VI. Lessons Learned

The TIIAP program has always had an emphasis on learning from the experiences of the projects it funds. In fact, a document published by the program in 1996 focused exclusively on lessons that could be learned from the 1994 and 1995 TIIAP projects. The publication, *Lessons Learned from the Telecommunications Information Infrastructure Assistance Program*, provides a number of noteworthy recommendations for projects preparing to implement similar technology projects. Topics covered by the document include conducting a needs assessment, developing a plan that outlines project goals and activities, preparing an evaluation plan, identifying funding, planning for sustainability, developing partnerships, and other practical lessons learned.

This chapter builds upon the recommendations outlined in the 1996 document by identifying additional lessons that emerged from our mail survey and case studies. These recommendations are organized around the following four themes: developing a human network, developing a telecommunications network, sustaining projects beyond the end of the grant period, and developing specialized projects.

DEVELOPING A HUMAN NETWORK

As discussed in Chapter II, an important benefit of many projects was the network of partnerships that were formed or strengthened as a result of TIIAP. However, the program's emphasis on forging partnerships proved to be a double-edged sword for some projects. Findings from the mail survey and case studies suggest that a project's failure to manage its human network can limit the eventual success and impact of its technological innovations. As one project director stated, "it is not the hardware nor the software that creates the most problems, it is the peopleware." Feedback from other projects confirmed this insight. Thus, one overarching lesson that emerged from this study is that developing and managing a human network is a necessary condition for having a successful community-based technology project. Such partnerships are often needed to identify the full extent of a community's needs, provide necessary financial and political support, help in the development of a technological innovation, publicize the availability of new technologies to community residents, and evaluate the implementation and impact of a given technological activity.

Mail survey respondents and case study participants offered a variety of recommendations regarding the development and maintenance of a dynamic human network. These lessons are summarized below.

Chose partners wisely. A number of projects emphasized the importance of developing alliances with organizations that are capable of performing their assigned role. One mail survey respondent suggested that grant recipients take the time to understand the strengths and limitations of their partner organizations. Another respondent cautioned against selecting partners that clearly lacked the time and resources to handle their assignments. Still others suggested partnering with organizations that shared common goals. Finally, one respondent cited the importance of identifying partner organizations that were flexible and comfortable with changing technologies.

Take steps to maximize partners' commitment to the project's goals. A number of respondents described the benefits of partnering with organizations that were highly motivated to facilitate the project's success. These respondents noted, however, that obtaining a high level of buy-in among partners often requires a great deal of work by the grant recipient organization. That is, such buy-in rarely occurs because all partner organizations share the same goals. Rather, it occurs because project leaders take the time to do the following:

- Define an explicit role for each partner;
- Develop a mission statement and operational plan that delineates the goals of the project and the responsibilities of all participating partners;
- Develop good working relationships with their counterparts in each of the partner organizations;
- Formalize a range of communication mechanisms (e.g., e-mail, conference calls, and face-to-face meetings) at the outset of the project;
- Meet on a regular basis with project partners (e.g., to keep members informed of upcoming activities and ensure specific tasks are being completed in a timely manner); and
- Ensure that partners receive appropriate credit for activities that they successfully accomplish.

Findings from the mail survey and case studies emphasized the importance of meeting with project partners as early in the project as possible. Projects indicated that involving partners early on can reinforce that they are valued and important members of the team. Meeting at the beginning of the effort can also ensure that all participating organizations have shared expectations about the project's timetable and outcomes. One project suggested making sure that, "each partner has a contact person (site coordinator) that is interested in and excited about your project." This project also suggested meeting weekly in an official capacity and allowing for social and casual contact between members. Partners unable to attend these meetings can be kept informed through a website or newsletter.

Formalize working relationships. An important lesson that emerged from both the mail survey and case studies was the need to establish written agreements with all project partners. Such agreements were viewed as means of minimizing the potential for subsequent misunderstandings about roles, responsibilities, and timetables.

Projects further recommended that written agreements should be as specific as possible. One mail survey respondent warned, "be sure you receive some kind of legal or binding agreement for matches in the form of money." Other projects noted that formal contracts can minimize misunderstandings about whether a given organization has actually agreed to participate in a coalition (one site's failure to formalize its relationship with the local municipality contributed to the project's eventual collapse). In a rural project in Ada, Oklahoma, for example, a written memorandum of understanding was used to delineate the responsibilities of each organization that was using TIIAP-funded terminals to provide public access to the Internet. The agreement outlined the responsibilities of both the lead agency (the Chickasaw Nation) and the participating organizations. The use of these agreements assured that all agencies understood their responsibilities regarding the installation and maintenance of equipment, the payment of fees, and the provision of access and support to end users. It also ensured that there were no misunderstandings regarding who owned the equipment, who was responsible for maintaining the equipment, and who was responsible for providing technical assistance to end users.

Anticipate staff turnover (within and outside the grant recipient organization). Many projects described the difficulties of retaining quality personnel over the life of their initiative. Programmers responsible for working with new

and complex technologies are often in high demand. Thus, as some projects progressed, personnel became more marketable as they gained valuable experience with innovative equipment and up-to-date software packages. The trends uncovered during the site visits suggest that in the short run, working with contemporary hardware and software sometimes makes it easier to obtain personnel (who need on-the-job experience). However, once these staff become proficient, they are often able to command significantly higher wages from other employers. One case study site recommended staggering the hiring and training of computer personnel to reflect the following 3-year cycle:[31]

Year 1: Hire and train new technical staff member.

Year 2: Technical staff member is semi-productive as s/he applies skills learned in the first year.

Year 3: Technical staff member is very productive. Consequently, s/he is hired by another company by the end of the third year.

This cycle suggests that projects should attempt to (1) understand early the types of technical skills that will be needed to complete a given task; (2) have an appreciation of the salaries being paid to local programmers who possess these technical skills; (3) develop a project timeline and corresponding staffing plan that ensures the necessary staff will be trained and available (i.e., still affiliated with the project) when a given task is ready to be undertaken; and (4) have alternate staff available in case the original staff leave before a given task is completed. In addition, a project's staffing plan should do the following:

- Recognize the need to have a "third-year" (i.e., experienced) programmer on hand to complete the most complicated assignments;
- Contain incentives to keep good technical staff employed for at least 3 years (or whatever learning/implementation cycle is in place in a given labor market);
- Stagger the hiring of technical staff so that they are not preparing to leave at the same time; and
- Budget for more staff members to prevent burnout.

Projects pointed out that problems associated with staff turnover are not limited to the grant recipient organization. As such, they suggested establishing working relationships with several individuals within a given partner organization. One mail survey respondent indicated that by making sure organizational support runs deeper than a single individual, projects can avert delays that often occur when the partner's primary contact leaves for another job (as happens frequently in technology-based projects).

Gaining the support of key community stakeholders takes considerable time and energy. Some case study sites indicated that they failed to recognize early on the need to demonstrate the shared value of their project to the very stakeholders that had the most to gain from the project. As such, they stressed that promoting or marketing the project's benefits at the outset can make it easier to reach intended beneficiaries as the project matures. Several projects offered advice on accessing essential organizations and their constituencies, including demonstrate nonduplication of services, show how the project can be of assistance to the organization's members, be aware of an organization's customs, utilize key community and religious leaders who are influential within a targeted neighborhood, and develop a media plan that relies on cost-effective approaches for reaching an intended audience.

Pay attention to the political environment. Several projects indicated that some stakeholders became more concerned with getting publicity for their own group, rather than the project as a whole.

[31] The current demand for computer programmers with cutting-edge skills suggests that in some labor markets, this 3-year cycle may actually represent a 1- or 2-year cycle.

They suggested that this issue be handled on a case-by-case basis, the goal being to finesse each relationship into something more beneficial for all parties involved. In addition, projects cited the importance of gaining support from elected officials and other important political figures. However, as one survey respondent warned, "expect to step on toes if you intend to change the landscape."

DEVELOPING A TELECOMMUNICATIONS NETWORK

The success of many TIIAP projects rested on their ability to develop telecommunications applications that were useful and accessible. It is therefore not surprising that projects had an abundance of practical pointers for future organizations seeking to develop or expand access to existing telecommunications networks. For example, projects recommended that prospective technology should design networks for general use, build expandable networks, and (whenever possible) integrate with other networks rather than running new wires. In addition, projects emphasized that multimedia capabilities, Web server access (in addition to text Internet access), and e-mail need to be made available on all networks.

The following lessons learned, taken from the mail surveys and case studies, cover a wide range of technology-related issues. These recommendations are organized around three broad topics: financial, technical, and training.

Financial Considerations

Look for innovative and practical ways to cut operating costs. Given the expense associated with most telecommunications ventures, projects were especially mindful of the need to monitor and, if possible, moderate their operating expenses. Projects offered the following financial lessons learned from their own experiences.

- *Find a cost-effective place to house equipment.* One project noted that hospitals or other public sites can be ideal settings for housing equipment. In this particular project, the telecommunications technology was situated in a regional medical center that housed the regional network's server. The site was air conditioned, physically secure, and had emergency generators in case of a power failure. In addition, the project received the space to house servers free of charge. Finally, the hospital donated telephone lines, thereby alleviating any expenses associated with leasing.

- *Share resources to avoid duplication of expensive costs.* In Louisville, Kentucky, project partners coordinated efforts to install and later maintain different sections of the fiberoptic cable they laid. Working this out in advance took time and careful negotiation, but the project reported that it was worth it in the end. Through cooperation, they avoided duplication of laying and maintaining costly fiber technology.

- *Negotiate for discounted services.* Many telephone companies (and third-party providers) are vigorously competing for customers, particularly long-term data customers. As such, according to projects, they often have such unannounced discounts as free installation.

Avoid the most expensive technology for technology's sake. Projects often stressed that it is not always necessary to buy top-of-the-line equipment. One of the case study sites was operating on a shoestring budget, with donated office space and 500 active volunteers. Nonetheless, the project reported monthly operating expenses of $26,000. Although the project has leveraged over $13 million in operating funds, staff indicated that unnecessary expenditures to procure the finest cutting-edge technology might have pushed the project to bankruptcy. They concluded that it only makes sense to purchase the best equipment that money

can buy if the project's needs demand it. In the case of this project, such technology was not needed.

Explore Alternative Payment Options. Projects indicated that it is not always necessary to purchase computer equipment. For example, one option is to lease, rather than buy, equipment. This is an especially important consideration for telecommunications initiatives, where technology changes so rapidly that leasing may enable projects to adapt more easily as new innovations become available at an accelerated pace.

Technical Considerations

Maintain a balance between content versus connectivity. As one ECLL project recommended, throughout the different phases of the project, "content development and affordable connectivity must occur simultaneously—if one is developed before the other, neither will be effective." Not only should projects with an educational mission strive to provide quality content in their networks and programs, but technology demands constant updating to keep the content on the cutting edge.

Do not underdesign the system. That is, anticipate the project's future needs, which requires diligence due to the rapid pace of technological advancement. One project recommended that since a network can grow faster than anyone expects, causing the file server to become overburdened, "build a basic framework four times as big as you anticipate needing."

Have local technical expertise on hand. Local experts are often necessary to assist with software and hardware selection and other needs that may arise, such as consulting on standard protocols. One project found that local communities that designed their own networks needed standards to prevent incompatibility problems. Such standards should be sought from the community's telecommunications provider (e.g., Southwestern Bell), but a technical advisor will be able to translate standards into practical guidelines. In addition, a good technical help desk may also be a necessity—telecommunications technology is complicated and as such is prone to complex problems. A reliable help desk should be able to ameliorate many problems that occur during project operation.

Rely on industry standards. Projects repeatedly recommended relying on industry-standard hardware and software purchases rather than taking chances with unproven technologies. Standard protocols, software, and hardware will enable a project to adapt more nimbly to the evolution of the product marketplace. In one instance, a project team strayed from this general strategy and attempted to develop their own customized version of Mosaic, and a great deal of time and effort was expended with virtually no benefit. This occurred because the marketplace had caught up with the needs of the project by the time the extensive customization had been completed. This constraint does not, however, mean that a project cannot be innovative. For example, a project used multiple PCs as servers that allowed the network to be more flexible and cost efficient as it grew and evolved, rather than a mainframe-based configuration that would (theoretically) have been more powerful. System failures were reported to be easier to diagnose and correct because different network modules were located on different PCs.

Develop technological applications that are user-friendly. As discussed previously, the most difficult problems faced by technology projects are often linked to political and human considerations. Therefore, it is not surprising that many projects stressed the importance of developing technologies that are as easy to access and use as possible. The more user-friendly the network, the greater the likelihood that community members will use a given service. Several projects suggested that prospective end users be asked early in the project to:

- Identify the types of services they most desire;

- Specify the types of barriers that will need to be overcome if they are to use a given service;

- Pretest a given technology to assess its usability, identify problems, and recommend additional features; and

- Review handbooks, manuals, and other instructions to ensure that other users will have the materials needed to help them navigate the system.

Training Considerations

The need for training is relentless. As technology changes, the need for training is never-ending. One survey respondent noted, "training people to use computers was necessary—we didn't think this would be so universally true." Several projects have recommended a train-the-trainer approach to keep up with demand. This technique can provide a low cost and ongoing method for training a large volume of users.

Provide what is necessary for good instruction. Training essentials include a computer for each participant during training sessions, personal instruction, and equipment in good working order. Trainees will also need locally tailored, technically correct end-user documents. These can be provided in a hard copy form as well as online for easy access. Online training materials that guide self-directed learning has also been recommended. When educational materials are available online, they can provide assistance to users without requiring them to travel to a training center.

Budget for proper training. Projects should have an adequate budget that covers the costs for training time, materials, and trainers that can work with non-computer-literate trainees. It is important to give adequate time to train and not rush through important material. Giving participants time to practice new skills is essential, and this is best accomplished by using a hands-on approach to learning. It is also important to have trainers that can relate the material to the students, so it has been recommended that a project hire experienced instructors. As one survey respondent put it, "hire trainers with superb communication skills and ability to articulate the benefits and applications of the NII in a context that is relevant to the end user."

Tailor training for individual needs. Training for the project, partners, and other staff should be tailored to their needs and levels of computer literacy. For example, breakout sessions can be used to provide more intensive training to those individuals who have had the *least* exposure to the Internet or computers. Train-the-trainer programs can be used to increase the number of local citizens who are knowledgeable about the possibilities of the telecommunications and information infrastructure.

SUSTAINING PROJECTS BEYOND THE END OF THE GRANT PERIOD

As discussed in Chapter VIII, sustainability is an issue that cuts across all types of projects and technologies. Projects offered four fundamental recommendations for sustaining activities beyond the life of the grant period.

Develop a sustainability plan early. Projects stressed the need to begin thinking about sustainability as early as the planning stage. One suggestion was to develop a long-range financial plan at the outset of the project that identified potential funding and staff resources well after the expiration of the grant award. Starting early to garner additional funds is an essential lesson to learn for project sustainability. For example, NetWellness, a health-related network in Ohio, recognized early on that developing broad community involvement and solid political underpinnings would be critical to the success of the project. By nurturing long-standing relationships with important state legislators, the NetWellness team was able to secure ongoing financial support from the State of Ohio to develop

and continue the project beyond the close of the Federal grant period.

Proper budgeting is essential for sustainability. It is important to budget for programming tasks and maintenance. More time and money than expected are often needed to complete programming tasks. In addition, ongoing maintenance and repair may require more staff resources than originally expected. Budgeting for changes in technology and other aspects of community-based technology programs is another challenge to overcome. Several sites indicated that both training materials and website maintenance were much more expensive than they had budgeted for. High costs were also reported for labor, wiring, and equipment costs. Therefore, budgets should include ample amounts for training materials, website maintenance, and other ongoing expenses that can seem, at first, to be limited.

Continue to expand the base of end users. Many projects continued their outreach and dissemination activities after the grant period in order to continue to grow the demand for their products and services. Developing a market in this way is useful for both leveraging outside funds and generating funds through user fees.

Take advantage of creative funding opportunities. Another suggestion was to develop creative options for obtaining new funds. For example, charging fees for telecommunications services is permissible, with restrictions, during the grant period. Several of the case study projects were exploring the feasibility and consequences (e.g., loss of low-income users) of charging for certain services. Other projects have taken advantage of other Federal funds, e.g., the Technology Literacy Challenge Funds.

DEVELOPING SPECIALIZED PROJECTS

Projects also involve specialized concepts and networks that have created their own lessons. These projects included telemedicine projects, education programs in schools, and distance learning networks.

Considerations for Telemedicine Projects

Proper communication and training of all parties is essential. When beginning a telemedicine program, sites noted that neither technology nor legal issues were barriers to telemedicine. However, telemedicine is a complicated technology and often took more time than expected to start operating. In some areas, this might have been due to the training necessary, not addressing reimbursement of consultants and physicians early enough, and the placement of the technology.

Tackle telemedicine payment issues early. Telemedicine is so new that it is often not clear who will be paid for their services. One site reported that it is important to clear up misconceptions about payment early to further facilitate physician and personnel buy-in.

The location of computers is critical. In health projects, it was noted that if computers were located in physicians' offices or near the workstations of clinic staff who used them, they—and the network—were used more frequently than if the computers were located in a less accessible or convenient place, such as central office shared locations.

Considerations for K-12 Education Projects

Computer learning must be interactive. Not only is this lesson backed up by a great deal of research, it was learned as a result of experiments with classroom technology. The project involved "virtual visits" to museums and other places of educational interest. The project found three elements that increased student involvement with the lesson. First, virtual visits need a theme. Technology itself is not enough, and merely walking through a museum or park was insufficient to engage students. Second, placing

the computers in rows or against the wall did not create interest like a circular formation with the computers (and students) facing one another. Third, interactive lessons were the most engaging for students.

Communication is vital. Internally, technical coordinators, teachers, and school management need to communicate regularly. Each of these representatives has a different stake in and perspective on information technology. Reconciling these differences to forge a project that garners consensus will likely increase the project's acceptance and success.

Different schools have different needs. Thus, a multi-school project needs to provide flexibility and accommodate growth. Schools with different interests and needs may find a single solution restrictive and, eventually, unsuitable. In addition, different economic burdens may be borne by individual schools. For example, in one project, rural schools that were farthest from the frame relay had the highest costs and the smallest population base over which to spread the costs. Thus, it may be necessary for potential participants to have a choice in their access strategies that balances costs with a school's capability to pay.

Use direct digital connections to the Internet. In designing a school technology program, projects recommend that schools use direct digital connections to the Internet. This increases connection speeds and maintains student interest.

Placement of computers with Internet connections is important. One site observed that computers in classrooms are better than in labs. When computers are available in the classroom, students can get more consistent access to technology and teachers can integrate it into the lessons more easily.

Be clear about learning goals. Internet connectivity is not successful in and of itself. Success should be measured by the way schools use the technology to enhance and further education in their curricula. A study developed by New York's Electronic Learning Community Project found that technology could substantially change the ways students learn, as compared to using technology to teach in the same ways.

Providing Internet access requires a clear understanding of its administration and economics. That is, communities should work with existing Internet service providers whenever practical rather than becoming providers on their own. One project found that operating an Internet service is fraught with economic pitfalls and misperceptions. Its staff conceded that they would have been better concentrating their efforts on developing the infrastructure of the various school sites.

Schools need to view information technology as an investment. Otherwise, the considerable telecommunications costs can become a never-ending impediment to continued Internet access. Access fees are only a small fraction of the total costs because providing Internet access is only one piece of a complex arrangement between Internet service providers, hardware vendors, computer consultants, telecommunications companies, and other miscellaneous businesses. Schools need to be aware of the total cost so they can control their budgets during implementation and the subsequent operation of the network.

Schools need to have a local area network. The LAN infrastructure that connects to the wide area network is the first step in delivering Internet access to schools. A LAN will reduce Internet costs by extending its deployment to a large population. Dial-in access for most schools is not an option because it limits the number of students who can use the system at any one time. A LAN provides a cost-effective solution for campus-wide access as well as other computer services.

Considerations for Distance Learning Networks

For distance learning, it is important to remember that learning through this medium is not like being in a classroom. The influence of the equipment, the connections, and other environmental factors make it a unique medium for teaching and learning. As with any new technology, it takes some acclimation before it can be optimally productive. For example, some participants are uneasy about being on a monitor. Other advice for distance learning projects includes the following.

- To encourage camera-shy students to actively participate in discussions, the camera should not zoom in on students who comment or ask questions.

- Fax machines or Internet-based chat lines could be employed to allow students to comment and ask questions spontaneously and anonymously.

- The interactive classroom setup might work better if the instructor did not have any students in the on-campus classroom and could focus exclusively on the students in the remote classroom.

Know the learning community. It is important for any age group to have a meaningful learning experience, and projects must utilize whatever is at their disposal to pique the interest of each segment of the population served. Thus, it is essential to understand the culture of the communities that will receive services, including local institutions, professional associations, educational needs, resource needs, and target audience. For example, projects should determine if specific education needs exist by utilizing knowledgeable campus faculty, corporations, professional associations, other state and local agencies, and market research.

Plan adequately before enrolling students. The complexity of providing student services at a distance, the difficulty in securing local receiving sites for distance programs, and the high costs associated with nonresident tuition and distance learning technology can create significant barriers. Planning and laying the groundwork before enrolling students in a particular program is critical. The project director of the Western Brokering Project in Boulder, CO, speculated that a cost-effective system would market an umbrella or mall concept where all programs are "located" together through electronic means. Rather than the time-consuming and often fruitless process of matching individual students to individual programs, he believes it would make more sense to market one service where a variety of programs are listed. Potential students would then come to that one site.

Distance education requires significant administrative support. A separate administrative system may have to be set up to accommodate interactive class testing and evaluation dates. For building distance learning networks, one project advised using professional association contacts rather than university contacts. Professional associations provide a good source of information about the market for programs and contacts to garner potential students. The distance learning project found that where strong professional associations were lacking, recruiting was not as successful.

Know your equipment. Allow at least one semester for experimenting with new equipment before formally introducing classes utilizing the technology. Many distance learning start-up problems might have been avoided if there had been a longer lead time between the receipt and installation of equipment and the actual start of classes. A longer lead time may also help the faculty and technical staff who will be working with distance learning technology.

The distance "classroom" is different from regular classroom. It is more important to determine the needs of the students being served in a distance learning situation and carefully tailor the innovation to meet those needs than to attempt to duplicate or approximate the classroom experience. In one instance, students who had

previously enjoyed the flexibility of checking out prerecorded videotapes of class sessions were unwilling to give up that flexibility for increased interaction with the course instructors. It has been strongly suggested that a project move into distance education technology with a pedagogical mindset rather than letting the romance of the technology overshadow the needs of the student population being served.