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ABSTRACT

This guide is designed as a professional development tool for personal use within the context of a schoolwide improvement planning effort to assist individual K-12 classroom teachers who are beginning to integrate technology into their daily practices. Following an introductory section that addresses reasons for using technology, technology within schoolwide improvement planning, and the role of the technology committee and the individual teacher, the first section discusses developing a personal vision for uses of technology. The second section covers integrating technology into the curriculum, including developing lifelong learning skills, meeting content area standards, and technology in science, English/language arts, mathematics, and social studies instruction. Pursuing professional development is considered in the next section, including taking a learner-centered approach, technology-related proficiencies and levels of use, equitable use of technology resources, school-family-community partnerships, and a technology integration planning chart. The fourth section reflects on the next steps and presents a goal-setting chart. Most sections contain an objective, guiding questions, and relevant Internet resources. Action steps are also included to illustrate the transition a teacher experiences as she begins the process of infusing integrating technology into her daily routine. (Contains 23 references.) (MES)

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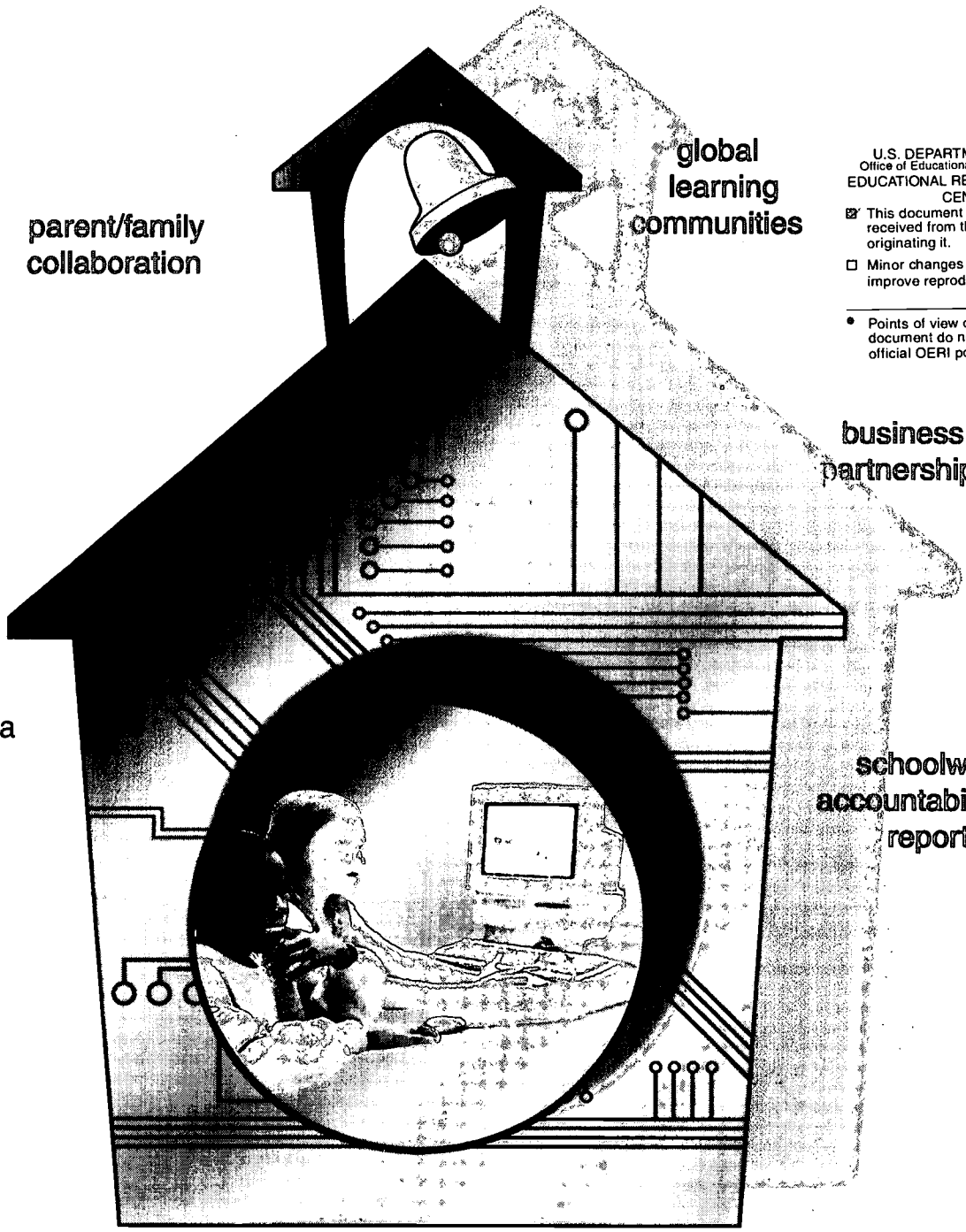
Technology Connections

For School Improvement



Teacher's Guide

U.S. Department of Education

North Central Regional Educational Laboratory

Technology Connections for School Improvement

Teacher's Guide

Mary L. McNabb, Ed.D.
North Central Regional Educational Laboratory

U.S. Department of Education

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Getting Started

Technology helps people to learn, to be creative, and to become players and communicators in a global village. Technology, tied to the Internet, allows students and teachers of all ages to engage in knowledge building on a worldwide stage as never before possible. Many learning opportunities may never reach students in high-poverty or isolated schools except through the use of technology.

In many settings, educators, family members, human service providers, and other business partners are considering how technology can assist in implementing schoolwide improvement plans. Across the nation, these improvement efforts set high standards for all students, draw on challenging content, and require engaging instructional strategies. Technology can be used to individualize instruction and to provide learning experiences ranging from remediation to enrichment. Technology also can provide easy access to vast resources. Teacher, parent, and community partnerships are key to facilitating school improvements, including planning for and implementing technology. Schools, through technology resources and telecommunication, can make those partnerships more informed, immediate, and meaningful.

In addition, research and best practices show that the relationship between technology and student learning involves understanding the following concepts:

- Technology empowers new solutions and opens doors to learning opportunities previously unavailable.
- The design of the technology tool and the instructional methods surrounding its use need to be congruent.
- Hands-on access to computers and ancillary equipment for all students on a regular basis is a determining factor in the success of technology.

(Valdez & McNabb, 1997)

Why Use Technology

✓*To facilitate and support student achievement of essential learning outcomes*

✓*To provide all students with appropriate technology literacy skills for 21st century citizenship, including social and economic prosperity*

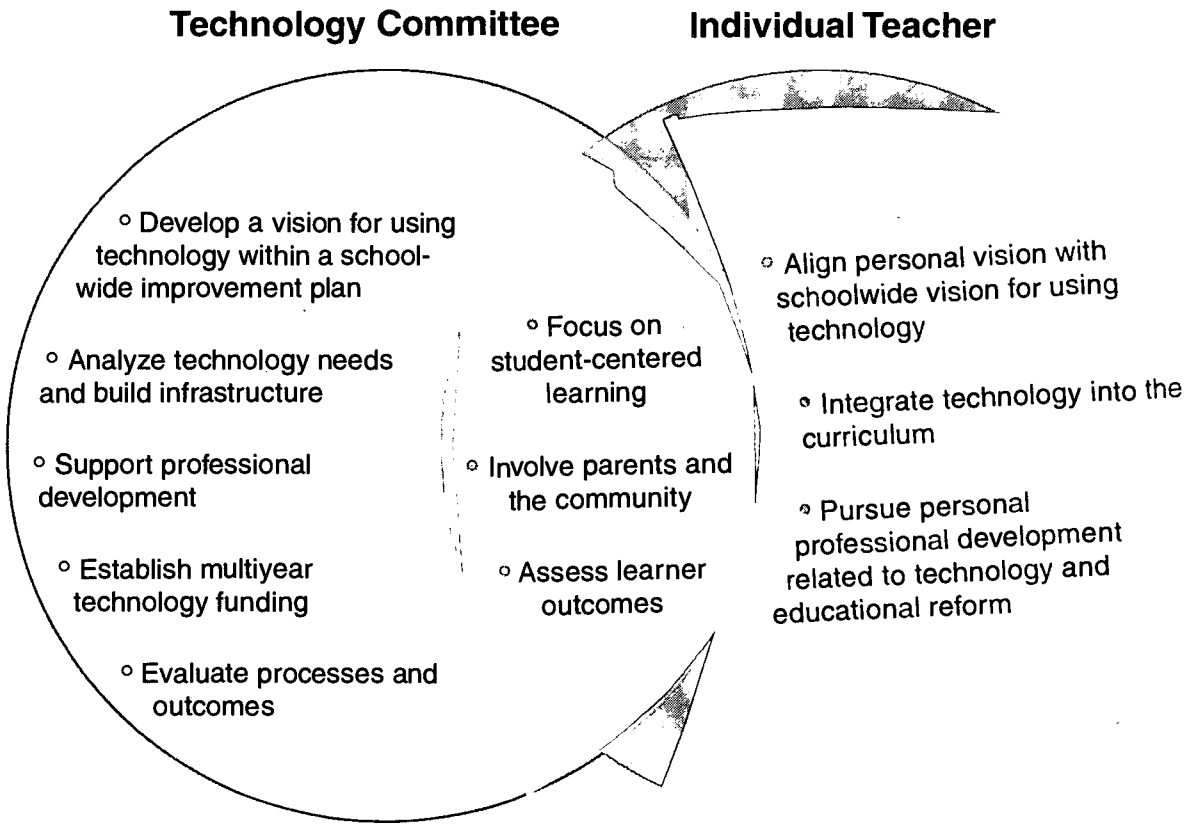
✓*To provide parents, community members, and staff with the tools and training necessary to support student achievement of essential learning outcomes*

The Teacher Connection

This guide is designed to assist individual classroom teachers who are just beginning to integrate technology into their daily practices. Teachers are at the forefront of making learning with technology happen based on the results of a comprehensive needs assessment. The school or district technology planning committee, which may operate as a subcommittee within the schoolwide improvement planning committee, is responsible for conducting this needs assessment and for identifying priorities for uses of technology to meet technology literacy and stan-

Ultimately, it is up to the classroom teacher to bring a building or district technology plan to life.

Technology Within Schoolwide Improvement Planning



The action steps in this guide illustrate the transition a teacher, Mrs. Jones, experiences as she begins the process of infusing integrating technology into her daily routine. Through the assistance of her technology mentor, Mrs. Jones discovers ways of using technology to engage her students in their learning activities. She also examines her professional practices and finds need for change.

dards-based learning goals. Most technology planning committees engage stakeholders—such as teachers, parents, and community partners—in studying how technology can be used to enhance student learning and in arranging for access to the appropriate technology resources. Teachers play their own vital role in determining how a school's technology resources will enhance students' learning experiences and opportunities.

The *Technology Connections to School Improvement: Teacher's Guide* is a companion booklet to the *Technology Connections to School Improvement: Planners' Handbook.* While the *Planners' Handbook* is designed to guide the technology planning committee at the systemic level, the *Teacher's Guide* is designed as a professional development tool for personal use within the context of a schoolwide improvement planning effort.

Developing a Personal Vision for Uses of Technology

Objective

Create a personal vision that aligns with school improvement efforts to use technology to prepare students for lifelong learning

It is important that plans for using technology in the classroom be guided by a personal vision about school improvement and technology. A personal technology vision also needs to align with the school community's vision about the desired learning outcomes for students and school-family-community partnerships. A good vision takes into account findings from research and best practices as well. Emerging trends indicate that technology can:

- Accelerate and enrich basic skills development in reading, writing, mathematics, and the sciences.
- Engage students in real-life applications of academics and encourage ownership of one's own lifelong learning.
- Help teachers meet the individual learning needs of their students more effectively, and connect teachers with each other across distances and time for professional collaboration.
- Serve as a catalyst for educational reforms, helping learners explore the world beyond the classroom and enhancing home-school connections.

(Lemke & Coughlin, 1998)

In your vision, you may picture your students using electronic networks to access cultural resources and to interact with experts providing new kinds of primary sources. You may see yourself involved in an online learning community—consisting of other teachers—using technology to acquire new skills and knowledge to meet the challenges of teaching in the 21st century.

Stories about a school community's past successes and failures implementing technology indicate the importance of technology within the school. A good vision creates a new story pointing to a future that is better than the present or past, yet is achievable within a reasonable timeframe.

Guiding Questions

✓*Have I participated in any technology planning meetings to learn more about the school community's needs related to uses of technology?*

✓*Am I well versed in the learning goals identified in my school's technology plan, and do I regularly consult with the resource teacher or technology coordinator on suggestions for meeting those goals?*

✓*Do I have a personal vision, and do I communicate my vision about technology when collaborating with parents, co-workers, and other school stakeholders so they understand my rationale and methods for using technology to foster student achievement?*

Internet Resources for Developing a Vision

- ✔ *The Closing the Equity Gap in Technology Access and Use: A Practical Guide for K-12 Educators Web site, by NWREL, includes online guidance to help plan for equitable uses of technology (available at www.netc.org/equity).*
- ✔ *The Northwest Educational Technology Consortium Web site looks at the impact of technology on educational reform and how a vision about school must adapt to changes in the world (available at www.netc.org/tech_plans/).*
- ✔ *World-Class Education for the 21st Century: The Challenge and the Vision describes the Illinois State Board of Education's mission and vision statement for providing all students with access to a system of high-quality public education (available at www.isbe.state).*

Action Step 1: Looking into the Future

Mrs Jones, a sixth-grade teacher in a large urban district, asked her principal for a copy of the school's technology plan. After receiving a copy, which was embedded in the school improvement plan, she spent some time familiarizing herself with it. She identified the components that were directly applicable to her, such as the outcomes of the needs assessment and priorities for the student learning outcomes at her grade level. To help organize her own plan for integrating the available technology into her teaching practices, she wrote the following personal vision:

"My school's vision requires all staff to be technology literate. Although I began using Apple IIe's with students in the 1980s, technology is rapidly evolving, and my skills need to keep pace. I envision my students regularly using networked computers with ease in all facets of the curriculum. They will conduct research, collaborate with co-learners, design and produce artifacts, play educational games, and assess their own learning progress using technology tools. I will advance my own technology skills, learn about and implement engaging instructional and meaningful assessment practices, and share my 'know-how' with other teachers in my building."

Write your personal technology vision below and align it with the vision written in your school improvement plan.

Integrating Technology into the Curriculum

> I have a spelling checker; it came with my PC It clearly marks four my revue miss steaks I cannot sea; I ran this poem threw it, I'm sure you're please to no. Its let her perfect in it's weight, my checker tolled me sew.
>
> *Arthur Unknown (Holdstein, 1994, p. 9)*

Objective

Identify common uses of technology to foster student achievement in alignment with state and local learning standards

The poem illustrates what can happen when students rely too heavily on electronic tools, such as a spelling checker, and not enough on thinking skills. Without guidance on how to use electronic tools appropriately, students will not know how to interpret preprogrammed advice that may appear on the computer screen. Teachers can help students develop the thinking skills necessary to use technology tools effectively.

Developing Lifelong Learning Skills

In addition to good reading and math skills, the basic skills for the 21st century include the ability to solve semi-structured problems, work in diverse groups, and communicate effectively (Murnane & Levy, 1996). The processing capabilities of today's technology push the envelope on all of these, as well as other lifelong learning skills, including information literacy skills. The American Library Association (1999) has defined nine information literacy standards in the following three categories:

- The ability to access, evaluate, and use information appropriately
- The ability to use information for independent learning or to follow personal interest
- The ability to be a socially responsible consumer of information

Today's interactive technology tools often require the learner to develop and apply these higher-order thinking skills, along with the necessary hands-on technology literacy skills to access online communities and manipulate electronic information. The newly released National Educational Technology Standards (NETS) define a set of technology literacy standards for students in the following six categories:

Guiding Questions

✔ *What are the student learning standards I am responsible for meeting?*

✔ *Are my students prepared to use technology to meet their information literacy and content learning standards?*

✔ *Are there students in my classroom who could benefit from additional uses of technology tools for remediation, acceleration, or special help in specific areas?*

- Basic operation and concepts of technology systems
- Social, ethical, and human issues related to technology
- Uses for productivity tools
- Uses for networked communications tools
- Uses of research tools
- Uses of problem-solving and decision-making tools

(Vojtec & Vojtek, 1998)

Those involved in the NETS initiative indicate that these standards are only a starting place. They are working further to develop standards addressing technology integrated into specific curricular areas, at developmental learning levels, and for student assessment purposes. Nonetheless, technology standards for students have been set by the majority of states that are also developing ways to measure student progress when learning with and from technology (Technology Counts '98, 1998).

Meeting Content Area Standards

The types of technology resources that give students access to curricular content are expanding. On both state and national levels, policymakers are infusing technology into content standards and learning goals. A good example of this trend comes from the Wisconsin Educational Technology Plan PK-12 (WETP). WETP is based on the belief that "curriculum and technology will play an unquestionably crucial role in the futures of individual children and our world. Experts from many disciplines advise that technology should and can play an important role in curriculum planning, development, delivery, assessment, and administration" (Wisconsin Department of Public Instruction, 1995, p. 95). In addition, teachers are finding ways in which technology can facilitate developmentally appropriate learning experiences at all levels of education.

Action Step 2: Students and Standards

Mrs. Jones took a look through her assessment records and noticed an area of overall weakness in her students' understanding of conditions for plant growth. She began to think of a learning activity to address her students' specific learning needs. Her activity plan began with the following statement of the targeted learning standard and key concepts her students would be expected to master:

"My students will acquire content knowledge of plant biology, ecology, and the environment, and they will apply the scientific method to this content knowledge."

Identify a learning standard and the key concepts your students need to master:

_____

_____

_____

_____

_____

Technology in Science Instruction

Science is very conducive to the use of hands-on technologies. In real life, scientists are heavy users of technology and are highly dependent on it to conduct their work. Yet, surprisingly, the National Assessment of Educational Progress Survey (using data collected in 1994 but reported in 1996) showed that except for social studies (8%), science teachers were the lowest users of technology among the major content areas. The report indicated that only 12 percent of college bound students reported using computers in their science courses. This number is in sharp contrast to 72 percent using computers in schools for word processing, 44 percent for English classes, and 27 percent for mathematics (National Center for Education Statistics, 1997).

A coalition of organizations under the auspices of the National Research Council (1996), released science education standards for the nation. They included technology standards, such as being able to use technology to study scientific processes, explore new scientific knowledge, and understand the impact of technology on living organisms.

Internet Resources About Standards

- ✔ *Details of the American Library Association information literacy standards are available on the Internet (www.ala.org/news/v3n24/v3n24d.html).*
- ✔ *The new National Educational Technology Standards (NETS) for teachers and students are available on the Internet (www.iste.org)*
- ✔ *The Putnam Valley, New York, school district's home page includes an index of links to K-12 educational standards and curriculum frameworks for each state (available at http://putwest.boces.org/Standards.html).*
- ✔ *Another useful Web site that catalogues standards in most content areas is the online version of the Standards Compendium available from the Mid-continent Regional Educational Laboratory (available at www.mcrel.org/standards-benchmarks/).*

Network Science Models represent a promising use of technology to meet the science standards. Through telecommunications, usually the Internet, students at several schools work collaboratively to collect data. They then organize and analyze the data and share their findings with others (Feldman & Nyland, 1994). For example, one testbed project called for students' exploration and data collection of wetlands, providing hands-on learning experiences with the scientific research methods. Students disseminated data given by other schools through satellite broadcasts. They explained the results of their inquiry and compared them with the results of other schools working on the same unit. "Much of the research of the student teams depended on the information that was downloaded and discussed during interactive broadcasts" (Feldman & Nyland, 1994, p. 3).

Some concerns about using technology in science revolve around costly safeguards for high-end technology equipment, including specialized computers; probes; temperature, motion, color and other sensing devices; data analysis; and display tools. Additionally, many excellent applications of technology in science require ready access to the Internet, which is not yet available in many classrooms. However, most schools have an Internet connection available in the learning resource center and/or computer laboratory. While weary of outdated drill-and-practice technology in their science classes, many educators are not aware of the educational software built for scientific inquiry and discovery. Types of technology commonly used for science include:

- Simulation and demonstration tools that show how concepts apply to real-world phenomena.
- Exploration and guided practice tools that assist students' use of scientific knowledge.
- Online data-sharing communities involved in scientific inquiry.
- Reference CD-ROMs and Web sites for information research.
- Problem-solving tools that foster scientific thinking.
- Creative activity tools that encourage students to imagine probabilities.
- A range of digital and electronic instrumentation.

Technology in English/Language Arts Instruction

The new English/Language Arts Standards, developed by the National Council of Teachers of English and the International Reading Association (1996), reflect the influence technology is having on the discipline. Standard one acknowledges the need for students to be able to "read a wide range of print and nonprint text" (p. 25). The definition of text now explicitly includes multisensory forms of communication as well as print.

In reading instruction, electronic books, often on CD-ROM, turn reading from a static, print-based activity into a multisensory, interactive experience. Most print-based books embody a story grammar or rhetorical structure that assumes the reader will start at the beginning and read through the page sequence to the end. Hypertext (characterized by links that one can click on with the mouse to go to another section) adds depth and elaboration to content through associative, audio, dynamic visual, and video texts that affect the nature of reading and writing across the curriculum (Bolter, 1992; Reinking & Bridwell-Bowles, 1996; Selfe & Hilligoss, 1994). When reading an electronic text, the reader can decide from among a number of reading paths which one to follow.

Electronic books often allow readers to adapt texts to their vocabulary level or prior knowledge through the use of audio, animated demonstration, and/or video clips that elaborate on meaning. In his review of the literature, Park (1996) found evidence that the adaptive features of electronic texts can individualize learning approaches and techniques according to the needs of individual learners.

Some students find writing skills particularly difficult to acquire because of the cumbersome process of having to revise their writing over and over again. However, today's word-processing tools allow students to edit their work efficiently and proficiently as long as students have solid keyboarding, software, and analytical skills (Baker & Kinzer, 1998; Owston, Murphy & Wideman, 1992). Word-processing technology supports such writing tasks as brainstorming, analyzing audience, defining a purpose, organizing content, structuring an argument, and evaluating one's own or another's writing.

Some of the popular types of technology used for English/language arts instruction include the following:

- Drill and practice in reading and writing to improve basic skills
- Record keeping for self-monitoring
- Word processing to support generating and organizing text

- Software to support writing, including electronic grammar, spelling, and style checkers
- Authoring tools for creating multimedia presentations
- Multimedia reference tools, such as encyclopedias or the Internet, for student research
- Instructional vocabulary, phonics, and story mapping games
- Software for teaching reading strategies, including electronic books with multisensory stories
- Networked computers for participation in online learning communities with collaborative writing spaces

Technology in Mathematics Instruction

The National Council of Teachers of Mathematics (NCTM) was the first professional organization to create national standards for appropriate uses of technology in a content area. NCTM recommends that:

- Appropriate calculators be available to all students.
- A computer be available in every classroom for demonstration purposes.
- Every student have access to a computer for individual and group work.
- Students learn to use the computer as a tool for processing information and performing calculations to investigate and solve problems.

The NCTM report, *Curriculum and Evaluation Standards for School Mathematics* (National Council of Teachers of Mathematics, 1989), states that exposure to appropriate experiences gives students *mathematical power.* Mathematical power is defined as "an individual's abilities to explore, conjecture, and reason logically, as well as the ability to use a variety of mathematical methods effectively to solve nonroutine problems. This ... is based on the recognition of mathematics as more than a collection of concepts and skills to be mastered; it includes methods of investigating and reasoning, means of communication, and notions of context. In addition, for each individual, mathematical power involves the development of personal self-confidence" (p. 5). The hands-on learning experiences fostered through today's interactive technology applications empower students with a level of mathematical power they cannot achieve without technology.

Mathematics teachers were early users and champions of technology because much of the initial software that was available to schools assisted in the teaching of basic mathematics skills. Since then, many schools have reported that students who supplemented teacher-led instruction with individualized computer-assisted drill-and-practice did better in mathematics than students who received conventional instruction. But perhaps even more significant is that because the new technology made calculating and graphing easier, it changed the very nature of the problems that mathematics can solve and the methods mathematicians use to solve them. Generally speaking in mathematics education, technology serves as a tool for:

- Acquiring, evaluating, and processing numeric information.
- Performing calculations and interpreting trends.
- Graphing and communicating numeric information.
- Investigating and solving problems with mathematical premises.
- Creating and running models and simulations.
- Scaffolding higher levels of abstraction.

Technology in Social Studies

Technology is also valuable in social studies. For example, WETP advocates using geographical, mapping, and history-based software applications, as well as age-appropriate simulations with elementary students who are expanding their understanding of the world beyond themselves and their families. "Simulations offer students the opportunity to participate in historical events or major decision-making events by virtue of role playing. Whether studying the 50 states or debating the pros and cons of declaring American's independence from England, students will find a wealth of excellent technology-based applications to make exploring social studies themes exciting" (Wisconsin Department of Public Instruction, 1995, p. 97). Suggested types of technology tools for social studies include:

- Databases and graphing and charting software for conducting comparative studies of demographic trends.
- Electronic atlases and laserdiscs, videos, and CD-ROM images for developing an understanding of geographical and physical characteristics.
- Telecommunications, especially the Internet, for conceptualizing self, family, and community contexts around the world and for demonstrating characteristics of our global village.

Internet Resources on Teaching and Learning

✔*The SchoolNet Software Review Project (SSRP), sponsored by the Eisenhower National Clearinghouse, evaluates science, mathematics, language arts, and social studies software programs for K-4 classrooms (available online at www.enc.org/rf/ssrp/).*

✔*The PEP Registry of Educational Software Publishers is valuable for anyone interested in quickly accessing information about a software publisher from the compendium of links to over a thousand software publishers (available online at www.microweb.com/pepsite/Software/publishers.html).*

✔*The California Instructional Technology Clearinghouse gives "exemplary" or "desirable" ratings to CD-ROMs for students in grades K-12 in a searchable database of over 2,000 recommendations (available online at http://clearinghouse.k12.ca.us/).*

- Simulations for role-playing activities of historical events.
- Statistical programs for conducting quantitative research and for analyzing results.

Existing technology applications support all areas of curricula, including world languages, business, vocational education, fine arts, and special education. Today, the momentum behind putting technology into classrooms requires teachers to consider all aspects of their curriculum to identify places where technology can benefit students by enhancing their learning experiences.

Action Step 3: Hunting for Resources

Mrs. Jones met with her building's technology coordinator to find out what technology tools (hardware and software) were accessible to help students meet the learning standard she identified in Step 2. Her technology coordinator gave her a book full of software reviews compiled by the district's software adoption committee. She browsed through the reviews and selected The Rainforest Researcher, *published by Tom Snyder Productions. Next, she spent some planning time familiarizing herself with the CD-ROM and the accompanying print materials in preparation for introducing it to her students. Mrs. Jones made a note of the software information using the categories below. She also selected a technology mentor from among her colleagues to help her design and implement her planned activity.*

Title:

Publisher:

Developmental Level:

Description:

Instructional Mode:

Intended Learner Outcome(s):

Assessment Reporting Features:

Curricular Alignment:

Hardware and Scheduling Requirements:

Pursuing Professional Development

Objective

To identify areas for personal professional growth aimed at enhancing one's teaching practices and uses of appropriate technology resources

Successful professional development in technology happens both on a personal level and on a systemic, schoolwide level. Many teachers can take advantage of professional development opportunities offered at the district level, such as software or Internet workshops and incentives for taking graduate-level courses in educational technology. However, teachers are responsible for their own progress in integrating technology into their daily practices.

Taking a Learner-Centered Approach

Technology often plays the role of catalyst within a district, ushering in educational reforms that call for learner-centered practices. The American Psychological Association (1997) has established a set of learner-centered principles that focus on psychological factors *primarily internal to and under the control of the learner.* The learner-centered approach is based on the understanding that each learner is unique. When integrating technology into a learner-centered classroom, students' individualized learning styles and strategies become apparent. Reviews of research conclude that low-achieving students or those with little prior content knowledge are likely to require more structure and instructional guidance than students at higher levels of achievement. Thus, a rule of thumb for selecting technology resources is that students with different levels of achievement and content knowledge require a range of technology resources.

Technology resources can range from close-ended drill and practice to the open-ended World Wide Web. Drill-and-practice software can reinforce specific types of skills or mastery of knowledge. Technology advancements, however, have moved educational technology beyond the limits of drill and practice to interactive technology tools designed around learner-centered principles that call for engaged learning roles. Engaged learning changes the teacher's role from information gatekeeper to facilitator, guide, and co-learner, with the student as explorer, producer, cognitive apprentice, and sometime teacher (Jones, Valdez, Nowakowski, & Rasmussen, 1995). In addition to educational reform methods, teachers must also reskill in the following four technology-related proficiencies areas (see Table 1 on page 17).

Guiding Questions

- ✔*How familiar am I with the learner-centered principles and the engaged learning roles and tasks for teachers and students?*
- ✔*Have I acquired the same technology literacy skills required of my students?*
- ✔*Do my technology integration practices provide equitable use of technology resources for all of my students?*
- ✔*Do I encourage my students to use technology to address special learning needs for reinforcement, motivation, or individualized pacing?*
- ✔*Do my plans for learning activities provide a role for parents and other community members to play in the education of children?*
- ✔*Am I familiar with the policies and procedures governing in-school and after-school access to technology resources in my school and community centers?*

Basic Uses of Technology. Teachers acquire basic "know-how" for operating computer hardware, software, and ancillary equipment, such as scientific probes or telecommunications cameras, as well as troubleshooting abilities to address technical problems that may arise. The novice characteristically uses preset, surface toolbar features of technology to automate established practices. The intermediate user explores layered toolbar features of technology to increase productivity and efficiency. The advanced user customizes toolbar features to transform his or her daily workflow.

Instructional Uses of Technology. Teachers increasingly individualize their instructional practices with technology to support various learner strategies to meet achievement standards. The novice begins to understand from a specialist how technology applications align with learning standards. The intermediate user consults with a mentor to successfully integrate technology in learner-centered ways that lead to overall standards' achievement. The advanced teacher plays an active facilitation role within a community of learners, using technology on an individualized basis to meet achievement standards.

Administrative Uses of Technology. Teachers develop data-driven practices and manage individualized learning with the support of technology tools. The novice responds to mandated uses of technology for record keeping and scheduling. The intermediate user regularly enforces technology usage policies and draws on established management features of technology for monitoring and reporting students' progress, as well as managing daily practice. The advanced user personalizes and/or creates technology tools for managing data-driven practices, helps develop usage policies, and models ethical technology practices.

Professional Development Uses of Technology. Teachers use telecommunications and networked computers to access online courses and information resources, as well as collaborate among colleagues. The novice begins to use technology as a supplemental resource for accessing professional information. The intermediate user accesses technology for up-to-date professional information and to communicate one-on-one with colleagues. The advanced user relies on a paperless, interactive information system for professional growth and purposeful collaborations among students, colleagues, mentors, parents, and business partners.

Teachers need to reach an agreement on which technology proficiency criteria are most pertinent to their grade level or content area. Teacher teams can create their own technology proficiency chart to identify levels of technology use relevant in their school context. Teachers can then use the chart to assess their own progress and mentor others in area(s) where they have excelled.

Table I: Sample Technology Proficiency and Levels of Use Chart

Proficiency Criteria	Novice Level	Intermediate Level	Advanced Level
Basic uses of word processing	• Teacher creates, saves, retrieves, and prints file(s) to store information electronically. • Teacher uses preset toolbars and templates for organizing word-processed plans and reports.	• Teacher manipulates electronic information using editing, formatting, and text analysis tools to generate plans and reports. • Teacher customizes toolbar selections for efficiency and organizes work folder(s).	• Teacher designs macros to merge information from other applications into word-processed reports and plans. • Teacher help colleagues create document template(s) according to contextual needs.
Instructional uses of software	• Teacher relies on a specialist to align instructional software with learning standards for existing activity plan(s). • Teacher acts as an instructional aide to a specialist who implements activity plan(s) with students.	• Teacher is assisted in aligning instructional software with learning standards for interactive classroom activities. • Teacher implements learner-centered technology activities with the help of a colleague acting as an instructional aide.	• Teacher uses software to enrich and individualize content, with students defining areas of interest that meet learning standards. • Teacher assists colleagues in evaluating, selecting, and using software to foster specific learning outcomes.
Administrative uses of a wide area computer network	• Teacher enters mandated student data into districtwide database on a daily basis. • Teacher occasionally uses the schoolwide electronic reading program to track students' reading progress.	• Teacher uses electronic reading program records and a grade database to monitor students' reading progress. • Teacher implements students' self-assessment procedures with an electronic grade-level portfolio rubric.	• Teacher creates a database to integrate districtwide records, personal records, and student portfolios into biweekly assessment reports and parental updates on demand. • Teacher's biweekly assessment reports inform instructional plans.
Professional development uses of the Internet	• Teacher uses a computer network to access announcements about and sign up for district-sponsored technology workshops.	• Teacher uses the Internet to look up information and register for courses at a nearby university. • Teacher uses e-mail to communicate occasionally with colleagues and parents.	• Teacher uses the Internet to engage in online courses and lead professional discussion forums. • Teacher contributes resource links and artifacts of practice to school's teacher listserv.

Example illustrates technology proficiency criteria and levels of use for teachers at a school district implementing its first technology plan for school improvement.

Equitable Use of Technology Resources

Students who are ready for the future know how to use technology effectively for a variety of purposes. Students who miss out on the opportunity to learn to use technology effectively miss out on vital life skills. Most schools, however, do not have enough technology resources for every student and require rotating schedules for the use of computers in order to maintain equitable access for students. Important to a teacher's professional growth is learning how to integrate technology resources equitably.

Some activities require that all students have hands-on time with a keyboard/mouse. Other activities call for learning through technology-enriched demonstrations or collaborative group work wherein teammates rotate the hands-on use of technology tools. Vojtek and Vojtek (1998) state that technology integration happens when the teacher knows "when a technology is the most appropriate tool to help students learn or demonstrate a particular concept or skill. . . Only when we truly integrate technology into instruction, using it as a tool to help *all* students improve their learning, will we finally score" (pp. 67, 69).

Equitable expectations vary from school context to school context, depending on the amount and types of technology available. Nonetheless, all schools and districts should have procedures for monitoring technology equity practices. Teachers need to familiarize themselves with and enforce these procedures when using technology in their daily practices.

School-Family-Community Partnerships

Today's families come in many different shapes and sizes. Nonetheless, many researchers and school personnel agree that parents (or guardians) are a child's first teachers and that the home is his/her first classroom (Boyer, 1993). Teachers who know how to use technology to facilitate parent involvement can build valuable school-family-community connections that will enhance a child's growth and development, especially in today's fast-paced culture.

Family uses of technology appear to differ when income, parental education, and ethnicity differ (Anderson, et al., 1995). These familial differences can have considerable consequences for student achievement at school. Access to technology that supports extended time on learning tasks outside the normal school day enriches learning and expands access to resources. Parents, as school partners, can guide the use of technology resources in the home and/or through the public library or other community centers. But parents need to be aware of and supportive of educational change. Teachers can help by keeping parents informed and knowledgeable about how and why technology is used for learning.

Action Step 4: Puzzling Over the Pieces

Mrs. Jones met with Mr. Nelson, her technology mentor, to review her initial activity plan. Mrs. Jones explained to Mr. Nelson how she identified and selected The Rainforest Researcher *as the technology resource for her planned science activity. Mr. Nelson pointed out that, given the students' low performance in science, her plan could be enhanced with the use of Internet resources—so students could research their assigned scientific role as well as gain in-depth knowledge of the scientific concepts to be covered. He also recommended students use* PowerPoint *to organize and present their scientific solutions and develop interactive problem-solution scenarios using* HyperStudio *to demonstrate their learning outcomes.*

These suggestions required Mrs. Jones to reflect upon and modify her routine instructional mode. After all, she thought she could send her students to the computer lab and have them take the multiple choice quizzes on the CD-ROM to demonstrate their learning. But, as she investigated new instructional practices using the Internet, she was confronted with re-articulating her instructional mode and revisiting her standards statement. Mrs. Jones reviewed the Technology Proficiency Chart for her grade level (see p. 17) and self-assessed her current abilities to implement the expanded learning activity Mr. Nelson had proposed. Mr. Nelson said that he had already taught these same students how to use PowerPoint *and* HyperStudio, *so Mrs. Jones didn't have to be responsible for teaching those technology skills. Her plan began to evolve into a Science Fair project. Mrs. Jones used the Technology Integration Planning Chart (see p. 20) to pull her new plan together.*

Instructional Mode:

Student Tasks:

Teacher Tasks:

Methods of Assessment:

Parent/Community Tasks:

Internet Resources for Professional Development

✔*Hosted by the North Central Regional Education Laboratory (NCREL), Pathways to School Improvement is a repository of "timely topics" and "critical issues" (available online at* http://www.ncrel.org/pathways.htm).

✔*The Association for Supervision and Curriculum Development (ASCD) maintains an interactive Web site, including the Electronic Exchange, for educators and connections to other related sites (available online at* http://www.ascd.org/services/library.html).

✔*The National Staff Development Council's (NSDC) mission is to ensure success for all students by serving as the international network for those who improve schools and by advancing individual and organizational development (available online at* http://www.nsdc.org).

✔*The National Network for School-Family-Community Partnerships offers a wide variety of resources for those interested in forming a three-way alliance (available online at* http://familyeducation.com).

Technology Integration Planning Chart

Mrs. Jones' 6th-Grade Science Fair Project

Teacher Tasks

Identify learning standard(s) and key concepts

Select technology resources

Create an assessment rubric and activity log template

Assign students to learning teams

Schedule and hold team conference meetings with students

Monitor teams' rotating use of technology resources

Keep assessment log with Team Review reports from Rainforest Researcher™

Provide parents with Internet tips

Student Tasks

Formulate individual and team questions to be answered

Research scientific professions using the Internet (e.g., taxonomist, chemist, ecologist, ethnobotanist)

Rotate leadership responsibilities within learning team

Read workbook, view video clips, and complete all quizzes on Rainforest Researcher™ CD-ROM

Provide teammates with appropriate information to help solve scientific problem

Monitor individual and team progress using assessment rubric and activity log

Compile PowerPoint® report recommending scientific solution(s) and create interactive problem-solution scenario with HyperStudio™

Compile unit portfolio and prepare for Science Fair

Parent/Community Tasks

Provide access to the Internet at home, library, or community center

Monitor Internet research homework on assigned scientific profession

Individually tutor child in area(s) of weakness(es)

Participate in Science Fair

Resources Selected

Rainforest Researcher™ CD-ROM (6 copies) and workbook for each student

Microsoft PowerPoint® (6 copies)

HyperStudio™ (6 copies)

The Rainforest Alliance Home Page
http://www.rainforest-alliance.org

The Global Schoolhouse's Introduction to the World Wide Web
http://www.gsn.org/WEB/_lib/_html/soregion/webintro.htm

Learning Standard(s)

Students will demonstrate knowledge of interactions among components of the rain forest ecosystem and basic uses of electronic reference tools and the Internet for information research

Instructional Mode

Role playing as an assigned scientific professional on a collaborative team whose mission is to solve a semi-structured problem using available productivity technology and human resources

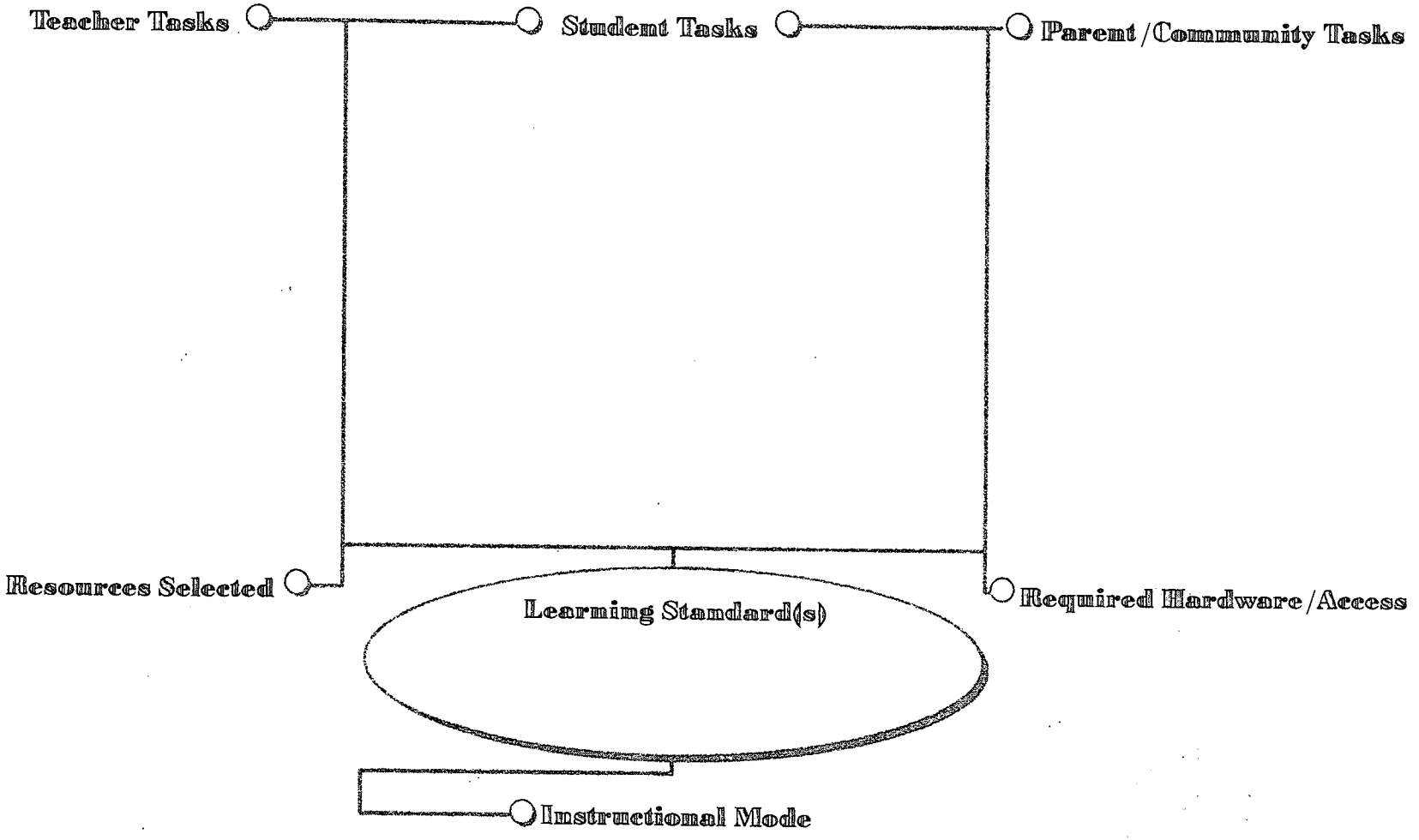
Required Hardware/Access

Minimum of one multimedia computer for each team of four students accessible between 10-11:30 a.m. daily for three weeks

Compatible LCD panel for practicing Science Fair presentations 10-11:30 a.m. daily for one week

Multimedia computers (6 total) set up for Science Fair

Technology Integration Planning Chart



Reflecting on Next Steps

Education in a technology-rich environment is a dynamic, interpersonal learning experience for both teachers and students. Teachers become more familiar with each of their students' learning styles, personal interests, and achievements. Students have the opportunity to explore personal interests and abilities and to interact more closely with their peers, parents, and community members interested in their academic and personal development. Students learn vital lifelong learning skills, such as how to generate and access valuable assessment data about themselves and how to share their knowledge with others in meaningful ways.

Technology, when used effectively to empower the learner to achieve a learning goal, has great potential. Teachers hold the key to determining how the learning standards and goals, instructional mode, tasks, and technology resources align with individual learner needs. Teachers in technology-rich learning environments make decisions that require time for meaningful reflection on their personal practices to help students achieve required learning standards.

Action Step 5: Pondering the Possibilities

Mrs. Jones had a measure of success in implementing her plan for the technology-enriched Science Fair. The experience left her with the feeling that she was really making a valuable difference in the lives of her young learners, which inspired her to continue to use technology. Technology, she discovered, was a wonderful thing! Mrs. Jones knew her students' assessment records also showed the need for improved student writing skills. She investigated writing instruction on the Internet and discovered that technology could be used as a thinking tool rather than just an electronic pen. Reflecting back on her writing lesson plans, she came to the realization that she had not adequately guided her students' vocabulary-building and research skills. She called on Mr. Nelson to help her put together an action plan to address her new professional goal and used the Goal-Setting Chart (p. 23) to organize her next steps around the following categories.

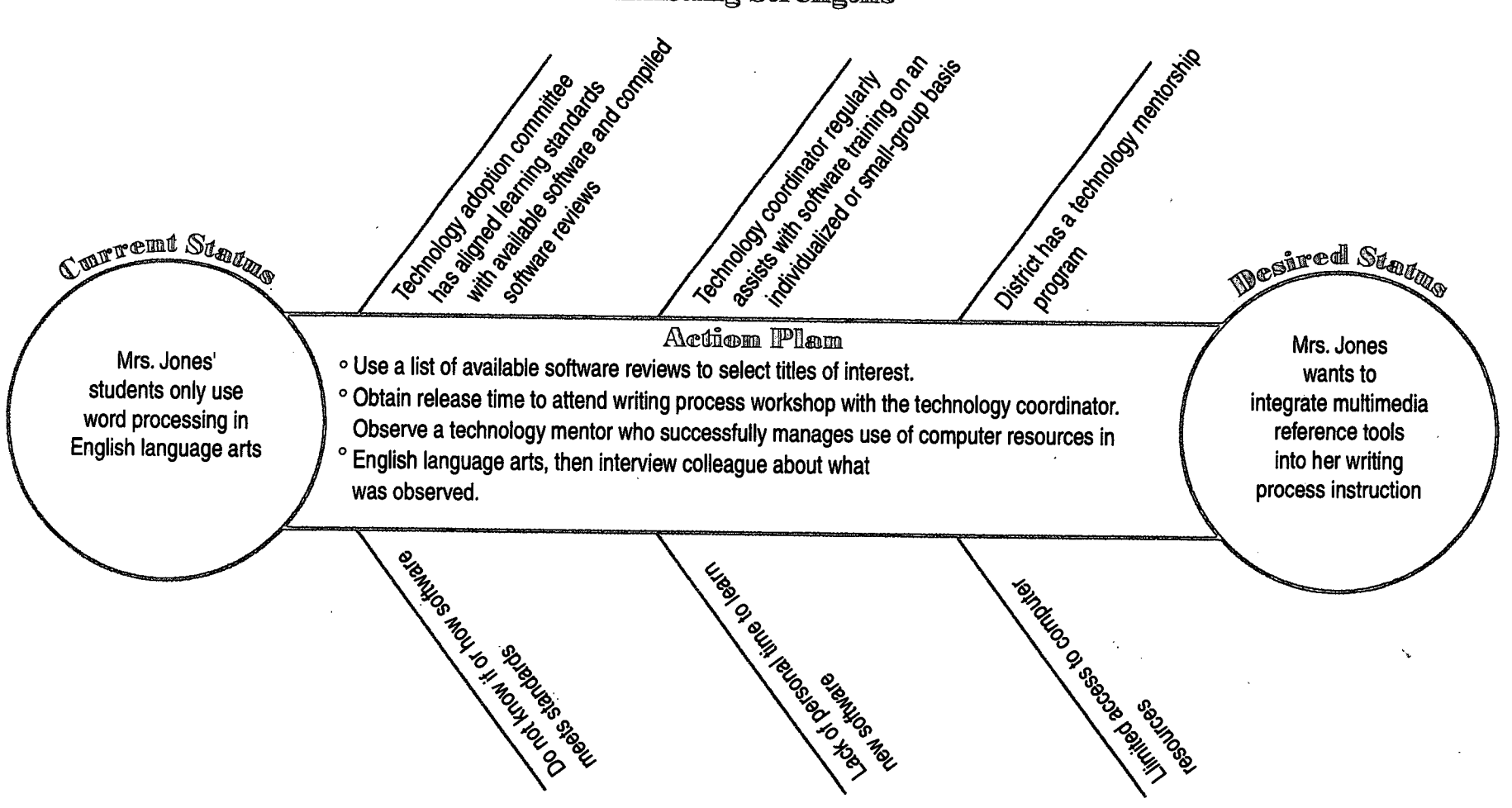
Professional Goal:

Professional Strengths and Weaknesses:

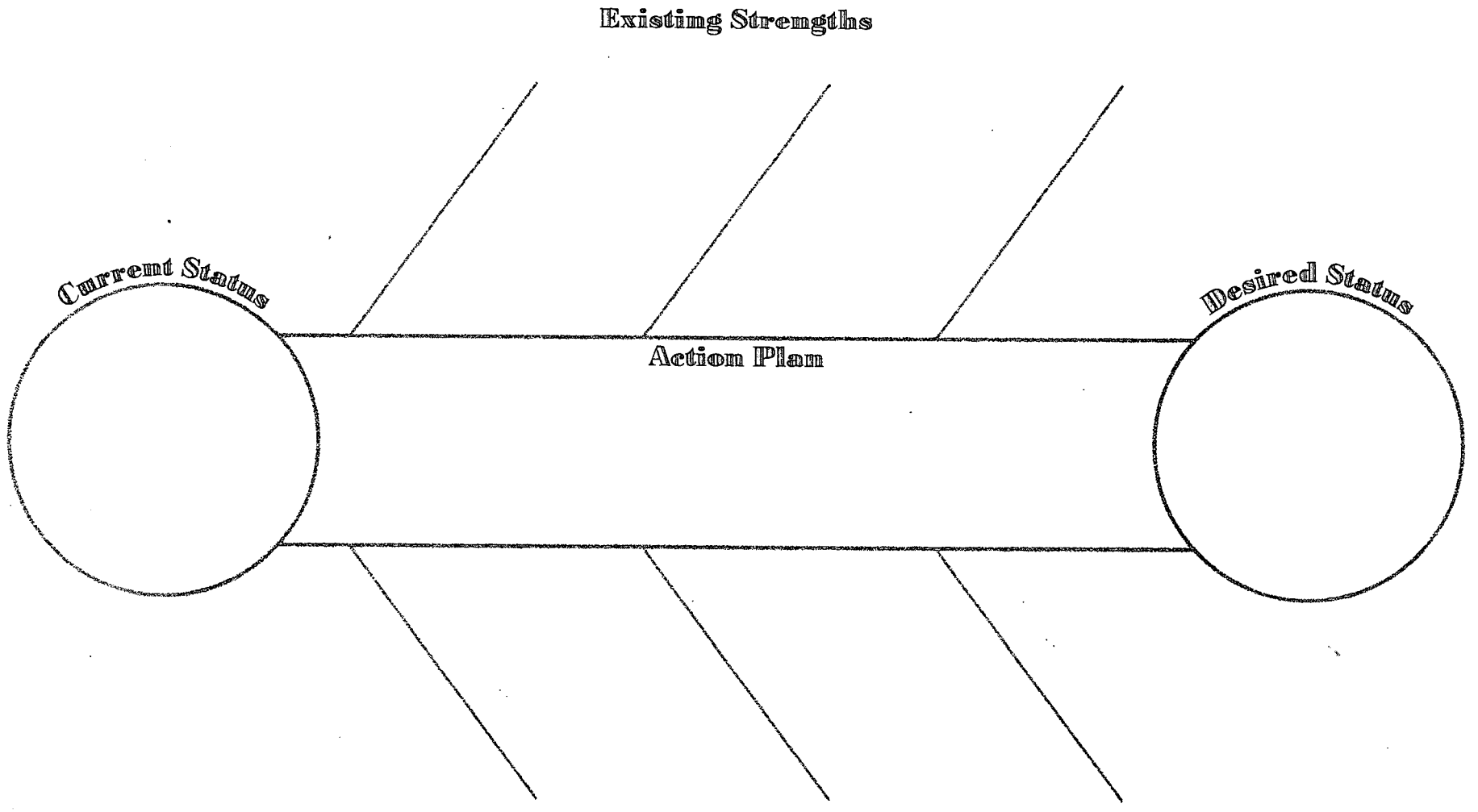
Professional Resources Available:

Goal-Setting Chart

Mrs.Jones' Professional Development Focus



Goal-Setting Chart



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