Critical Issue: Providing Professional Development for Effective Technology Use

ISSUE: Whether technology should be used in schools is no longer the issue in education. Instead, the current emphasis is ensuring that technology is used effectively to create new opportunities for learning and to promote student achievement. Educational technology is not, and never will be, transformative on its own, however. It requires the assistance of educators who integrate technology into the curriculum, align it with student learning goals, and use it for engaged learning projects. "Teacher quality is the factor that matters most for student learning," note Darling-Hammond and Berry (1998). Therefore, professional development for teachers becomes the key issue in using technology to improve the quality of learning in the classroom.

Lack of professional development for technology use is one of the most serious obstacles to fully integrating technology into the curriculum (Fatemi, 1999; Office of Technology Assessment, 1995; Panel on Educational Technology, 1997). But traditional sit-and-get training sessions or one-time-only workshops have not been effective in making teachers comfortable with using technology or adept at integrating it into their lesson plans. Instead, a well-planned, ongoing professional development program that is tied to the school's curriculum goals, designed with built-in evaluation, and sustained by adequate financial and staff support is essential if teachers are to use technology appropriately to promote learning for all students in the classroom.
OVERVIEW: The role of the classroom teacher is the crucial factor in the full development and use of technology in the schools (Office of Technology Assessment, 1995; Trotter, 1999). "The transformation of classroom technology from hardware, software, and connections into tools for teaching and learning depends on knowledgeable and enthusiastic teachers who are motivated and prepared to put technology to work on behalf of their students," notes the CEO Forum on Education and Technology (1999). Yet, many teachers do not have the technical knowledge or skills to recognize the potential for technology in teaching and learning. Just knowing how to use a computer is not enough. Instead, teachers must become knowledgeable about technology and self-confident enough to integrate it effectively in the classroom. Teachers, in other words, must become "fearless in their use of technology" and empowered by the many opportunities it offers (Illinois State Board of Education, n.d.). Most teachers want to learn to use educational technology effectively, but they lack the time, access, and support necessary to do so (Guhlin, 1996).

Joellen Killion, director of special projects for the National Staff Development Council, describes professional development in technology as an important intervention but emphasizes that in order to improve student learning, teachers have to implement their technology knowledge and experience effectively in the classroom [1.5MB audio file]. Excerpted from a videotaped presentation by Joellen Killion at the Technology Leadership Team Institute, July 1999, in Leesburg, VA (North Central Regional Educational Laboratory, 1999).

To reach the goal of preparing teachers for effective technology use, a well-designed professional development program is essential. Professional development in a technological age requires new definitions and new resources. It cannot take the traditional forms of individual workshops or one-time training sessions. Instead, it must be viewed as an ongoing and integral part of teachers' professional lives.

How can schools and districts provide the type of professional development that will promote teachers' effective use of technology in the classroom? How can this professional development inspire teachers to use technology to create new learning opportunities that will have a positive impact on student achievement? Two requirements help ensure the success of professional development for effective technology use. First, the professional development should be an integral part of the school technology plan or overall school-improvement plan. Second, the professional development should contain all the necessary components that research has found to be important.

Professional Development as an Integral Part of the School Technology Plan

Professional development for technology use should be an integral part of the school technology plan or an overall school-improvement plan, not just an add-on. Initial inclusion in
The technology plan ensures that professional development is considered an essential factor in using technology to improve teaching and learning. (For additional information on school technology plans, refer to the Critical Issue "Developing a School or District Technology Plan.")

The technology plan, with its important professional development component, is written by a technology planning committee or team. The group approach ensures that all stakeholders support the integration of technology into the curriculum as well as sustained professional development in technology use for all teachers and administrators. The technology planning team ensures that the professional development component of the technology plan is research based and meets high standards for effective staff development (Lockwood, 1999). Sources of professional development standards include the five tenets outlined in the Policy Position paper, developed by the National Board for Professional Teaching Standards, and the Standards for Staff Development, developed by the National Staff Development Council. The technology planning team has important things to think about when reviewing the professional development section of a technology plan, such as the following: How do instructional and technological goals affect professional development? What is expected from the staff as a result of their professional development? Who will manage, design, and deliver the professional development?

Before defining the focus of professional development activities, the technology planning team should determine the school's current level of technology use. Materials such as the Seven Dimensions for Gauging Progress of Technology in the Schools, developed by the Milken Exchange on Educational Technology, and the Learning with Technology Profile Tool, developed by North Central Regional Technology in Education Consortium, can be used to assess the school or district's current technology practice and provide a point of comparison. The team also may wish to conduct both informal and formal needs assessments to determine priorities for professional development activities. Finally, the professional development component of the technology plan should include a fair and equitable system for assessing each individual teacher's level of technology competency. Tools such as the Recommended Foundations in Technology for All Teachers, developed by the International Society for Technology in Education, and the Professional Competency Continuum, developed by the Milken Exchange on Educational Technology, can be used to determine the skill level of individual teachers and their needs for professional development. Such assessment provides data that can be used for future planning and development of strategies for coaching teachers at different skill levels. Use of Internet skills rubrics and similar tools can help educators chart their progress in acquiring technology skills. All this information helps the technology planning team establish professional development goals for using technology to promote engaged learning.

Components of Effective Professional Development for Technology Use

Professional development for technology use should contain essential components that research has found to be important. These components include the following: a connection to student learning, hands-on technology use, variety of learning experiences, curriculum-specific applications, new roles for teachers, collegial learning, active participation of teachers, ongoing
Connection to Student Learning. The ultimate goal of professional development is to improve student learning (Speck, 1996). A study by the National Institute for the Improvement of Education (Renyi, 1996) found that 73 percent of surveyed teachers cited improved student achievement as the most important reason for participating in professional development activities. "Teachers value increased student achievement as an outcome of professional development more than any other variable and judge the value of their professional development activities by how much they see a leap in student learning," notes Lockwood (1999, p. 13). "Schools should provide teachers with abundant opportunities to become fluent in using technology to bolster instruction and help students develop higher-order thinking and problem-solving skills," notes the National Staff Development Council (1999). As a result, the use of technology enables teachers to implement new teaching techniques, to help students work collaboratively and develop higher-order thinking skills, to encourage students to be engaged in the learning process, to assist students who have various learning styles and special needs, and to expose students to a broad range of information and experts.

Hands-On Technology Use. Recent research has shown the importance of current professional development emphasizing hands-on technology use. "Teachers who received technology training in the past year are more likely than teachers who hadn't to say they feel 'better prepared' to integrate technology into their classroom lessons," notes Fatemi (1999). "They also are more likely to use and rely on digital content for instruction, and to spend more time trying out software and searching for Web sites to use in class."

Initially, teachers will need to acquire core technology competencies and skills; but during these initial experiences, teachers should be thinking in terms of how the technology can enhance student learning and how it can be used in different content areas. Hands-on technology use at school and at home allows teachers to develop confidence in their skills and a comfort level with the technology. When teachers are accustomed to using the equipment to boost their own productivity, they "are more likely to see ways in which similar uses could support the projects they want their students to do," notes the Office of Educational Research and Improvement (1994).

Variety of Learning Experiences. "To help teachers incorporate technology in ways that support powerful instruction requires an array of professional development experiences quite different from traditional workshops and how-to training sessions," notes David (1996, p. 238). Professional development for effective technology use can come in a variety of forms, such as mentoring, modeling, ongoing workshops, special courses, structured observations, and summer institutes (David, 1996; Guhlin, 1996). Whatever the format, effective professional development utilizes key points from adult learning theory. Adults require relevant, concrete experiences with adequate support, appropriate feedback, and long-term follow-up (Speck, 1996). This type of professional development is very different from traditional one-time teacher workshops. Research indicates that teachers learn and incorporate new information best when it is presented over a long time frame instead of a single session.
Preferably, new strategies are modeled during routine school days in the classroom (Guhlin, 1996; Sparks & Hirsch, 1997; Yocam, 1996). Such practical demonstrations encourage teachers to accept and use the new strategies in their own classrooms. Sparks (1998) calls for 15 live or videotaped demonstrations "for a modest-size change in practice" (p. 34). Teachers then need opportunities for hands-on experience in using the new skill, developing a unit, and implementing it (Guhlin, 1996; Sparks, 1998; Yocam, 1996). Finally, follow-up support as well as opportunities for ongoing discussion and reflection on the new procedures are essential in ensuring change (Yocam, 1996). Practice logs can promote these helpful activities. Such logs can show how often teachers use a new practice, how it worked, what problems occurred, and what help they needed (Sparks, 1998).

**Curriculum-Specific Applications.** If technology is to be used to produce improvements in student achievement, teachers must see a direct link between the technology and the curriculum for which they are responsible (Byrom, 1998). Professional development for technology use should demonstrate projects in specific curriculum areas and help teachers integrate technology into the content. In particular, professional development activities should enhance teachers' curriculum, learning, and assessment competencies and skills as well as classroom and instructional management competencies and skills. Specific content can help teachers analyze, synthesize, and structure ideas into projects that they can use in their classrooms (Center for Applied Special Technology, 1996).

A good professional development program is job embedded and tied to learning goals: It provides activities in the context of practice. The best integration training for teachers does not simply show them how to add technology to their what they are doing. "It helps them learn how to select digital content based on the needs and learning styles of their students, and infuse it into the curriculum rather than making it an end in itself," notes Fatemi (1999). "Using technology effectively also requires having a wide repertoire of teaching approaches."

**New Roles for Teachers.** Technology encourages teachers to take on new and expanded roles, both inside and outside of the classroom. Within the classroom, technology supports student-centered instruction. The teacher assumes the role of coach or facilitator while students work collaboratively (Jones, Valdez, Nowakowski, & Rasmussen, 1995; Kupperstein, Gentile, & Zwier, 1999). Outside of the classroom, technology supports teacher collaboration. Instead of working in isolation, teachers can work together on schoolwide programs. They can help find solutions to problems, act as peer advisors to provide information and feedback, and collect data to test hypotheses (Lieberman, 1996; Little, 1982). Their new roles may involve distance collaboration with cross-school peer groups and study groups through telecommunications (Kosakowski, 1998). Professional development for technology use provides opportunities for teachers to become comfortable and effective in these new roles.

**Collegial Learning.** A professional development curriculum that helps teachers use technology for discovery learning, developing students' higher-order thinking skills, and communicating ideas is new and demanding and thus cannot be implemented in isolation (Guhlin, 1996). In addition to working in pairs or teams, teachers need access to follow-up discussion and collegial activities, as required of professionals in other fields (Lockwood, 1999). Teachers also need time to discuss technology use with other teachers, whether face to
face, through e-mail, or by videoconferencing (David, 1996). A networked computer on every teacher's desk can allow for greater interaction between educators. The National Commission on Teaching and America's Future (1996) suggests that school districts find creative ways to build teacher networks so that teachers have additional opportunities to discuss the new instructional methods that technology promotes.

**Active Participation of Teachers.** If technology is to be used equitably for all students, a majority of teachers should be included in the professional development program. One strategy to motivate teachers to spend the time and energy necessary to develop technology competency is to mandate participation in technology professional development. Another strategy for encouraging teachers to participate in professional development for technology use is **creating incentives for technology use.** Possible incentives include the following: a judicious use of contingency pay, in which a certain segment of the teacher's base pay (such as 5 percent) is reserved contingent upon participation in a wide range of professional development activities; bonuses (Lockwood, 1999; Speck, 1996); or a compensation system that rewards knowledge and skill along a career continuum (National Commission on Teaching and America's Future, 1996). A less traditional incentive program could give teachers credits for hours spent in professional development; teachers could use these credits to earn technology for their classrooms, loans of hardware and software to be used at home, or reduced prices on personal equipment (Guhlin, 1996). Mini-grants might reward teachers who have innovative ideas for using technology in instruction (Office of Educational Research and Improvement, 1994).

Incentives must be used carefully, however. Although group rewards may motivate some teachers, individual rewards may increase competition among staff or lead to less equitable distribution of technology (Lockwood, 1999). The only way to ensure that all students have the same opportunities is to require all teachers to become proficient in the use of technology in content areas to support student learning.

**Ongoing Process.** A high-quality professional development program is conducted as an ongoing process, not a one-shot approach. Teachers need continued practice to become comfortable with and to implement change, especially in technology use. In evaluating the best practice in professional development, Speck (1996) concludes: "Professional development takes time and must be conducted over several years for significant change in educational practices to take place. Substantial change in school practice typically takes four to seven years, and in some cases longer" (p. 35). Administrators must take into account this long time frame, and teachers must be prepared to be involved in professional development throughout their careers.

**Sufficient Time.** An effective professional development program provides "sufficient time and follow-up support for teachers to master new content and strategies and to integrate them into their practice," notes Corcoran (1995). For any professional development activity, teachers need time to plan, practice skills, try out new ideas, collaborate, and reflect on ideas. Acquiring technology skills and becoming proficient at new ways of teaching in which technology is appropriately integrated requires additional time (Brand, 1997; David, 1996). "Teachers need large blocks of time to gain initial familiarity with new hardware or software, learning and practicing for sustained periods," states Renyi (1996). Time built into teachers'
schedules can provide teachers with opportunities to "discover what the technologies can do, learn how to operate them, and experiment with ways to apply them," notes the Office of Technology Assessment (1995, p. 6).

To address these professional development issues and to acknowledge that the demands of engaged learning using technology may lead to longer class periods, more team teaching, and more interdisciplinary work (Lockwood, 1999), the school district may have to make some adjustments to the school-day schedule. One adjustment might consist of arranging preparation times of teachers in the same content areas to coincide in order to allow collaboration in planning and study. Another adjustment is to make small changes in daily scheduling in order to make a substantial difference over time: If teachers arrive five minutes early, shave five minutes off their lunch hour, and expand the day by five minutes, they gain 15 minutes they can "bank" each day to buy a 75-minute block of time for professional development one day each week. Students can be released early on this day or can be supervised by substitute teachers or parent volunteers. Teachers can use the weekly time to plan, to learn from each other, or to connect to outside networks. For example, teachers can schedule a voluntary weekly "inquiry meeting" (Lockwood, 1999) or devote weekly time for whole-faculty study groups. Another way to allow time for teachers of the same subjects to team-teach or otherwise collaborate is to use block scheduling. Schools may use a variety of creative ideas and strategies to provide professional development time.

**Technical Assistance and Support.** Another important component of effective professional development for technology is access to on-site technical support personnel who are responsible for troubleshooting and assistance after the technology and lessons are in place. When teachers are trying to use technology in their classrooms and they encounter difficulties, they need immediate help and support. Technology that is not easily accessed and implemented will not be used. Teachers will return to more traditional ways of teaching if the problems they encounter cannot be solved quickly and efficiently. Schools, therefore, have a vested interest in providing technical support. McKenzie (1998) states, "The best way to win widespread use of new technologies is to provide just-in-time support, assistance, and encouragement when needed. Not tomorrow. Not next week. Now!"

Joellen Killion, director of special projects for the National Staff Development Council, discusses the importance of technical support and other support systems in promoting professional development for effective technology use [1.5MB audio file]. Excerpted from a videotaped presentation by Joellen Killion at the Technology Leadership Team Institute, July 1999, in Leesburg, Virginia (North Central Regional Educational Laboratory, 1999).

**Administrative Support.** Fully implementing an effective professional development program as part of a well-designed technology plan requires support from school administrators and leaders. Administrators must have a clear vision of technology to support student learning and an understanding of the roles that all school staff must play in achieving that vision. They must be the cheerleaders and visionaries who see beyond the daily routine to
a vision of what is possible through the use of technology (Byrom, 1998; Guskey, cited in Lockwood, 1999). Administrators also can participate in professional development activities so they are aware firsthand of how technology is used and what problems are experienced by the staff. It also is important for each administrator to have a networked computer on his or her desk for use in daily tasks. In fact, professional development in technology use for teachers will not be successful unless the principal is invested in the process. "This conception of leadership sees the principal almost as a master teacher, rather than an administrator limited to coping with the minutiae of school life and divorced from the demand for instructional leadership," notes Lockwood (1999, p. 17).

**Adequate Resources.** The overall technology plan and its professional development component cannot occur without a significant commitment of resources by the school district. The district, first of all, must purchase the type of technical equipment necessary to meet the learning goals identified and provide for ongoing maintenance and upgrading. Skimping on this step can be more expensive in the long run because teachers and students eventually will want and need access to multiple technologies (such as CD-ROM, satellite, and full-motion video) that will enhance the curriculum and expand learning opportunities. "The education technology that is implemented today must allow for increased capabilities in the future, rather than the threat of total replacement of the system," note Bell and Ramirez (1997). The technology used for professional development should be the same as the technology used in the classroom. Funds should be available to provide teachers with technology that they can use at home or in private to become comfortable with the capabilities it offers. Funding also should be considered for a networked computer on every teacher's desk to allow telecommunications support for teachers and provide easy access to programs and files.

A significant portion of the technology budget should be allocated for professional development. School districts typically devote no more than 15 percent of their technology budget for teacher training, but a better amount would be 30 percent (Office of Technology Assessment, 1995).

**Continuous Funding.** Finding the funding for ongoing technology needs and professional development can be difficult. School funding formulas that depend on residential property taxes and centralized purchasing and distribution policies may not be flexible enough to meet these new needs. Funding strategies that combine short- and long-term measures—including local tax revenues, bonds, grants, and federal programs—can help meet a school district's needs. Projects such as Taking Total Cost of Ownership to the Classroom can help planners determine all the costs involved in operating networks and computers. These costs include professional development, technical support, connectivity, software, replacement costs, and retrofitting. The costs of using technology to improve teaching and learning should become a line item in school budgets. These costs are not considered a one-time investment but an ongoing expense. This approach may require rethinking a school district's funding priorities.

The National Commission on Teaching and America's Future (1996) advocates, "Flatten hierarchies, and reallocate resources to send more money to the front lines in schools: Invest more in teachers and technology and less in nonteaching personnel." School districts may need to be even more creative to meet their technology and related professional development needs,
however. The Commission suggests partnering with universities and forming teacher networks to help provide professional development activities at lower cost. Another potential resource is partnerships with community organizations. Members of the community can lobby, coordinate fundraisers, provide direct funding, assist in identifying technical skills and experiences that children need, assist in providing professional development activities, and volunteer to substitute in the classroom when teachers are engaged in professional development.

**Built-In Evaluation.** Effective professional development uses evaluation to ensure that each activity is meeting the needs of the participants and providing them with new learning experiences. Evaluation is built into the professional development program during the planning process, before the actual activities begin. It consists of three types: preformative evaluation, formative evaluation, and summative evaluation.

*Preformative evaluation* assesses educators' needs during the planning process. During this phase, intended goals are clarified and strategies for gathering data about reaching them are set (Guskey, 1998) using agreed-upon guidelines for evaluating professional development.

Evaluation continues with *formative evaluation*, which is conducted during the professional development activity. Formative evaluation provides feedback and determines changes that can be made during the activity to make it more valuable to participating educators.

The evaluation process concludes with *summative evaluation*, which is conducted after the activity. Summative evaluation allows participants to judge the overall merit or worth of the activity and gives decision makers the information they need to plan for the future. Good summative evaluation uses a variety of techniques to gauge the five levels of professional development evaluation. These levels are: participants' reactions, participants' learning, organizational support and change, participants' use of new knowledge and skills, and student learning outcomes (Guskey, 1998).

The ultimate goal of evaluation is to determine whether professional development promotes using technology to improve student achievement. No longer can administrators simply assume that professional development is good by definition. Now that students are being held to higher standards, teachers are being held accountable for student achievement; educators must show that professional development has an impact on achieving the learning goals that were identified in the original plan (Guskey, 1998; Wilde, 1996). This part of the evaluation process assesses whether the specific learning goals for students using technology have been met or whether unintended results have been achieved. Using multiple measures is essential. These measures might include grades, scores from standardized tests, and results from alternative assessment (such as portfolio evaluations that focus on students' ability to use higher-order thinking skills). Schoolwide indicators--such as enrollment in advanced classes, membership in honor societies, participation in school activities, disciplinary actions, and retention or dropout rates--also might be considered. Sources of this information might include student and school records, questionnaires, and interviews with students, parents, teachers, and administrators. This information can be used to document the return on investment from
professional development (Guskey, 1998; Lockwood, 1999). It also allows teachers to evaluate how technology improves the quality of student learning.

For teachers to implement technology in the classroom to increase engaged learning and improve achievement among their students, a well-planned professional development program for technology use is essential. Such a program gives teachers the skills they need to incorporate the strengths of technology into their lesson planning rather than merely to add technology to the way they have always done things. Effective professional development requires careful planning, job-embedded and hands-on activities directly linked to the curriculum, plenty of follow-up, built-in evaluation using several assessment techniques, adequate time, sustained funding, and the willingness of educators to take on new and expanded roles. The Office of Technology Assessment (1995) states, "Helping schools to make the connection between teachers and technology may be one of the most important steps to making the most of the past, present, and future investments in educational technology and our children's future" (p. iii).

GOALS:

- The school community holds a shared vision of what and how students should learn, and it acknowledges the importance of ongoing professional development in promoting student learning.

- Professional development is an integral part of the overall technology plan, which clearly identifies specific learning goals to achieve by using technology.

- Professional development helps teachers solve particular instructional issues by indicating how technology can enable or enhance learning.

- Professional development activities for technology use are linked to content and the curriculum, as determined by both formal and informal needs assessment.

- Professional development activities for technology use provide sufficient time for job-embedded learning experiences, demonstrations, hands-on experiences, planning, reflection, and follow-up.

- The professional development plan for technology use provides clear performance expectations. Teachers know what is expected of them and what counts as an acceptable level of competence.

- The professional development program uses incentives and requirements for motivating teachers to engage in ongoing professional development activities and to develop technical competence.
• The school pursues a combination of short- and long-term strategies to provide the resources for planned technology use and the professional development it requires.

• Professional development is considered part of everyone's job, and adequate time and resources are allocated to support it.

• Professional development has a measurable positive impact on student performance.

• The effectiveness of professional development is evaluated regularly. This evaluation is used to improve its content and form and to provide data for future planning.

**ACTION OPTIONS:** The technology planning team, administrators, teachers, and parents and community members can take the following steps to promote professional development for effective technology use.

**Technology Planning Team** (comprising administrators, teachers, technology coordinator, professional development coordinator, other staff members, parents, interested community members, and students):

• Develop a technology plan that includes professional development for technology use as an essential component.

• Focus on building a knowledge base about teaching and learning with technology to ensure that technology planning, decision making, and professional development are based on research.

• Ensure that the educational goals for technology are aligned with school or district goals for student learning and that professional development supports those goals.

• Recommend the purchase of specific technologies to achieve the identified learning goals.

• Consult a total cost of ownership (TCO) checklist to determine the total cost of ownership of technology.

• Ensure that technology purchases are considered to be supplies. Ensure that such purchases have ongoing funding and are included in all parts of the budget from building and maintenance to instructional supplies.

• Develop a process for selecting and using appropriate software to support learning goals.
• Develop a professional development program based on research on training teachers for using technology that will meet the educational goals for the use of technology. Look at model professional development programs as examples of best practice.

• Create strategies for adult technology learning that utilize learning cultures and just-in-time support.

• Continue identifying professional development resources and opportunities relating to technology use for school staff.

• Clearly specify the intended outcomes of the technology professional development. Develop a plan for evaluating the success of professional development activities using various assessment tools and strategies.

• Provide for a community of educators through telecommunications; place a networked computer on the desk of every teacher and administrator.

• Develop strategies for building virtual communities for professional development.

Administrators:

• Ensure that the technology plan includes professional development as a major component.

• Pursue strategies for obtaining and sustaining funding to provide the necessary technology, professional development, technical support, equipment upgrades, and equipment maintenance to achieve educational goals.

• Use a variety of incentives and requirements to motivate teachers to participate in professional development activities designed to help them integrate technology into their classrooms. Offer technology for classroom or personal use as an incentive to participation.

• Acknowledge the benefits of using professional development for plugging educators into technology: improved student performance, increased student motivation, lower student absenteeism, and higher teacher morale.

• Understand the implications of designing staff development for the information age.

• Determine expectations for teachers in regard to their use of technology in their classrooms.

• Develop strategies for encouraging resistant educators to use technology and eventually winning teachers over.
• Provide all teachers and administrators with an Internet e-mail account. Use e-mail for all school announcements.

• Encourage teachers to attend professional development technology sessions in pairs or groups to avoid isolation.

• Develop strategies for making time for professional development activities related to technology use. Build adequate time into the school day to allow teachers to practice, plan, refine, and reflect upon technology use. Consider innovative scheduling options such as "banked" time and block scheduling to allow collegial activities using technology.

• Demonstrate support for and leadership of ongoing inquiry-driven professional development for technology use.

• Participate in professional development programs, study groups, and other technology activities with teachers and other staff members.

• Address any problems that arise with new uses of technology in the classroom quickly and efficiently.

• Recognize teacher successes with technology. Share these stories with the school and the community. Encourage teachers to share their successes with colleagues at conferences.

**Teachers:**

• Develop strategies for using technology to improve student achievement.

• Develop strategies for using technology to enhance engaged learning for at-risk students.

• Develop an individual professional development plan that provides for acquisition of technology skills and integration of technology into classroom projects. This plan can be based on documents such as Core Technology Competencies and Skills, Curriculum, Learning, and Assessment Competencies and Skills, Classroom and Instructional Management Competencies and Skills, Recommended Foundations in Technology for All Teachers, Internet Skills Rubrics, and the Professional Competency Continuum Online Assessment Tool.

• Form study groups to explore issues, share assessments of student work, and identify strategies for improving technology use.

• Engage in collaborative planning and evaluation.

• Take on new and expanded roles as part of professional development. Such roles might include devising individual professional development plans, acting as peer advisors and mentors, collecting data, and forming study groups.
• Pursue innovative ideas for using community resources to provide and support professional development in technology use.

• Visit other schools and classrooms to see how technology has been integrated effectively into the curriculum. Or virtually visit classrooms by viewing CD-ROMs (such as the Captured Wisdom CD-ROM Library, produced by the North Central Regional Technology in Education Consortium), videotapes of technology use in schools, or Internet sites relating to technology integration in content areas (such as the Handbook of Engaged Learning Projects).

• Use telecommunications (such as e-mail lists and mail groups) to become part of a community of teachers. Form peer groups across schools, and join subject-matter networks and collaboratives to communicate about technology.

• At faculty meetings, share ideas for using technology within different content areas.

• Attend and present at conferences to learn more and share ideas about teaching with technology.

Parents and Community Members:

• Join in planning for technology implementation and the professional development it requires; provide perspectives on real-world needs.

• Join in fund-raising efforts, lobbying, and identifying potential sources of funding.

• Suggest possible collaborations, such as with a local university, and use contacts to help the school develop them.

• Volunteer time to allow teachers to engage in professional development activities.

IMPLEMENTATION PITFALLS: In many schools, technology is not easily accessible by teachers. Computers may be located in labs instead of in each teacher's classroom, and Internet connections may be limited to certain designated computers. To promote teachers' use of technology, school administrators should ensure that adequate numbers of computers with Internet connections are available to teachers and that access times are not limited. Teachers need ample opportunities to practice with the technology and gain confidence in its use.

Schools often assign only one individual or a few people to develop the professional development program for technology use, without allowing for the input of teachers, parents, and the community. Although this approach may seem an efficient use of time, it does not
promote the buy-in of all stakeholders. In the long run, the effort will not be successful without adequate buy-in. Further, if parents and community members are not informed of changes in instructional practices relating to technology use and the importance of ongoing professional development for teachers, they may react with resistance when technology innovations are implemented or when teachers are given time for professional development activities in technology.

School administrators may not provide adequate time and resources for high-quality technology implementation and the associated professional development. They may see professional development as a one-shot training session to impart skills in using specific equipment. Instead, professional development should be considered an ongoing process that helps teachers develop new methods of promoting engaged learning in the classroom using technology. Oliver (1997) notes the importance of school leaders having a vision and creativity to provide time for thorough and continuous professional development.

The school climate may not be supportive of the changes in traditional pedagogy that result from ongoing professional development in technology. School leaders may expect significant change too quickly. Byrom (1998) states, "Truly integrating technology into teaching and learning is a slow, time-consuming process that requires substantial levels of support and encouragement for educators." This process may take three to five years in technology-rich schools and even longer in technology-poor schools.

Assessing the impact of professional development on student achievement is the most problematic part of the evaluation process. Proving a direct link between student learning and measures of professional development is always difficult because other school-improvement activities also may have an impact (Lockwood, 1999).

If access to technology is not equitable, opposition to the use of technology in the classroom may develop among the "have-nots." Ensuring equitable use of education technology involves provision of access to technology as well as professional development for the staff to ensure that the school is making effective use of available technology and software.

DIFFERENT POINTS OF VIEW: Some educators believe that professional development for technology use is important for math and science teachers but not for teachers in other areas. They may question the value of professional development that integrates technology into the teaching of history, social studies, English, and the arts. The Office of Technology Assessment (1995) suggests that a key issue for technology integration is determining what kinds of teachers should have priority for technology-related professional development:

"Should resources concentrate on supervisors and teacher-leaders, or on those most in need of improvement? On math and science teachers, since technology applications are proceeding rapidly in these fields, or on humanities and other fields, since they have been somewhat neglected to date? On specialists who work with children most at-risk, or on 'regular'
teachers who work with all children? On elementary or secondary school teachers? Preservice or inservice teachers? Faculty in schools and colleges of education? The current federal role tries to cover all of these target groups, although some very superficially." (p. 252)

Some educators may not be interested in professional development for technology use because they oppose technology as a means to improved student learning. They may argue that technology shifts the focus of schools from the content of the information conveyed to the means of delivery (hardware, software, and networks).

Some parents and community members believe that schools should not allocate money and time for teachers to receive professional development in technology use. They may suggest that teachers learn about technology with their own resources and on their own time.

**ILLUSTRATIVE CASES:**

- The **Hanau Model Schools Partnership** was a three-year collaborative effort to integrate technology into four schools serving children of military personnel at the U.S. Army Base in Hanau, Germany, and to provide professional development in technology for teachers at those schools.

- **Spotlight Schools**, from the July 1999 Secretary's Conference on Educational Technology, "Evaluating the Effectiveness of Technology," were selected for their exemplary integration and use of technology. Some of the descriptions include information on how the school provided professional development for technology use.

- A **staff development** plan for technology use was developed by the Kenai Peninsula Borough School District in Soldotna, Alaska.

- **Cases from the Technology Leadership Team Institute** consists of articles on technology use at one public elementary school and three Department of Defense Education Activity (DoDEA) schools.

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- **Educators Go to SCOUT Camp for Technology-Enhanced Learning** describes an intensive five-day summer program in integrating technology for teachers. After completing the program, teachers implement technology-related projects in their classrooms and receive follow-up support from project coordinators.
Association for the Advancement of Computing in Education (AACE)
P.O. Box 2966
Charlottesville, VA 22902
(804) 973-3987; fax (804) 978-7449
E-mail: aace@virginia.edu
WWW: http://www.aace.org/

Center for Children and Technology
96 Morton St., 7th Floor
New York, NY 10014
(212) 807-4200; fax (212) 633-8804
Contact: Laura Sanderson
E-mail: lsanderson@edc.org
WWW: http://www.edc.org/CCT/ccthome/

Center for Technology in Learning
SRI International
333 Ravenswood Ave.
Menlo Park, CA 93025
(415) 859-5248
Contact: Lucy Omo, Webmaster
E-mail: lomo@unix.sri.com
WWW: http://ctl.sri.com/index.jsp

Computer-Using Educators (CUE)
1210 Marina Village Parkway, Suite 100B
Alameda, CA 94501
(510) 814-6630; fax (510) 814-0195
Contact: Jennifer O'Sullivan, Operations Manager
E-mail: cueinc@aol.com
WWW: http://www.cue.org/

Consortium for School Networking (CoSN)
155 Connecticut Ave. N.W., Suite 200
Washington, DC 20036
(202) 462-9600; fax (202) 462-9043
E-mail: info@cosn.org
WWW: http://cosn.org

Focus on Technology
National Education Association
1202 16th St. N.W.
Washington, DC 20036
(202) 822-7360
E-mail: neayentzer@aol.com
WWW: http://www.nea.org/cet/
Institute for the Transfer of Technology to Education (ITTE)
National School Boards Association
1680 Duke St.
Alexandria, VA 22314
(703) 838-6722; fax (703) 683-7590
Contact: Cheryl S. Williams, Director of Technology Programs
E-mail: itte@nsba.org
WWW: http://www.nsba.org/itte/welcome.html

International Society for Technology in Education (ISTE)
1787 Agate St.
Eugene, OR 97403-1923
(541) 346-4414; fax (541) 346-5890
E-mail: cust_svc@iste.org
WWW: http://www.iste.org/

International Technology Education Association (ITEA)
1914 Association Drive, Suite 201
Reston, VA 20191-1539
(703) 860-2100; fax (703) 860-0353
Contact: Kendall N. Starkweather, Executive Director
E-mail: itea@iris.org
WWW: http://www.iteawww.org/

Leadership and the New Technologies
Center for Online Professional Education (COPE)
Education Development Center
55 Chapel St.
Newton, MA 02458
(617) 969-7100; fax: (617) 969-1580
Contact: Kirsten Johnson or Joyce Callahan
E-mail: kjohnson@edc.org or jcallahan@edc.org
WWW: http://www.edc.org/LNT/

National Board for Professional Teaching Standards
26555 Evergreen Road, Suite 400
Southfield, MI 48076
(248) 351-4444; fax (248) 351-4170
E-mail: info@nbpts.org
WWW: http://www.nbpts.org/

National Center for Research on Teacher Learning (NCRTL)
Michigan State University, College of Education
116 Erickson Hall
East Lansing, MI 48824-1034
(517) 355-9302; fax (517) 432-2795
This Critical Issue was written by Ginger Rodriguez, a Chicago-area writer specializing in educational issues, in collaboration with Randy Knuth, senior program associate at North Central Regional Educational Laboratory.

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