasing district staff involvement in the discovery stage allows for persuasion of a group to occur more quickly. Staff involvement early on invites them to learn the advantages of the innovation. Less staff involvement may have led to resistance to buy in.

The difference in this study from other aforementioned studies was that the federal government was offering financial incentives to help school districts connect to the Internet. There were no financial incentives provided by the federal government for school districts to adopt the modern math curriculum or a kindergarten program. The adoption of these programs seems to have been more driven by opinion leaders or the perceived need to imbue national values in young children.

As in any study on the diffusion of innovation using Rogers' work, you can identify how one school district may or may not have fallen into different categories of adopters. Diffusion research has shown many differences between earlier and later adopters of innovations, including socioeconomic status, personality variables and communication behaviors. These differences can be used to devise strategies in which communication channels can be used to address different adopter categories.

I knew from personal experience that each of the local school districts in Central Oregon were at various stages in their implementation of the Internet in their schools during the 1990s. Having been the Principal of Sisters High School from 1992-1999 and the Superintendent of the High Desert ESD since 2000, I was involved directly or indirectly with many of the discussions and decisions made about the diffusion of the Internet and the World Wide Web in our local schools and school districts. Some of the local schools had installed high-speed fiber or cable networks in and between their schools to connect to the Internet. Other schools were dependent on local twisted-pair cabling for connectivity, which is much slower at transmitting data to individual computers. This meant that some schools had the ability to transmit large amounts of data to a large number of computers, while others were limited in the amount of data and number of computers connected to a network.

An analysis of how different school districts in Central Oregon would have fit into Rogers' adopter categories shows Sisters School District in the *innovators* category. The group of educators who started the school district's OutlawNet ISP were venturesome and daring enough to create a company that would provide Internet access to the students of the school district. They were also fortunate to have access to people in the community who had the financial means to provide the necessary startup dollars for the ISP.

While Sisters High School might have been an innovator in the framework of Rogers' work, Culver School District could be identified as an *early adopter*. While their connection to the Internet was in a similar time period as most of the other Central Oregon School Districts (except Sisters), they decided to build on this new innovation and make judicious use of their limited resources by installing a fiber optic network between their three schools. They were able to do this financially because the cost of distributing the cable on their single-site campus was very reasonable compared to what would have been required by other districts. By making this investment, the school district had placed themselves strategically for the long term in regards to connectivity to the Internet in and between their schools.

The rest of the school districts in Central Oregon fall into either the *early* or *late majority* of adopters in regards to connecting their schools and classrooms to the Internet. School districts like Bend, Redmond, and Crook County were much more deliberate in how they connected their schools to the Internet. They made decisions to connect their high schools to high-speed broadband connections and then started to connect their elementary schools to high-speed broadband. There are many reasons for this discrepancy in deployment of the Internet in their school districts. These districts were being very deliberate before completely adopting the idea of Internet use for all students and staff. They wanted to see how the Internet was going to be used in other local school districts, particularly at the elementary level, before making the investment to connect these schools. And even if they wanted to make the investment, the cost of providing broadband Internet connectivity to all of their schools became a prioritized decision due to a lack of funds as the state of Oregon went through a recession in the late 1990s and early 2000s. None of the school districts could be considered *laggards*, or the last to adopt access to the Internet and the World Wide Web for their students and staff.

The focus of the study was to determine whether the United States federal E-Rate Program was successful in diffusing the innovation of the Internet in this one rural school district. The federal government via the Universal Services Administration Corporation became the change agent by providing discounts to schools to pay for and access the Internet based on a sliding scale that was tied the school district's free and reduced lunch rate. At the outset there was an effort made to include all schools districts in the country in this diffusion project. The Crook County School District made the decision to be part of this program at a very high administrative level without involving, for the most part, building principals and teaching staff. This was due, in part, to the fact that most building principals and classroom teachers did not have enough understanding in 1998 about the Internet, its possible uses and how any agency would go about connecting all classrooms and schools in the district to this new innovation.

While the research shows that the school districts' use of the E-Rate program and their Internet usage has grown exponentially over the last 10 years, I wonder if the growth of Internet usage might have been greater and much more aggressive if all the stakeholders were involved in the decision at the beginning. Were teachers slower to access the Internet and World Wide Web because they were not originally part of the decision to do this via the vehicle of E-Rate program? Were teachers slower to access the Internet because they were not involved in the early stages of discovery and persuasion and the relative advantage of the Internet, as Rogers argued was needed for the diffusion of an innovation to be successful? This could be a question for further research if someone were to follow-up on the results that I present in this dissertation.

In the case of the Crook County School District, their key administrative staff saw the advantages that leveraging the E-Rate program meant to their school district. After trying to use the local cable company to meet their needs unsuccessfully, the district took it upon themselves to create their own solution using E-Rate dollars. After the collapse of the cable company connection, the following year the district requested almost $250,000 to build their school district and individual school networks. While they were not able to secure enough funding initially to do this in one school year, they stayed the course over the years. This long-term vision and the improbable "kick start" they received to do something creative when the cable company connection went down has led to a school district that now owns their own fiber optic network.

Moving from having one school connected to a frame relay from Qwest in 1998 to building their own district-wide fiber optic network with district funds is truly an outstanding accomplishment for a small rural school district. Conversations that occurred over the last ten years with the district superintendent, technology director and business manager, confirmed for me that the E-Rate program was key to their moving from a district with one frame relay connection with Qwest, to now owning and operating their own fiber network in conjunction with the High Desert ESD. During the last 10 years, the school district has been able to train staff and students on the use of the Internet and the World Wide Web. They were able to upgrade their networks and connections to allow more and diverse usage for staff and teachers via the Internet and the World Wide Web. Their continuous push to use more technology in their schools even gave them the opportunity to be one of five sites in the state of Oregon to receive funds from the Intel Corporation to pilot a one to one laptop initiative with their middle school students.

Using Rogers' model allowed me to look at how new innovations evolve successfully or unsuccessfully in a school district. An understanding of how the diffusion process works in schools with innovations should be required reading of all educators. I believe this premise because if we understand how innovations are diffused in a school or school district we will have an understanding of what issues might hinder the innovations' implementation in a school. Rogers' work is a wonderful framework to understand this process and Hall and Hord's work takes it to an even higher level of understanding of how change works in a school system. Once we understand the impediments in the innovation adoption process and how the diffusion process works, schools can use this knowledge to achieve success in adopting innovations.

## Limitations of This Study and Recommendations for Future Research

I believe being a participant-observer in the use of the E-Rate program and the design and management of the regional network for Central Oregon added strength to this research. At the same time, I had to be careful that my bias about how this federal program did or did not work or how the regional network should be managed did not overly impact my collection of data and my communication with key stakeholders in the

Crook County School District. For that reason, I tried to be very explicit in documenting the steps of the process so a reader can reach one's own conclusions.

There are a few suggestions I would make for further study in this area of case study research. First, I would recommend involving more school districts in the study to see if the diffusion process they went through was similar to the one that Crook County School District experienced.

I would like to compare how each district included stakeholders in the decision process to use the E-Rate program and, if they did include more stakeholders like teachers and principals in the beginning, whether this involvement increased their use of the Internet. I would also like to examine if this created more trust, less anxiety, and acted as a catalyst to reduce the time involved in implementing their technology plan.

Secondly, I would have liked to have compared the decision-making process to use the E-Rate program within each district while also determining who was really making the decision to use this federal program. Was the process driven by the superintendent, the technology director or the business manager? Did their understanding of the E-Rate program, Internet connectivity and the World Wide Web have an impact on how much Internet use grew in their school district over a 10-year period?

Finally, I would have liked to have collected data that would have allowed me to compare the Crook County School District in their use of the E-Rate programs with other school districts around the state regarding the label they earned as an innovator, an early adopter or a late adopter.

In the future, I would recommend that further study be done to determine the role or impact that a superintendent of a school district plays in the innovation adoption process. Does the understanding of the Internet, World Wide Web and communication technology by a superintendent of a school district affect the speed and successful adoption of a new technology innovation like the Internet in a school district? Does his or her understanding of how a technology works lead to greater success in trying diffuse an innovation in a school system?

This study does show that the use of the E-Rate program in the Crook County School District was helpful and necessary to diffuse an innovation into this school district. The amount of bandwidth utilization and capability of individual school networks increased at each school over the 10-year period. What the study does not show is other factors, which may or may not have been just as important as the E-Rate money that was given to the school district to discount their costs to connect to the Internet.

At the beginning of this paper, I wrote about how change was rapid and that the Internet and the World Wide Web were driving some of this change. I also wrote about how important it was for federal legislators and the many individuals who have studied the business of education in the last 30 years that we use technology to prepare our children for the future. The E-Rate program was seen as a vehicle to connect schools and their students to the "Information Highway." In the Crook County School District the E-Rate program did play a large part in helping the school district connect their students to the Internet. Finally, the E-Rate program was the vehicle that helped the district build its network and realize the current and future need for its own fiber network.

The E-Rate program has helped to facilitate student and staff accessibility to more online resources. The public library system was to my generation what the Internet is to this current generation. The library was our resource tool for doing research and learning about the world. It helped us complete school projects and enhance our learning. The Internet, World Wide Web and the creation of a fiber network infrastructure are very important innovations for this generation. School district decisions on implementation and diffusion of these innovations will determine their staff and student outcomes, whether their district serves an urban or rural population. Attaining more accessibility, better speed, funding resources, and equality of access to World Wide Web resources is tantamount to offering students resources for learning in the 21st Century. I feel this study plays an important piece in the puzzle in understanding the history of how a rural school district began their Internet journey and where it led them. The information gained provides a resource for others as well as posing questions for other schools engaged in their own journey. The question yet to be answered is whether the diffusion of this new innovation is better preparing the students of Crook County for the future. Time will only tell.

# APPENDIX A

# CROOK COUNTY SCHOOL DISTRICT

# TECHNOLOGY PLAN

# (2006-2008)

# Table of Contents

**Crook County Technology Plan**
**Executive Summary**

In November of 2000, a group consisting of teachers and technology personnel began the process of developing a Crook County District Technology Plan. The Initial purposes were to:

- Development of a technology delivery model
- Determine appropriate practice in network management, maintenance, and equipment replacement
- Review Staff Development needs
- Create Instruction Goals (curriculum and delivery)

Guided by Crook County's value statement, mission, and goals, the committee believes that technology facilitates the vision of using skills for success by:

- Providing the opportunity for students to acquire the technical skills necessary for success in school and in the future
- Accommodating for different learning styles
- Increasing the productivity of teachers in the district

# Goals

The following goals will help the district meet this vision of technology. These goals address maintenance of equipment, acquisition and replacement of equipment, staff development, curriculum and instruction, and policy. The goals are:

A. The district will enhance technology and support by researching, developing, and maintaining infrastructure and programs that support the needs of the staff, students, and community.

B. To provide the best possible use of technology the district will acquire, upgrade, and replace hardware and software to enhance administrative and instructional needs.

C. To improve the utilization of technology in the classroom and to enhance student achievement, the district will provide staff development.

D. To enhance student achievement the district will provide curriculum and best practices for instruction using technology.

E. To develop, enforce and monitor policy development for staff, students, and community.

Each goal has a set of indicators that will be used to monitor the district's success in meeting these goals.

# Replacement and Upgrades

Replacements and upgrades of equipment and software represent and on going cost to the district. To meet the goal of maintaining a one computer for every six students, the committee suggested that the district replace 20% of approximately 600 computers each year. The committee also suggests the following as replacement priorities:

1. Upgrade high school and middle school labs on a two-year rotation—60 computers with Windows 2000 (or greater) and Office 2000 (or greater). (Computers will be recycled to elementary schools. Recycled computers will be distributed on an equal basis with no more than 50% being dedicated to teacher use, therefore assuring a minimum of 50% being dedicated to student use.
2. Continue to develop elementary labs/classrooms to maintain a 6 to 1 ratio (approximately 75+ student computers per building).
3. Replace teacher computers at the rate of 20% per year using with both building funding and technology funding.
4. Replace network equipment as needed, including routers and switches. Begin installation of fiber optic cables to connect all schools within the Prineville city limits.
5. Upgrade and purchase administrative, educational, and management software based on recommendations of the technology committee.

As funds become available:

6. Purchase projectors, scanners, cameras, and laser printers as per building technology plan.
7. Purchase a set of wireless laptops at each school per building technology plan.
8. Purchase two networked computers per classroom at the elementary schools.

# Curriculum

Crook County School District will offer a comprehensive technology curriculum based on the current Oregon Educational Technology Consortium (OETC) Standards.

The district technology committee believes that formal technology training at grade kindergarten through second grade is not necessary. Students, at those levels, should focus on the skills of reading and mathematics.

The district will begin a formal technology curriculum at about grade 3. The curriculum will include: hardware and software identification, keyboarding, and the use of presentation software basics.

The district believes that with the help of skills learned at home that students will be ready to succeed in technology classes at both the middle school and high schools as well as learn skills specific to their own career needs.

## Policy

Even though the district has policy to guide the use of technology, the technology committee believes that policy, especially student use policy, must be revised.

# Crook County Technology Plan
# March 2006

**Demographics**
Community

The Crook County School District resides within a rural community in the center of the state of Oregon and east of the Cascade mountain range. The county is situated in the geographical center of Oregon. Crook County encompasses an area of 2, 991 square miles and ranks 12 among counties in area size. Crook County is the home of approximately 19,182 people, according to US Census figures. Approximately 8000 of those people live in the town of Prineville, the only incorporated town in Crook County. Crook County was the third fastest growing county in Oregon according to 2003 census data growing by 7.3 % from 2000 – through 2003.

The County is extremely rural, with 50% of the landmass in state or federal ownership and a density of just five people per square mile. The economy of Crook County is heavily reliant on lumber, the manufacturing of wood products and on tire production and distribution. Agriculture provides very little full-time, year round employment and its source of personal income continues to shrink. The school district comprises approximately 3200 students in grade kindergarten through grade 12, offering a free appropriate public education to all the school-age children in the area. One high school of approximately 987 students, one middle school with 700 students, and three elementary schools with 400 plus students in each are located within the town of Prineville. The district also supports two rural schools: one in Powell Butte serving 170 kindergarten through sixth grade students and Paulina Elementary located 60 miles out of Prineville with an enrollment of 46 students in kindergarten through eighth grade.

Crook County ranks 34th out of 37 Oregon counties in the percentage of adults over 25 years of age with college degrees. Crook County ranks 37th out of 37 counties in the number of adults over 25 with high school degrees.

**I. Values**

Research indicates that successful nonprofit organizations are value driven. For this reason, the basis of all planning in CCSD lies in our four value statements:

- **Integrity is vital to our success.**

  Integrity is the foundation value. Integrity demands honesty, responsibility, and accountability from everyone in the educational environment. Organizational unity, communication, and teamwork are hallmarks of our organization.

- **We are a dynamic organization.**

  Everyone in the organization is learning and growing. The desire for life-long Learning is our most prized result.

- **Everyone deserves respect and dignity.**

  Personal dignity and respect are central to a safe, secure learning environment.

- **We expect excellence.**
  Excellence in life comes from a quality education. We expect continuous quality improvement in our district.

**II. Mission Statement**

Crook County School District will make a positive difference by educating and preparing our youth for excellence today and success tomorrow. Our students, as outstanding citizens, will change our community, our country, and our world.

**III. Vision**

CCSD is an organization with integrity, a model for educational success, and a recognized leader for excellence in preparing its students to be productive citizens guided by a vision of a successful future.

**IV. District Goals**

Crook County School District focuses on educating the entire child. It provides safe facilities, creates partnerships, values people, and presents a broad-based curriculum to meet the needs of students. The primary emphasis is to teaching material in the Oregon state Content Standards so that all students progress toward the Certificate of Initial Mastery (CIM) and the Certificate of Advanced Mastery.

To assure focus on student achievement the Crook County School District believes that:

- All Students will read at their grade level.
- All Students will meet grade level math proficiencies in all benchmark areas.

- All Students will show grade level proficiency in writing by reaching state scoring guide standards.
- All Students will graduate from high school.

## Skills for Success. . .. Every student is important

**Each student is given the opportunity to learn the basic skills necessary to become a life-long learner with a vision of a successful future.**

Crook County values education and is committed to providing educational opportunity for all. Crook County Schools meets all children at their ability levels to make students a success in the basic skills of reading, writing and mathematics as well as the core curriculum areas.

By planning for the academic, emotional and social needs of students, all involved in the education of our youth will empower students to create goals as well as progress toward those goals as life-long learners with social consciousness and responsibility to provide a successful future for themselves and the community. Community pride and high sense of esteem will lead to academic success and minimize the use of drugs and alcohol as well as reduce teen pregnancy and teen violence. Students will be mentored by adults in the community toward success in a well-rounded education that stresses both the basic skills and exposure and participation in art, music, foreign languages, and co-curricular sports.

To enable educational success for all, the district will create and implement a long-term strategic plan for the use of technology.

## Technology facilitates the vision of using skills for success by:

- Providing the opportunity for students to acquire the technical skills necessary for success in school and in the future
- Accommodating for different learning styles
- Increasing the productivity of teachers in the district

The school district believes that technology is integral to curriculum, instruction, and assessment, and all other areas involved in the learning process. The district will budget adequate money to maintain current technology and to provide for the ever-changing needs, including sufficient funds to permit access to all students and to use technology to deliver student services. In addition, the district will use technology as a key part of both initial and continuing teacher education to provide teachers with the knowledge and skills they need to integrate technology into the curriculum and to adapt it to instructional strategies. The district will encourage and collaborate with employers to provide the current software, training, and equipment necessary to prepare students for entry into the workforce. Finally, the district will designate a technology resource person to provide technical assistance and to consult with the staff to assist them in finding the people, information, and materials that they need to make best use of technology.

## Beliefs about Technology

Crook County School District believes that technology should assist in the development of each student by providing a wide application of technology for learning opportunities in and outside of the classroom.

District personnel and students value an environment that stimulates learning through the application of computer technology.

District personnel and students use technology to support student learning.

District personnel structure facilities, technologies, and support systems to promote and facilitate individual potential.

District personnel must develop mastery of modern technology.

Through technology, the district fosters a positive image of the value of life-long learning by connecting to the global community.

# Technology Goals

Crook County School District has five (5) goals for using technology to provide opportunity for student success, to accommodate different learning styles and to improve the productiveness of building staffs.

The goals address maintenance of equipment, acquisition and replacement of equipment, staff development, curriculum and instruction and policy. The goals are:

A. The district will enhance technology and support by researching, developing, and maintaining infrastructure and programs that support the needs of the staff, students, and community.

B. To provide the best possible use of technology the district will acquire, upgrade, and replace hardware and software to enhance administrative and instructional needs.

C. To improve the utilization of technology in the classroom and to enhance student achievement, the district will provide staff development.

D. To enhance student achievement the district will provide curriculum and best practices for instruction using technology.

E. To develop, enforce and monitor policy development for staff, students, and community.

**The following indicators will serve as indicators for meeting the district Maintenance Goal**

## A. Maintenance

**The district will enhance technology and support by researching, developing, and maintaining infrastructure and programs that support the needs of the staff, students, and community.**

1. Obtain staffing levels that will ensure support of technology (custodial and technological) in all schools.
2. Consider specialized technical staff in the areas of software.
3. Develop a strategy for researching, acquiring, and implementing a student information system.
4. Develop a strategy for implementing the use of V-tel.
5. Monitor a repair request and maintenance scheduling system.
6. Maintain at least one networked computer per classroom.
7. Maintain one computer for every six students in each elementary and secondary school.
8. Develop a method of budgeting for replacement parts for existing computers.
9. Create and maintain a schedule for cleaning and upkeep of all school labs and classrooms.
10. Maintain and upgrade educational and administrative software as needed.
11. Promote community involvement through the development and maintenance of district web pages, parental access to current student progress (Schoolmaster, Mastery in Motion).
12. Use newsletters to inform the community of the communication tools available.

**The following indicators will serve as indicators for meeting the district Acquisition, Upgrade, and Replacement Goals**

## B. Acquisition, Upgrade and Replacement

## To provide the best possible use of technology the district will acquire, upgrade, and replace hardware and software to enhance administrative and instructional needs.

1. Research and acquire equipment for utilization and management of fiber optic WAN technology in keeping with current opportunities.
2. Upgrade and replace PC hardware to a minimum level of P3.
3. Update all PC's to Windows 2000 (or greater) and Office 2000 (or greater).
4. Maintain a ratio of one student computer for every six students.
5. Research the availability of PC educational software and develop a software evaluation strategy.
6. Develop a plan to replace 20% of all district computers.
7. Upgrade data gathering hardware and software as necessary.
8. Continue to provide systems integration of administrative, library and special program software.
9. The district will support the needs of specialized curricula (specially designed instruction for special education students and advanced high school technologies).
10. Encourage the development of innovative strategies through Perkins funding and Ed Tech funding as resources become available.

**The following indicators will serve as indicators for meeting the district Staff Development Goal**

## C. Staff Development

### To improve the utilization of technology in the classroom and to enhance student achievement, the district will provide staff development.

1. Develop hiring criteria that will include competency in technology skills.
2. Develop and distribute a survey yearly to determine staff development needs.
3. Provide staff development in the use of administrative hardware and software (Schoolmaster, Windows, Mastery in Motion, Schoolmaster Grade book, Follett, Microsoft Office, Renaissance Learning, etc.) as needed.
4. Provide staff development in the use of educational hardware and software (PLATO, Accelerated Reader, STAR, Office, Web-based resources, etc.) As needed.
5. Provide opportunities for staff to attend conferences related to the use of technology in the classroom.
6. Provide a technology staff development consultant to teachers and to coordinate training through the curriculum department that schedules activities throughout the year.

**The following indicators will serve as indicators for meeting the district Curriculum and Instruction Goal.**

## D. Curriculum and Instruction

To enhance student achievement the district will provide curriculum and best practices for instruction using technology.

1. Adopt standards and curriculum for grades K-12.
2. Develop a plan for curriculum delivery.
3. Research devices (projectors, white boards, ELMO, etc.) necessary for classroom and library use of technology.

Provide technology instruction as it relates to graduation requirements.

**The following indicators will serve as indicators for meeting the district Policy Goal.**

## E. POLICIES

To develop, enforce and monitor policy development for staff, students, and community.

1. Determine district purchasing and platform policy.
2. Review / revise an acceptable network use policy and procedure.
3. Complete an annual review of district Internet and e-mail policy.
4. Create a policy for the acquisition of software.
5. Inform staff and students of copyright laws.

### Evaluation

The district technology department and technology coordinator will use the above indicators for twice-yearly meetings (December and May).

Using the Plan/Do/Study/Act process of continuous improvement, the technology department in conjunction with building principals will determine needs and revisions for maintenance, acquisition, staff development, curriculum and instruction, and policies.

Recommendations for purchasing and revisions to the plan will be made each March prior to budgeting.

# E-rate

Based on the 2004 data, Crook County School District uses e-rate to pay for connectivity, both through landlines and high-speed access lines.

This connectivity provides opportunity for students to access information to improve skills in relation to gathering the information.

Staff uses several web-based programs (Mastery in Motion, Schoolmaster, Accelerated Reading, Star Math, etc.) to both track student information and provide instruction.

The district does not qualify for services or functions listed under Internet Connections and pays for this connectivity.

Crook County School District
Technology Plan Addendum for fiscal years 2006 - 2008

## E-Rate Eligible Products and Services

### Telecommunications Services

| Service or Function | Quantity and/or Capacity | 2006/2007 Pre-discount Cost (est.) | 2007/2008 Pre-discount Cost (est.) | 2008/2009 Pre-discount Cost (est.) |
|---|---|---|---|---|
| Local and long distanc | 120 phones | 59,202 | 65,122 | 71,634 |
| High speed access lin | Regional Lines (3 + Bandwidth) | 69,358 | 76,795 | 83,923 |
| Mobile telephone serv | 2 phones | 3,000 | 3,300 | 3,630 |
| Paging service | 4 Users | | | |
| Video Conferencing | 6 Licensed | | | |

### Internet Access

| Service or Function | Quantity and/or Capacity | Pre-discount Cost (est.) | Pre-discount Cost (est.) | Pre-discount Cost (est.) |
|---|---|---|---|---|
| Dedicated Internet acc | 30 Mbps | 0 | 0 | 0 |
| Internet access servic | N/A | | | |
| | | | | |
| | | | | |
| | | | | |

### Internal Connections

| Service or Function | Quantity and/or Capacity | Pre-discount Cost (est.) | Pre-discount Cost (est.) | Pre-discount Cost (est.) |
|---|---|---|---|---|
| Upgraded LAN equipn | N/A | 15,000 | 16,500 | 18,150 |
| LAN cable and/or wire | N/A | 266,738 | 25,000 | 25,000 |
| Internet access servic | N/A | 5,800 | 6,380 | 7,018 |
| LAN maintenance | 15 devices -swithes, routhers, firewall | 2,000 | 2,200 | 2,420 |
| Telephone system ma | 19 devices for VoIP/WAN | | | |
| | | | | |

| | | | |
|---|---|---|---|
| Total Pre-discount Cost (est.) | 421,098 | 195,297 | 211,775 |
| Average Discount Rate (est.) | 70% | 70% | 70% |
| Total Post-discount Cost (est.) | 126,329 | 58,589 | 63,532 |

## Ineligible Technology Support Resources

| Service or Function | Quantity and/or Capacity | Budgeted Cost (est.) | Budgeted Cost (est.) | Budgeted Cost (est.) |
|---|---|---|---|---|
| Hardware (computers | 6 Intel Servers | 35,000 | 36,400 | 37,856 |
| Software (ineligible) | Linux, MS, Cuda License | 21,750 | 22,620 | 23,524 |
| Professional developn | 4 Training Classes | 2,000 | 2,080 | 2,163 |
| Maintenance (ineligibl | 4 servers | | | |
| Network Intrusion Pre | Hardware + Contract (1) | 5,000 | 5,200 | 5,408 |
| Rack & Lab Equipmer | 3 Monitors | | | |
| Power / UPS Equipme | 3 UPS Devices and misc. | 1,000 | 1,040 | 1,081 |
| Upgraded LAN equipn | 10 Routers / Switches / Misc. | 15,282 | 15,893 | 16,529 |
| Cabling and Other Mis | Misc. | | | |
| Backup Media | 20 | | | |
| Other Consumables a | Operating Supplies & Materials | 250 | 250 | 250 |
| | **Total Support Cost (est.)** | 80,282 | 83,493 | 86,831 |
| | **Total E-rate & Support Cost (est.)** | 206,611 | 148,082 | 150,363 |

| | | | |
|---|---|---|---|
| ESD Resol | 6,798 | 7,001 | 7,212 |
| Title IID | 9,260 | 9,260 | 9,260 |
| General fu | 754,345 | 498,155 | 512,349 |
| | 770,403 | 514,416 | 528,821 |

## Ed Tech Funds

Crook County School District using the majority of its Ed tech funds to hire an elementary technology coordinator. See below

# 2005-2006 CIP Budget
# Narrative/Spending Workbook
# Enhancing Education Through Technology, Title II-D

**Purpose:** The purposes of Title II – D, Ed Tech program are to:

- Assist districts in implementing a comprehensive system that effectively uses technology in schools to improve student academic achievement.
- Support high-quality professional development programs that enable schools to effectively integrate technology into curriculum and instruction aligned with state academic standards and Instructional Technology Common Curriculum Goals;
- Enhance ongoing professional development for teachers, principals, and administrators by providing constant access to training and updated research in teaching and learning through electronic means such as, but not limited to, Oregon's Teaching and Learning Resources; (http://www.ode.state.or.us/teachlearn/standards/center/)
- Assist districts in the acquisition, development, interconnection, implementation, improvement, and maintenance of an effective educational technology infrastructure in a manner that expands access of technology to students (particularly disadvantaged students) and teachers;
- Support the rigorous evaluation of programs regarding the impact of Ed Tech programs on student academic achievement, and ensure the results are widely accessible through electronic means.

**Link to Allowable Activities:** For a complete list of allowable programs and activities, please click on http://www.ed.gov/programs/edtech/guidance.doc

List all activities funded, one activity per row. Add additional rows as needed.

| **Budget Narrative**Activity<br>**List key activities or strategies funded by Title II-D. Add additional rows as needed. (Including necessary staff development)** | **Title II-D Budgeted Amount By Function Code ($$ By Function Code)** |
|---|---|
| **Staff Development (Fall .25):** Help administrators and teachers use data (Student information system and Mastery in Motion) to inform instruction as well as to develop materials for short cycle assessment. This will assure that schools will continue to meet AYP. Also, will provide assistance in the use of technology for the purpose of instruction. This position will also facilitate the district technology plan and it's portion of the state technology grant. | **2240-111 10,639**<br>**2240-2xx 5,549**<br>**2240-340 1,000**<br>**2240-4xx 500** |

TITLE II D

# Title II-D - Enhancing Education Through Technology
## 2005-2006 SPENDING

**District Name & Number:**  **Date of Report:**

| Grant Allocation: | $13,522 | Transfer In: | $4,166 | Transfer Out: | $0 | Grant Amount after Transfers: | $17,688 |
|---|---|---|---|---|---|---|---|

| Object / Function | 11XX Instruction - Regular Programs (All expenditures not related to Staff Development) | 2240 Instructional Staff Development (Technical, Professional and Instructional Staff Development) | 3300 Community Services (Services to Private Schools) | Total By Object |
|---|---|---|---|---|
| 1XX Salaries | $0.00 | $10,639.00 | $0.00 | $10,639.00 |
| 2XX Benefits | $0.00 | $5,549.00 | $0.00 | $5,549.00 |
| 310 Instructional, Professional and Technical Services | $0.00 | $0.00 | $0.00 | $0.00 |
| 340 Travel | $0.00 | $1,000.00 | $0.00 | $1,000.00 |
| 390 Other General Professional and Technical Services | $0.00 | $0.00 | $0.00 | $0.00 |
| 4XX Supplies and Materials (Textbooks, Library Books and Periodicals) | $0.00 | $500.00 | $0.00 | $500.00 |
| 460 Non-consumable Items | $0.00 | | $0.00 | $0.00 |
| 470 Computer Software | $0.00 | | $0.00 | $0.00 |
| 480 Computer Hardware | | | $0.00 | $0.00 |
| 550 Technology Capital Outlay | $0.00 | | $0.00 | $0.00 |
| 690 Grant Indirect Charges @ 0.00% | | | | $0.00 |
| ***Total by Function*** | $0.00 | $17,688.00 | $0.00 | $17,688.00 |

***2240 Must be ? 25% of the Total***

## Technology Replacement and Upgrade Proposal

Based on the numbers reported on the Oregon Fall Report, Crook County has a total of 730 networked computers available to staff and students. The enrollment as of March 2006 is 3145 students in grade k through 12. In addition, the district provides one computer in every classroom and, beyond that, a ration of one (1) computer for every five (5) students.

### The following represents the recommendation of the technology committee.

**Replacement:** (Costs per year depend on cycle chosen)

**Computer Replacement:**

Using 700 computers as the basis for determining replacement cost and placing the district on a 5-year cycle, Crook County School District would replace 120 computers (20%) per year at the cost of approximately $700.00 per computer.

**Replacement Priorities: In December 2005, the district technology committee recommended the following priorities for use of the replacement fund. The committee endeavored to look to**

1. Upgrade high school and middle school labs on a two-year rotation—60 computers with Windows 2000 (or greater) and Office 2000 (or greater). (Computers will be recycled to elementary schools. Recycled computers will be distributed on an equal basis with no more than 50% being dedicated to teacher use, therefore assuring a minimum of 50% being dedicated to student use.
2. Develop elementary labs/classrooms to maintain a 5 to 1 ratio (approximately 75+ student computers per building).
3. Replace teacher computers at the rate of 20% per year using building funding, technology funding, and federal funding when available.
4. Assess the specific needs of personnel to determine the placement of replacement computers, as reflected in individual building technology plans.

As funds become available:

1. Purchase projectors, scanners, cameras, and laser printers as per building technology plan.
2. Purchase wireless access points to provide access throughout the building as per building technology plan.
3. Maintain two networked computers per classroom at the elementary schools.

**Network Upgrade / Replacement**: ($445,000 pending receipt of funds)

Networking Equipment must be upgraded on a five-year cycle. Currently routers and switches are being replaced for a total cost of $120,000.

We are considering a change to wireless access / fiber. The approximate costs of this conversion would be $ 250,000.

Switches and routers currently being purchased are Voice over I.P. compatible. There will be an additional cost of $ 75,000 for purchasing Voice over I.P. telephones.

## Curriculum: Scope and Sequence

Crook County School District will offer a comprehensive technology curriculum based on the current Oregon Educational Technology Consortium (OETC) Standards.

National Standards

1. Basic operations and concepts
   - Students demonstrate a sound understanding of the nature and operation of technology systems.
   - Students are proficient in the use of technology.

2. Social, ethical and human issues
   - Students understand the ethical, cultural, and societal issues related to technology.
   - Students practice responsible use of technology systems, information, and software.
   - Students develop positive attitudes toward technology uses that support lifelong learning, collaboration, personal pursuits, and productivity.

3. Technology productivity tools
   - Students use technology to enhance learning, increase productivity, and promote creativity.
   - Students use productivity tolls to collaborate in constructing technology—enhanced models, prepare publications, and produce other creative works.

4. Technology communication tools
   - Students use telecommunications to collaborate, publish, and interact with peers, experts, and other audiences.
   - Students use a variety of media and formats to communicate information and ideas effectively to multiple audiences.

5. Technology research tools
   - Students use technology to locate, evaluate, and collect information from a variety of sources.
   - Students use technology tools to process data and report results.
   - Students evaluate and select new information resources and technological innovations based on the appropriateness for specific tasks.

## Curriculum: Scope and Sequence

National Standards

6. Technology problem-solving and decision-making tools
   - Students use technology resources for solving problems and making informed decisions.
   - Students employ technology in the development of strategies for solving problems in the real world.

# Oregon Technology Common Curriculum Goals (Adopted by the State Board March 21, 2002)

Technology is one of many tools that students have at their disposal as they engage in the learning process. Educational technology is the application of technology to the teaching and learning process. A technologically literate student accesses and acquires knowledge, exchanges ideas and opinions, solves problems, and creates, innovates and expresses themselves through the skillful use of a variety of technologies. As with any other tool, students should use technology when its use will increase understanding and enhance learning.

As technology filters out to every aspect of our society, it is essential that students no develop technological skills in isolation. Rather, technology should be integrated into every content area. By providing access to information, opening pathways to communication, and facilitating personal understanding, technology supports learning all subjects.

Students will:

1. Demonstrate proficiency in the use of technological tools and devices.
2. Select and use technology to enhance learning and problem solving.
3. Access, organize, and analyze information to make informed decisions, using one or more technologies.
4. Use technology in an ethical and legal manner and understand how technology affects society.
5. Design, prepare, and present unique works using technology to communicate information and idea.
6. Extend communication and collaboration with peers, experts, and other audiences using telecommunications.

Student Outcome Statement for Technology

Students will demonstrate the ability to use appropriate technology tools to find, process and communicate information and to create high quality products across the curriculum.

Standard #1: Use Technology to create age appropriate curriculum based products.

Standard #2: Use technology to gather, organize, analyze, and evaluate data.

Standard #3: Students will use existing and emerging technologies responsibly and appropriately.

## Curriculum Philosophy:

The district believes that formal technology training at grade kindergarten through second grade is not necessary. Students, at those levels, should focus on the skills of reading and mathematics.

The district will begin a formal technology curriculum at about grade 3. The curriculum will include: hardware and software identification, keyboarding, and the basic use of presentation software.

Following is Crook County School District Policy on the use of technology.

| | | |
|---|---|---|
| IIBG | Instructional Technology | Adopted 4/18/94 |
| IIBGA | Acceptable Use | Adopted 8/14/94 |
| IIBGA-AR (1) | Acceptable Use | Adopted 8/14/95 |
| IIBGA-AR (2) | User Responsibilities | Adopted 8/14/95 |
| IIBGA-AR (3) | Internet Filtering | Adopted 3/13/00 |

Code: IIBG

Adopted: 4/18/94

# INSTRUCTIONAL TECHNOLOGY

The Board recognizes its responsibility to ensure that district staff and students have access to up-to-date technological materials and equipment. As used in this policy, "technology" refers principally to electronic materials and equipment, including computers, telecommunications, lasers, and robotics.

The following reflect the district's goals for students regarding instructional technology:

1. To foster an atmosphere of enthusiasm and curiosity regarding new technology and its applications;

2. To heighten each student's familiarity and/or working knowledge of current technological materials/equipment;

3. To provide all students equal access to district technological materials/equipment and to instruction to in their implementation;

4. To ensure that the various technologies are utilized in a variety of applications, and are not restricted to one subject area or one location in the schools;

5. To promote district educational goals by such technology (ies).

In order to achieve the above-stated goals, the Board shall seek the advice of representatives from groups utilizing technology in pursuit of district goals (i.e., Board members, administrators, teachers, support staff, parents and students). In addition, the Board directs the superintendent to equip district schools with appropriate and up-to-date hardware/software, to schedule "hands-on" in-service activities for district staff and to implement suggestions from the above representatives and the instructional materials planning committee, within budgetary constraints.

END OF POLICY

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Legal References:

OAR 581-022-1030 (West 1982)

Copyrights, Title 17, United States Code

CODE:
IIBGA
ADOPTED: 8/14/94

## ELECTRONIC COMMUNICATIONS SYSTEM - ACCEPTABLE USE POLICY

The Board is committed to the development and establishment of a quality, equitable, and cost effective electronic communications system. The system's purpose shall be for the advancement and promotion of learning, teaching, and communications through the district.

The district's system will be used to provide district-wide, statewide, national and global communications opportunities for staff and students.

The district's electronic communications system shall be referred to as "crookEDnet".

The Network Administrator will establish administrative regulations for the use of the district's system. The administrative regulations will be consistent with sound guidelines as may be provided by the education service district and/or the Oregon Department of Education.

Failure to abide by district policy and administrative regulations governing use of the district's system may result in the suspension and/or revocation of system access. Additionally, student violations may result in discipline up to and including expulsion. Staff violations may also result in discipline up to and including dismissal. Fees, fines, or other charges may also be imposed.

END OF POLICY

Legal References:

| | | |
|---|---|---|
| ORS 30.765 | ORS 167.070 | ORS 332.107 |
| ORS 163.435 | ORS 167.080 | ORS 336.222 |
| ORS 164.345 | ORS 167.087 | ORS 339.250 |
| ORS 164.365 | ORS 167.090 | ORS 339.260 |
| ORS 167.060 | ORS 167.095 | ORS 339.270 |
| ORS 167.065 | ORS Chapter 192 | |

OAR 581-21-050 OAR 581-21-055

Copyrights, Title 17, as amended, United States Code

"Attorney General's Public Records and Meetings Manual" (1993)

Drug-Free Schools and Communities Act of 1986, P.L. 99-570.

Anti-Drug Abuse Act of 1988, P.L. 100-690, 102 Stat. 418 et. seq.

Drug-Free Workplace Act of 1988, P.L. 100-690, Title V, Subtitle D, Sections 5151-5160, 102 Stat. 4305-4308.

Controlled Substances Act, 21 U.S.C. 812, Section 202, Schedules I through V, 21 C.F.R. 1300.11 through 1300.15

Drug-Free Schools and Communities Act Amendments of 1989, P.L. 101-226, 103 Stat. 1928 et. seq.

Americans with Disabilities Act of 1990, 42 U.S.C. Section 12101 et. seq. (1988) 29 CFR Part 1630

Family Educational Rights and Privacy Act, Sec. 438, 20 U.S.C. Sec. 1232g

CODE: IIBGA-AR (1)
ADOPTED: 8/14/95

**ELECTRONIC COMMUNICATIONS SYSTEM - ACCEPTABLE USE POLICY**

I. General District Responsibilities

A. The network administrator will serve as coordinator to oversee the district's electronic communications system and work with the local education service district and the Oregon Department of Education network staff as necessary.

B. The district will cooperate fully with local, state, or federal officials in any investigation concerning or relating to misuse of the district's electronic communications system.

C. The district may provide for students and staff that have their own computer hardware at home access to the district's system.

II. General Building Principal Responsibilities

A. The network administrator will not intentionally inspect the contents of electronic mail sent by a system user to an identified addressee or disclose such contents to other than the sender unless required to do so by law. Policies of the district are to investigate complaints regarding electric mail, which is alleged to contain defamatory, inaccurate, abusive obscene, profane, sexually oriented, threatening, offensive, or illegal material.

B. The building principal will be designated the responsibility for disseminating and interpreting district policy and administrative regulations governing use of the district's system at the building level with all system users.

C. The building principal will provide employee training for proper use of the system and will ensure staff supervising students using the district's system provide similar training to their students, including copies of district policy and administrative regulations governing use of the district's system.

D. The network administrator may monitor or examine all system activities as deemed appropriate to ensure proper use of the system.

E. The network administrator may establish a retention schedule for electronic messages and remove messages posted locally that are deemed inappropriate.

F. The network administrator may set quotas for disk usage on the system. A system user who remains in noncompliance of disk space quotas after seven (7) calendar days of notification may have their files removed by the network administrator. System users may request their quota be increased by submitting a written request to the network administrator stating the need for the quota increase.

G. The network administrator will ensure all users of the district's system complete and sign an agreement to abide by district policy and administrative regulations. All such agreements will be maintained on file in the network support office.

III. System Access

A. The following individuals are authorized to use the district's system:

1. All district employees.

2. Students in grades 6-12 who have obtained a sponsoring teacher may be granted, with parental permission, an individual account for up to one academic year at a time.

Students in grades five and below are not allowed individual accounts. Teachers of these grades may apply for yearly classroom accounts at Level 2. Classroom Internet access or district-wide student E-Mail may also be requested in addition to standard Level 2 accounts. Students using the classroom account must have a completed parental permission form on file with the site's administration. The teacher is ultimately responsible for use of the account and is obligated to directly supervise these students according to the Acceptable Use Policy. Teachers requesting classroom accounts are required to maintain the account password confidentiality by not giving their password to students.

<u>Level 1 Account:</u> Shall have access to stand-alone computers NOT connected to the district or building networks. Have no access outside the system's location.

<u>Level 2 Account</u>: Shall have Level 1 access plus access to local and district-wide services. This is the default classroom account for Grades K-5.

Level 3 Account: Shall have Level 2 access plus student Electronic Mail (E-Mail) account.

Level 4 Account: Shall have Level 3access plus Internet access. This is the default student account for Grades 6-12.

Level 5 Account: Shall have Level 4 access plus access to district management system and administrative E-Mail services. This is the default level for staff. *NO student will be allowed a Level 5 account.*

3. Students may not maintain accounts upon graduation unless they otherwise qualify under one of the other acceptable use provisions.

4. Non-school persons who request guest accounts. Guest account requests may be made to the network administrator. Requests may be granted on a case-by-case basis consistent with the district's mission and goals and as needs and resources permit.

CODE:
IIBGA-AR(2)
ADOPTED: 8/14/95

## GENERAL SYSTEM USER RESPONSIBILITIES

I. On-Line Conduct

A. The individual in whose name a system account is issued is responsible at all times for its proper use. The district's system shall be used only for educational purposes consistent with the district's mission and goals. Commercial and/or personal use of the district's system is strictly prohibited.

B. System users shall not knowingly submit, publish, or display on the district's system any inaccurate and/or objectionable material.

C. System users shall not promote any other activity prohibited by district policy, state, or federal law.

D. Transmission of material information or software in violation of any district policy, local, state, or federal law is prohibited.

E. System users identifying a security problem on the district's system must notify the network administrator.

F. System users may not use another individual's system account without written permission from the network administrator.

G. Attempts by a student to log on to the district's system as a district employee will result in cancellation of user privileges, and may result in disciplinary action up to and including expulsion.

H. Teachers may require students to restrict access to course program files.

I. Any system user identified as a security risk or having a history of violations or district and/or building computer-use guidelines may be denied access to the district's system

J. The Electronic Communications Privacy Act of 1986 (ECPA) is the only existing federal law specifically governing e-mail. Under the ECPA, there is privacy protection against both interception of electronic communications while in transmission and against unauthorized intrusion into e-mail stored on the system. Interception of electronic communication is prohibited (Section 101-100 Stat 1850), and service providers of electronic communications cannot intentionally divulge communication contents, with certain exceptions (Section 102). These provisions protect the privacy of electronic communications in general.

K. In order to reduce unnecessary system traffic, system users may use real-time conference features such as talk/chat/Internet relay chat only as approved by the student's teacher and network administrator.

L. System users will remove electronic mail in accordance with established retention guidelines. Such messages may be removed by the network administrator if not attended to by the system user.

M. System users will not evade, change, or exceed network resource quotas or server disk usage quotas as set by the network administrator. A user who remains in non-compliance of disk space quotas after seven (7) calendar days of notification may have their file removed by the network administrator. Such quotas may be exceeded only by requesting to the network administrator that disk quotas be increased and stating the need for the increase.

N. System users will do a virus check on downloaded files to avoid spreading computer viruses. Deliberate attempts to degrade or disrupt system performance will be viewed as a violation of district policy and administrative regulations and may be viewed as criminal activity under applicable state and federal laws.

O. Vandalism will result in cancellation of system use privileges. Fines will be imposed for acts of vandalism. Vandalism is defined as any malicious attempt to harm or destroy district equipment or materials, data of another user of the district's system or any of the agencies or other networks that are connected to Internet. This includes, but is not limited to, the uploading or creating of computer viruses.

P. Any software having the purpose of damaging the district's system or other user's system is prohibited.

Q. Copyrighted material may not be placed on any district system without the author's permission. Only the owner(s) or individuals the owner specifically authorizes may upload copyrighted material to the system with the permission of the system administrator.

R. System users may redistribute non-commercially copyrighted programs only with the express permission of the owner or authorized person. Such permission must be specified in the document or must be obtained directly from the author in accordance with applicable federal guidelines, copyright laws, district policy, and administrative regulations.

S. System users may also download public domain programs for their own use or non-commercially redistribute a public domain program. System users are responsible for determining whether a program is in the public domain.

II. Telephone/Membership/Other Charges

A. The district assumes no responsibility or liability for any membership or phone charges including, but not limited to, long distance charges, per minute (unit) surcharges and/or equipment or line costs incurred by any home usage of the district's system.

B. Any disputes or problems regarding phone services for home users of the district's system are strictly between the system user and his/her local phone company and/or long distance service provider.

C. Commercial and/or personal for-profit use of the district's system is prohibited.

III. Updating Member Account Information

A. The district may require new registration and account information from system users to continue service.

B. System users must notify the district of any changes of account information such as address and phone number.

C. Student account information will be maintained in accordance with applicable education records law and district policy and administrative regulations.

IV. Information Content/Third Party Supplied Information

A. System users and parents of system users are advised that use of the district's system may provide access to other electronic communications systems that may contain inaccurate and/or objectionable material.

B. The district does not condone the use of objectionable materials. Such materials are prohibited in the school environment.

C. Parents of students with accounts on the district's system should be aware of the existence of such materials and monitor their student's home usage of the district's system accordingly.

D. Students knowingly bringing prohibited materials into the school environment will be subject to suspension and/or revocation of their privileges on the district's system and will be subject to discipline in accordance with the district's policy and applicable administrative regulations.

E. Staff knowingly bringing prohibited materials into the school will be subject to disciplinary action in accordance with district policy and collective bargaining agreements for discipline and dismissal.

IV. Information Content/Third Party Supplied Information (Continued)

A. Opinions, advice, services, and all other information expressed by system users, information providers, service providers, or other third party individuals in the system are those of the providers and not the district.

B. All matters concerning merchandise and services ordered including, but not limited to, purchase terms, payment terms, warranties, guarantees, and delivery are solely between the seller and the system user. The district makes no warranties or representation whatsoever with regard to any goods or services provided by the seller.

C. District staff and administration shall not be a party to any such transaction or be liable for any costs or damages arising out of, either directly or indirectly, the actions or inactions of sellers.

V. Termination/Revocation of System User Account

A. A guest system user's access to and use of the district's system may be terminated by the system user notifying the network administrator as appropriate.

B. Terminations by any system user will be effective on the day the network administrator receives notice of a guest system user's termination or of a student withdrawal or revocation of system privileges or on a future date if so specified in the notice.

C. Guest system accounts inactive for more than 30 calendar days may be removed along with the system user's files without notice given to the system user.

D. The district may suspend or revoke a system user's access to the district's system upon any violation of district policy and/or administrative regulation.

E. Prior to a suspension or revocation of system service or as soon as practicable the network administrator will inform the system user of the suspected violation and give the system user an opportunity to present an explanation.

1. A system user may appeal the suspension or revocation within seven (7) calendar days.

2. The network administrator may conduct the hearing or designate the building principal to conduct the hearing.

VI. Disclaimer

The district does not warrant that the functions or services performed by or that the information or software contained on the system will meet the system user's requirements or that the system will be uninterrupted or error-free or that defects will be corrected. The district's system is provided on an "as is, as available" basis. The district does not make any warranties, whether express or implied including, without limitation, those of merchantability and fitness for a particular purpose with respect to any services provided by the system and any information or software contained herein.

**Student Agreement for an Electronic Communications System Account**

Student agreement must be renewed each academic year.

1. **STUDENT SECTION**

Student Name________________________________________________ Grade ..........................

School ............................................................................................................................

I have read the district's Electronic Communications System policy and applicable administrative regulation and do agree to abide by their provisions. I understand that violation of these provisions may constitute suspension or revocation of system access and related privileges. Certain violations can result in discipline, up to and including expulsion (please read the policy carefully).

Student Signature________________________________________________ Date ...............................

* * * * * * *

2. **SPONSORING TEACHER**

I agree to sponsor the above student and to supervise his/her responsible use of the district's system as defined by the district's policy and administrative regulations while in school.

Teacher's Signature______________________________________ Date .......................................

3. **SPONSORING PARENT OR GUARDIAN**

I have read the district's Electronic Communications System policy and administrative regulation. I will monitor my student's use in the system and his/her potential access to the worldwide Internet and will accept responsibility for supervision in that regard when my student's use is not in a school setting. In consideration for the privilege of using the district's Electronic Communications System and in consideration for having access to the public networks, I hereby release the district, its operators and any institutions with which they are affiliated from any and all claims and damages of any nature arising from my, or my student's use, or inability to use, the system including, without limitation, the type of damages identified in the district's policy and administrative regulations.

I certify that the information contained on this form is correct and give my permission to issue an account for my student at the following level (please initial each level of access you would allow for your student this school year):

______Level 4 - Same as Level 3 plus adds Internet. This is the default student account for Grades 6-12 if parental permission is granted. Level 2 is the highest access level for Grades K-5.

______Level 3 - Same as Level 2 plus gives the student the right to communicate to others on the "crookEDnet" E-Mail system.

______Level 2 - Same as Level 1 plus access to local and district-wide services. This is the default classroom account for Grades K-5 if parental permission is granted.

______Level 1 - This allows the student to use stand-alone computers.

+---+ I do not give my permission for my student to participate
+---+ In the district's communications system

Signature of parent or guardian ..........................................................................................

Home Address..................................................................................................................

Date______________________________ Home Phone Number ...........................................

------------------------------ This space reserved for network administrator -------------------

Assigned Username: ........................................................................................................

Assigned Password: ..........................................................................................................

**Staff Agreement for an Electronic Communications System Account**

I have read the district's Electronic Communications System policy and administrative regulation. In consideration for the privilege of using the district's Electronic Communications System and in consideration for having access to the public networks, I hereby release the district, its operators and any institutions with which they are affiliated from any and all claims and damages of any nature arising from my use or inability to use the system including, without limitation, the type of damages identified in the district's policy and administrative regulations.

Signature ..........................................................................................................................

Home Address.....................................................................................................................

Date____________________________ Home Phone Number ...............................................

--------------------------------------------------------------

This space reserved for network administrator:

Assigned Username: ...........................................................................................

Assigned Password: ............................................................................................

# ELECTRONIC COMMUNICATIONS SYSTEM – INTERNET FILTERING

The Board is committed to insuring that the District's electronic communication system is used in a manner consistent with its acceptable use policy (AUP). Consequently, Internet filtering shall be utilized to provide students and staff protection against accessing objectionable and inappropriate Internet material.

In order to achieve the above-stated commitment, the district contracts with the Crook Deschutes ESD who in turn contracts with a filtering service to identify and examine the thousands of new sites that come online everyday.

The filtering service features a Request Page Review that allows the district to request that any particular site be blocked or unblocked with each request reviewed and individually replied to. This feedback helps the filtering service refine its list, involves the District in the filtering process, and helps the District customize its own block list.

The filtering service proxy servers provide a powerful, flexible tool available for enforcing the District's Acceptable Use Policies (AUP). The Block Categories shown below reflect the criteria in identifying objectionable Internet material for the proxy server. The general categories of "blockable" Web sites are:

BLOCK CATEGORIES

- **Adults Only**: Material labeled by its author or publisher as being strictly for adults. (Examples: "Adults only", "You must be 18 to visit this site", "Registration is allowed only for people 18 or older", "You must be of legal drinking age to visit this site").
- **Hate/Discrimination**: Advocating discrimination against others based on race, religion, gender, nationality, or sexual orientation.
- **Illegal**: Advocating, promoting, or giving advice on carrying out acts widely considered illegal. This includes lock-picking, bomb-making, fraud, breaching computer security ("hacking"), phone service theft ("phreaking"), pirated software archives, or evading law enforcement.
- **Pornography**: Material intended to be sexually arousing or erotic. (See also Sex and Nudity)
- **Sex**: Images or descriptions of sexual activity. Any sexual merchandise. Sexual fetishism. (See also Pornography and Nudity)
- **Violence**: Graphic images or written descriptions of wanton violence or grave injury (mutilation, maiming, dismemberment, etc.) Includes graphically violent games.

- **Alcohol**: Advocating or promoting recreational use of alcohol. (See also "Adults Only.")
- **Chat**: Chat sites, services that allow short messages to be sent to others immediately in real time. Downloadable chat software.
- **Drugs**: Advocating or promoting recreational use of any controlled substance. (Also see Illegal)
- **Free Email**: Sites that offer e-mail accounts over the Web for free. Such sites can expose users to harmful content delivered via e-mail file attachments and blocking such sites helps to enforce local acceptable use policies when e-mail is already provided locally to users.
- **Free Page Websites**: Sites where home page space is offered for free. These sites historically have done nothing to prevent capricious abuse of their services by users who post offensive content under multiple pseudonyms, making them difficult to track. Individual pages that have been reviewed by N2N2 on such sites are removed from this category, but filed under other categories as necessary.
- **Gambling**: Gambling services, or information relevant primarily to gambling.
- **Tasteless/Gross**: Bodily functions. Tasteless humor. Graphic medial photos. Some extreme forms of body modification (cutting, branding, genital piercing).
- **Profanity**: Crude, vulgar, or obscene language or gestures.
- **Lingerie**: Models in lingerie.
- **Nudity**: Bare or visible genitalia, pubic hair, buttocks, female breasts, etc. (See also Lingerie, Sex, Pornography)
- **Personal Information**: Sites that gather personal information (name, address, phone number, etc.).
- **School Cheating Info Pages**: Any site that promotes plagiarism or similar cheating among students (such as by offering term papers, exam keys, etc.)
- **Suicide/Murder**: Information on committing murder or suicide.
- **Tobacco**: Advocating or promoting recreational use of tobacco. (See also "Adults Only.")
- **Weapons**: Information on use of weapons, weapon collecting, or weapon making.
- **Personals**: Personal advertisements, including "mail-order brides." (See also "Adults Only.")

EXCEPTION CATEGORIES

- **Education Material**: Material under another category (such as Sex, Nudity, Violence) that has educational value (such as classic literature, sex education, etc.)
- **For Kids Sites**: Sites that are designed specifically for kids.

SPECIAL CATEGORIES

- **Block search engine results based on key words.**
- **Block User Request List's based on key words.**

END OF POLICY

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Legal Reference

District Technology Plan
Action Plan

**Goal: A. The district will enhance technology and support by researching, developing, and maintaining infrastructure and programs that support the needs of the staff, students, and community.**

**Indicator: A completed plan that leads to maintenance of a goal of networked computers at a ratio of 5-1 for students in the district by September 2008.**

| Activity | Person Responsible | Completion Date | Cost |
|---|---|---|---|
| **Develop a strategy for researching and implementing V-tel.** *Strategy for use* | **Dennis Kostelecky/ Technology Coordinator/ Technology Committee** | **September ff** | **0 (Committee Time)** |

| Activity | Person Responsible | Completion Date | Cost |
|---|---|---|---|
| Maintain 1-networked computer per five students. | Technology Department | July 2008 | $20,000 |
| Maintain 750 computers (per priorities stated above) | Technology Department | July 2008 | Technology staff time |
| Distribute computers equitably to elementary schools | Technology Department | August/September 2008 | Technology staff time |
| Install technology in buildings<br><br>Plan for acquiring Technology for 2006-2008<br><br>Survey need<br>Research cost<br>Include in budgeting process | Technology Committee/Administrative Team | September 2008<br>October 2008<br>March 2008 | Committee Time<br>Technology Department Time<br>Administrative Time |

| Activity | Person Responsible | Completion Date | Cost |
| --- | --- | --- | --- |
| Develop a method of budgeting for replacement.<br>Discuss needs with superintendent<br><br>Budget appropriately<br><br>Acquire replacement computers and distribute usable used computers | Technology Committee<br><br>Superintendent/Budget Committee<br><br>Technology Department | February 2008<br><br>March 2008<br><br>Yearly—July/August | Committee Time<br><br>Committee Time ($75,000-$85,000 per year<br><br>Technology staff time |
| Maintain and upgrade educational and administrative software<br><br>Buildings survey needs<br><br>Upgrade to Windows 2000 (or greater) | Building Technology Committee<br><br>Technology Department | February 2006<br><br>August 2006--yearly | Determined by needs<br><br>$15,000 in first year |
| Develop a purchasing policy for hardware and software based on specification minimums. | Technology Committee | June 2006 | Time |

**Goal: B. To provide the best possible use of technology the district will acquire, upgrade, and replace hardware and software to enhance administrative and instructional needs.**

**Indicator: To provide hardware to assure networked computers at a ratio of 5-1 for students in the district by September 2008.**

| Activity | Person Responsible | Completion Date | Cost |
|---|---|---|---|
| Research and acquire equipment for utilization and management of fiber optic WAN technology. | Technology Coordinator | June 15, 2008 | Time |
| Upgrade and replace hardware to a minimum of P3. Purchase Hardware (see above) | Technology Department | July 2006--yearly | $85,000 first year |
| Update all PC to Windows 2000 (or greater) and Office 2000 (or greater) (See Goal B # 3) | Technology Coordinator | June 15, 2008 | $15,000 |

| Activity | Person Responsible | Completion Date | Cost |
|---|---|---|---|
| **Maintain at least a 1 to 5 Computer/student ratio (see Goal A #7 above)** | **Technology Coordinator** | **September 1, 2008** | **$75,000 Annually** |
| **Develop a plan for the acquisition of laser printers to replace Inkjet printers district wide.**<br><br>**Develop a policy for the implementation and purchasing of laser printers throughout the district** | **Technology Committee (Distribution policy)**<br><br>**Technology Committee (Distribution policy)** | **June 15, 2008**<br><br>**June 15, 2008** | **Time**<br><br>**Time** |

**Goal: C. To improve the utilization of technology in the classroom and to enhance student achievement, the district will provide staff development.**

**Indicators:**
1) **To develop staff competency requirements in technology by January 2007.**
2) **Develop a mastery training plan in technology.**
3) **To provide staff development in needed competency areas at least three times per year 2007-09.**

| Activity | Person Responsible | Completion Date | Cost |
|---|---|---|---|
| Develop hiring criteria that will include competency in technology skills. | Personnel Director<br>Technology Coordinator<br>Curriculum Coordinator | January 30, 2007 | Time |
| Develop and distribute a survey yearly to determine staff development needs | Curriculum Coordinator | October 1, 2006 | Time |
| Provide staff development in the use of administrative hardware and software (Schoolmaster, Windows, Mastery in Motion, Grade book, etc. | Technology Director<br>Curriculum Coordinator<br>Building Principals | August 30, 2008—Mastery in Motion<br>August 30, 2008-SchoolMaster<br>October 12, 2008—Needed | Time |
| Provide staff development in the use of educational hardware and software (PLATO, Accelerated Reader, STAR, etc.) as needed | Technology Director<br>Curriculum Coordinator<br>Building Principals | August 30, 2008—Accelerated Read<br>August 29, 2008—PLATO | Grant<br>$200 |
| Develop a mastery training plan | Staff Development Committee<br>Curriculum Coordinator | January 30, 2008 | Time<br>Grant |

**Goal: D. To enhance student achievement the district will provide curriculum and best practices for instruction using technology.**

**Indicators: 1) Written framework of technology skills K-5.**
**2) Develop a three-phase plan for the use of United Streaming.**
**3) Implementation of phase-two of the United Streaming plan.**
**4) Plan for implementing phase 3 of the plan.**

| Activity | Person Responsible | Completion Date | Cost |
|---|---|---|---|
| **Adopt standards and curriculum for grades 3-8** | **Curriculum Coordinator<br>Teacher Committee** | **October 1, 2006** | **Time** |
| **Develop a phase-two plan for curriculum delivery of United Streaming.<br><br>Provide training in United Streaming for 100% of staff in phase two.** | **Curriculum Coordinator<br>Technology Coordinator** | **October 1, 2006<br><br>October 12, 2007** | **Time<br><br>$3000-$6000<br><br>$800** |
| **Develop a phase three plan for using standards in the use of United Streaming** | **Curriculum Coordinator** | **Ongoing through 2008** | **Time** |

**Goal: E. To develop, enforce and monitor policy development for staff, students, and community.**

**Indicators: 1) Revised network use policy.**
**2) At least one sessions of staff development on the revision of network use policy for students and staff.**

| Activity | Person Responsible | Completion Date | Cost |
|---|---|---|---|
| Review and revise an acceptable network use policy | Technology Coordinator<br>Technology Committee | October 1, 2007 | Time |
| Complete an annual review of district Internet and email policy | Technology Coordinator | October 1, 2008 | Time |
| Inform staff and students of copyright laws and use policy | Technology Coordinator<br>Building Principals | September 30, 2006 and yearly | Time |

# APPENDIX B

## FCC FORM 470

FCC Form 470

Do not write in this area.

Approval by OMB
3060-0806

### Schools and Libraries Universal Service
### Description of Services Requested and Certification Form 470

**Estimated Average Burden Hours per Response: 4 hours**

This form is designed to help you describe the eligible telecommunications-related services you seek so that this data can be posted on the Fund Administrator Web Site and interested service providers can identify you as a potential customer and compete to serve you.

**Please read instructions before beginning this application. (You can also file online at www.sl.universalservice.org)**

Applicant's Form Identifier (Create your own code to identify THIS Form 470)

Form 470 Application #:

(To be assigned by administrator)

**Block 1: Applicant Address and Identifications**

1 Name of Applicant

2 Funding Year

July 1, through June 30,

3 Entity Number

4a Street Address, P.O. Box, or Route Number

City

State

Zip Code

b Telephone Number

Ext

c Fax Number

5 Type of Application

- Individual School (individual public or non-public school)
- School District (LEA; public or non-public [e.g. diocesan] local district representing multiple schools)
- Library (including library system, library outlet/branch or library consortium as defined under LSTA)
- Consortium (intermediate service agencies, states, state networks, special consortia of schools and/or libraries)

0 4 7 0 0 1 0 1 0 4

# APPENDIX C
# FCC FORM 471

FCC Form 471

Do not write in this area.

Approval by OMB 3060-0806

***Schools and Libraries Universal Service***
***Description of Services Ordered and Certification Form 471***

**Estimated Average Burden Hours per Response: 4 hours**

This form asks schools and libraries to list the eligible telecommunications-related services they have ordered and estimate the annual charges for them so that the Fund Administrator can set aside sufficient support to reimburse providers for services.

**Please read instructions before beginning this application. (You can also file online at www.sl.universalservice.org.)**
**The instructions include information on the deadlines for filing this application.**

Applicant's Form Identifier
(Create your own code to identify THIS Form 471)

Form 471 Application#:__________
(To be assigned by administrator)

**Block 1: Billed Entity Information** (The "Billed Entity" is the entity paying the bills for the services listed on this form.)

**1 a** Name of Billed Entity

**2 a** Funding Year: July 1, through June 30,

**3** Billed Entity Number

**4 a** Street Address, P.O. Box, or Route Number

City

State

Zip Code

**b** Telephone Number Ext

**c** Fax Number

**5 a** Type of Application

- Individual School (individual public or non-public school)
- School District (LEA; public or non-public [e.g. diocesan] local district representing multiple schools)
- Library (including library system, library outlet/branch or library consortium as defined under LSTA)
- Consortium — Check here if any members of this consortium are ineligible or non-governmental entities.

**6** Contact Person's Name

First, if the Contact Person's Street Address is the same as in Item 4, check this box. If not, please complete the entries for the Street Address below.

**b** Street Address, P.O. Box, or Route Number

City

State

Zip Code

Check the box next to your preferred mode of contact and provide your contact information. One box MUST be checked and an entry provided.

**c** Telephone Number Ext

**d** Fax Number

**e** E-mail Address

**f** Holiday/vacation/summer contact information:

0 4 7 0 0 1 0 1 0

FCC Form 471 - November 2004

# APPENDIX D

# FCC FORM 472

FCC Form 472

**Do not write in this space.**

Approval by OMB
3060 – 0856
Estimated time per response: 1.5 hours

**Universal Service for Schools and Libraries**

Please read instructions before completing.

(To be completed by schools, libraries, or consortia.)

## BILLED ENTITY APPLICANT REIMBURSEMENT FORM

**For reimbursement of discounts on approved services already paid for by the Billed Entity Applicant.**
**Only one Service Provider Identification Number (SPIN) per form.**
**Must be completed and signed by the Billed Entity Applicant and signed by the relevant service provider.**

**Persons willfully making false statements on this form can be punished by fine or forfeiture, under the Communications Act, 47 U.S.C. Secs. 502, 503(b), or fine or imprisonment under Title 18 of the United States Code, 18 U.S.C. Sec. 1001.**

FCC NOTICE FOR INDIVIDUALS REQUIRED BY THE PRIVACY ACT AND THE PAPERWORK REDUCTION ACT

Part 54 of the Commission's Rules authorizes the FCC to collect the information on this form. Failure to provide all requested information will delay the processing of the application or result in the application being returned without action. Information requested by this form will be available for public inspection. Your response is required to obtain the requested authorization.

The public reporting for this collection of information is estimated to range from 1 to 2 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the required data, and completing and reviewing the collection of information. If you have any comments on this burden estimate, or how we can improve the collection and reduce the burden it causes you, please write to the Federal Communications Commission, AMD-PERM, Paperwork Reduction Act Project (3060-0856), Washington, DC 20554. We will also accept your comments regarding the Paperwork Reduction Act aspects of this collection via the Internet if you send them to PRA@fcc.gov. PLEASE DO NOT SEND YOUR RESPONSE TO THIS FORM TO THIS ADDRESS.

Remember – You are not required to respond to a collection of information sponsored by the Federal government, and the government may not conduct or sponsor this collection, unless it displays a currently valid OMB control number or if we fail to provide you with this notice. This collection has been assigned an OMB control number of 3060-0856.

THE FOREGOING NOTICE IS REQUIRED BY THE PRIVACY ACT OF 1974, PUBLIC LAW 93-579, DECEMBER 31, 1974, 5 U.S.C. 552a(e)(3) AND THE PAPERWORK REDUCTION ACT OF 1995, PUBLIC LAW 104-13, OCTOBER 1, 1995, 44 U.S.C. SECTION 3507.

**BLOCK 1: HEADER INFORMATION**

1. **471 Billed Entity Name**
2. **471 Billed Entity Number**
3. **Service Provider Identification Number (SPIN)**
4. **Contact Name**
5. **Contact Telephone Number**
6. **Reimbursement Form Number**
7. **Reimbursement Date to USAC**
8. **Total Reimbursement Amount** (total of Block 2, Item 15 – 14.2 digits maximum)

# APPENDIX E

# FCC FORM 474

| | | |
|---|---|---|
| FCC Form 474 | Do not write in this space. | Approval by OMB 3060 – 0856<br>Estimated time per response: 1.5 hours |
| | **Schools and Libraries Universal Service**<br>**Service Provider Invoice Form 474**<br>**This form can be filed online or by mail.** | |
| Please read instructions before completing | Form 474 Invoice # ____________<br>**(To be inserted by administrator)** | |
| **BLOCK 1: Service Provider Information** | | |
| **1. Service Provider Name** | | |
| **2a. Service Provider Identification Number (SPIN)** | | |
| **3. Contact Person's Name** | | |
| **4. Contact Telephone Number Area Code: Phone Number: Ext.** | | |
| **Contact Fax Number Area Code: Fax Number:** | | |
| **Contact Email Address** | | |
| **5. Invoice Number** | | |
| **6. Invoice Date to USAC** | | |
| **7. Total Invoice Amount** | | |

FCC Form 474 April 2007

# APPENDIX F
# FCC FORM 486

FCC Form 486

Do Not Write in this Area

Approval by OMB
3060-0853
Estimated time
per response: 1.5 hours

**Schools and Libraries Universal Service**
**Receipt of Service Confirmation Form**

To be completed by the Billed Entity
Please read instructions before completing.

(You can also file online at www.usac.org/sl.)

| | |
|---|---|
| Applicant's Form Identifier (Create your own code to identify THIS Form 486) | Form 486 Application#: ______________ (To be assigned by administrator) |

**Block 1: Billed Entity Information**

**1. Name of Billed Entity**

**2. Billed Entity Number**

**3. Funding Year July 1, ________ through June 30, ________**

**4. Complete Mailing Address of Billed Entity**
Street Address, P.O. Box, or Route Number

City | State | Zip Code

Telephone Number | Extension | Fax Number

**5. Contact Person Information**
Contact Person Name

Street Address, P.O. Box or Route Number

City

State | Zip Code

**Check the box next to the preferred mode of contact. (At least one box MUST be checked.)**

☐ Telephone Number | Extension | ☐ Fax Number

☐ Email Address

0 4 8 6 0 1 0 1 0 3

# BIBLIOGRAPHY


Amendola, M., & Gaffard, J. L. (1988). *The innovative choice: An economic analysis of the dynamics of technology*. Oxford, Oxfordshire; New York, NY: B. Blackwell.

Arfstrom, K., & Sechler, A. (2007). *E-Rate: 10 years of connecting kids and community*. Washington, DC: The Education and Libraries Network Coalition.

Aufderheide, P. (1999). *Communications policy and the public interest: The telecommunications act of 1996*. New York: Guilford Press.

Barker, J. (2006, August). *What is the Internet, the World Wide Web, and Netscape?* Retrieved December 28, 2006, from the University of California, Berkeley, Web site: http://www.lib.berkeley.edu/TeachingLib/Guides/Internet/WhatIs.html

Berman, P. (1974). *Federal programs supporting educational change, V.2*. Santa Monica, CA: Rand.

Bessant, J. R., & Dodgson, M. (1996). *Effective innovation policy: A new approach*. New York: Routledge.

Bunn, S., & Campbell, D. (2002). *Oregon Senate Bill 622 and the implementation of the Oregon Access Network*. Salem: Oregon Department of Education.

Burrus, D., & Gittines, R. (1993). *Technotrends: How to use technology to go beyond your competition*. New York: Harper Business.

BytePile.com, Inc., (2002, October 19). *Data Transmission Speeds.* Retrieved May 5, 2007, from BytePile.com Web site: http://www.bytepile.com/data_speed.php

Carvin, A. (2000). *The E-Rate in America: A tale of 4 Cities.* Washington, DC: Benton Foundation.

Cattagni, A., & Farris, E. (2001). *Internet access in U.S. public schools and classrooms: 1994-2000.* Washington, DC: National Center for Education Statistics.

Cetron, M. J., Soriano, B., Gayle, M., & American Association of School Administrators. (1985). *Schools of the future: How American business and education can cooperate to save our schools*. New York: McGraw-Hill.

Cisco Systems, Inc. (1996, February 6). *TCP/IP.* Retrieved April 20, 2007, from About.com Web site: http://websearch.about.com/gi/dynamic/offsite.htm?zi=1/XJ&sdn=websearch&cdn=compute&tm=563&gps=90_741_1276_624&f=00&su=p284.7.420.ip_&tt=2&bt=1&bts=0&zu=http%3A//www.cisco.com/warp/public/535/4.html

Coley, R., Cradler, J., & Engle, P. K. (1997). *Computers and Classrooms* (PIC-COMPCLSS). Retrieved January 5, 2007, from http://www.ets.org/portal/site/ets/menuitem.c988ba0e5dd572bada20bc47c3921509/?vgnextoid=4500af5e44df4010VgnVCM10000022f95190RCRD&vgnextchannel=5c75be3a864f4010VgnVCM10000022f95190RCRD

Compaine, B. M. (2001). *The digital divide: Facing a crisis or creating a myth?* Cambridge, MA: MIT Press.

Dempsey, D. F. (1999). The benefits of creating your own school Internet Service Provider. *NASSP Bulletin, 83*(607), 16-20.

Dodgson, M., & Bessant, J. (1996). *Effective innovation policy.* London: International Thomson Business Press.

Educational Testing Service. (1996). *Computers and the Classroom.* Princeton: Educational Testing Service.

Feizabadi, S. (1996). *History of the World Wide Web.* Retrieved December 20, 2006, from Virginia Tech University Web site: http://ei.cs.vt.edu/book/chap1/index.html

Friedman, T. L. (2005). *The world is flat: A brief history of the twenty-first century.* New York: Picadour.

Fullan, M. (1992, October). Getting reform right: What works and what doesn't. *Phi Delta Kappa,* 744-52.

Gall, J. P., Gall, M. D., & Borg, W. R. (1999). *Applying educational research: A practical guide* (4th ed.). New York: Longman.

Gates, B., Myhrvold, N., & Rinearson, P. (1995). *The road ahead.* New York: Viking.

Goolsbee, A., & Guryan, J. (2006). Impact of Internet subsidies in public schools. *The Review of Economic and Statistics,* 336-347.

Griffin, S. (2000). *Internet pioneers.* Retrieved April 22, 2007, from Ibiblio Web site: http://www.ibiblio.org/pioneers/andreesen.html

Grubler, A. (1997) *Time for a change: On the patterns of diffusion of innovation.* Retrieved April 17, 2008, from National Academies Press Web site: http://www.nap.edu/openbook.php?record_id=4767&page=15

Gubrium, J. F., & Holstein, J. A. (2002). *Handbook of interview research: Context & method.* Thousand Oaks, CA: Sage Publications.

Hall, G. E., & Hord, S. M. (2001). *Implementing change: Patterns, principles, and potholes*. Boston: Allyn & Bacon.

Harris, L., & Associates. (2003). *E-Rate: A vision of opportunity and innovation.* Washington, DC: The Education and Libraries Network Coalition.

Hauben, M. (1996). *History of ARPANET.* Retrieved January 5, 2007, from Columbia University Web site: http://www2.dei.isep.ipp.pt/docs/arpa.html

Hord, S. M. (1987). *Evaluating educational innovation*. New York: Croom Helm.

Hord, S. M. (1987). *Taking charge of change*. Alexandria, VA: Association for Supervision and Curriculum Development.

H. R. Conf. Rep. NO. 458, 104th Congress; 2nd Session 132 (1996).

Hutchinson, D., Mariani, J. A., & Shepherd, D. (1985). The Ethernet. In D. Hutchinson (Ed.), *Local Area Networks* (pp. 1-3). New York: Springer.

International Society for Technology in Education. (2000-2005). *National educational technology standards*. Retrieved May 5, 2007, from Louisiana Tech University Web site: http://cnets.iste.org/index.shtml

Katz, Elihu (1999). Theorizing diffusion: Tarde and Sorokin revisited. *The Annals 566: 144-155 C (N).*

Kosiur, D. R., & Angel, J. (1995). *How local area networks work: What they are and what they do*. Englewood Cliffs, NJ: Prentice Hall PTR.

Leiner, B., Cerf, V. G., Clark, D. D., Kahn, R., Kleinrock, L., Lynch, D. C., et al. (2006, November). A brief history of the Internet. In *A brief history of the Internet* (1). Retrieved December 30, 2006, from The Internet Society Web site: http://www.isoc.org/internet/history/brief.shtml#Introduction

Marshall, C, & Rossman, G. B. (1995). *Designing qualitative research* (2nd ed.) Thousand Oaks, CA: Sage Publications.

McCauley, M. P., Artz, B. L., Peterson, E. E., & Halleck, D. D. (Eds.). (2003). *Public Broadcasting and the Public Interest*. Armonk, NY: M. E. Sharpe.

Messere, F. J. (1996). *U.S. Policy: Telecommunications Act of 1996*. Retrieved December 28, 2006, from Museum of Broadcast Communications Web site: http://museum.tv/archives/etv/U/htmlU/uspolicyt/uspolicyt.htm

National Center for Education Statistics (2000, September). *Teachers' tools for the 21st Century: A report on teachers' use of technology* (NCES 2000-102). Washington, DC: U.S. Department of Education.

National Commission on Excellence in Education. (1983). *A nation at risk.* Cambridge, MA: USA Research.

Nuechterlein, J. E., & Weiser, P. J. (2005). *Digital crossroads: American telecommunications policy in the internet age*. Cambridge, MA: MIT Press.

Oregon Public Education Network. (2006). *About OPEN.* Retrieved October 15, 2004, from Oregon Public Education Network Web site: http://www.open.k12.or.us/about.html

Patton, M. Q. (2002). *Qualitative research and evaluation methods* (3rd ed., Rev.). (2006). Personal Computer. Microsoft Encarta Online Encyclopedia.

Peslak, A. (2004). An empirical study of the effect of information technology expenditures on student achievement. *Information Research*, *9*(4), paper 185. Available at http://InformationR.net/ir/9-4/paper185.html

Puma, M. J. (2000). *E-Rate and the digital divide.* Washington DC: Department of Education.

Rogers, E. M. (2003). *Diffusion of innovations* (5th ed., Rev.). New York: Free Press.

Rowand, C. (1999). *Internet access in public schools and classrooms: 1994-98.* Retrieved November 7, 2007, from Web site: http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=1999017

Rutherford, W. L., & Murphy, S. C. (1985). *Change in high schools: Roles and reactions of teachers*. Austin: Research and Development Center for Teacher Education, the University of Texas at Austin.

Schofield, J. W., & Davidson, A. L. (2002). *Bringing the Internet to school: Lessons from an urban district*. San Francisco: Jossey-Bass.

Servon, L. J. (2002). *Bridging the digital divide: Technology, community, and public policy*. Malden, MA: Blackwell Publishers.

Tanenbaum, A. S. (2002). *Computer networks* (4th ed., Rev.). Englewood Cliffs, NJ: Prentice Hall PTR.

U.S. Department of Labor. (1991). *What work requires of schools: A SCANS report for America 2000*. Washington, DC: Secretary's Commission on Achieving Necessary Skills.

Universal Service Administration Corporation. (2006). *Universal Service fund facts*. Retrieved December 28, 2006, from Universal Service Administrative Company Web site: http://www.universalservice.org/about/universal-service/fund-facts/fund-facts.aspx

Wall, A. (2007). *History of search engines.* Retrieved August 15, 2008, from Search Engine History Web site: http://www.searchenginehistory.com

Yin, R. K. (2003). *Case study research: Design and methods* (3rd ed.). Thousand Oaks, CA: Sage Publications.

Yost, J. R. (2005). *The computer industry*. Westport, CT: Greenwood Press.