Chapter

3

Integrating Technology into the Curriculum

Chapter 3

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Integrating Technology into the Curriculum

What Do We Mean by Integration?

One thing that we have found to be consistent as we work in schools around the nation and in the SEIR•TEC region is that there are many different definitions of the term technology *integration*. So, to begin this chapter on the *integration* of technology, we offer our definition of the term. To us, integration is *the use of technology by students and teachers to enhance teaching and learning and to support existing curricular goals and objectives.*

In other words, we are not talking about computer classes or some other sort of stand-alone technology curriculum that focuses on teaching students about technology. By and large, we are thinking about regular classroom teachers using the different technologies to support the learning of all students within and across curriculum areas. We are always careful to remember that technology is not a cure-all, and sometimes the best teaching tool is not a technology tool. Technology benefits skilled teachers and engaged students but does not by itself *create* either. As with any teaching tool, technology must be understood within the broad context of curriculum and pedagogy.

At the same time, technology tools come with their own particular challenges and benefits. We work toward a vision in which all teachers use technology fluently and seamlessly to support student-focused learning rather than teacher-driven instruction. At present, however, teacher use is typically neither fluent nor seamless. Indeed, the attention paid to technology planning and use often serves to highlight other educational problems such as teachers with weak pedagogical skills and insufficient understanding of the curriculum; a lack of staff development and other support for teachers; and conflicts between educational expectations and the effort required to meet those expectations. The bottom line is that many teachers find it difficult to integrate technology because it usually means changing the way they teach. And, it doesn't help matters when policymakers measure the success of technology initiatives in terms of student scores on standardized tests.

Fortunately, there are a number of research studies that give evidence that effective teaching and learning with technology can improve student outcomes. For example, research conducted through the Apple Classrooms of Tomorrow (ACOT) indicates that students who use technology extensively as part of their daily school experience exhibit the following behaviors and characteristics:

- Explore and represent information dynamically and in many forms.
- Become socially aware and more confident.

- Communicate effectively about complex processes.
- Use technology routinely and appropriately.
- Become independent learners and self-starters.
- Know their areas of expertise and share that expertise spontaneously.
- Work well collaboratively.
- Develop a positive orientation to the future.

Our experience suggests that when teachers realize that technology can improve student learning, they are willing and eager to begin integrating it into the ongoing educational program. For more information about research on the impact of technology on learning, look on the Internet at the following sites:
http://www.apple-imac.com/education/k12/leadership/acot/
http://www.ed.gov/Technology/TechConf/1999/confsun.html
http://www.mcrel.org/products/tech/technology/impact.asp

Once teachers realize the potential for improving learning through the effective use of technology, and as they strive to become competent or even proficient technology users, they begin to change the way they teach. The ACOT studies revealed that teachers go through stages as they learn to infuse technology into teaching and learning (Sandholtz, Ringstaff, and Dwyer, 1997). As teachers move through the phases and learn to fluidly integrate technology into the curriculum, they usually find it hard to understand how they could have taught without it.

ACOT Stages of Technology Integration

Stage	Example of What Teachers Do
Entry	Learn the basics of using the new technology.
Adoption	Use new technology to support traditional instruction.
Adaptation	Integrate new technology into traditional classroom practice. Here they often focus on increased student productivity and engagement by using word processors, spreadsheets, and graphics tools.
Appropriation	Focus on cooperative, project-based, and interdisciplinary work—incorporating the technology as needed and as one of many tools.
Invention	Discover new uses for technology tools (for example, developing spreadsheet macros for teaching algebra or designing projects that combine multiple technologies).

As teachers integrate technology into teaching and learning, shifts occur in classrooms. In essence, traditional teacher-focused instruction changes to student-oriented knowledge construction, as the following chart from ACOT's research shows:

	Traditional Instruction	Extended (Knowledge Construction)
Activity	Teacher-centered and didactic	Learner-centered and interactive
Teacher role	Fact teller and expert	Collaborator and sometimes learner
Student role	Listener and learner	Collaborator and sometimes expert
Learning Emphasis	Facts and replication	Relationships and inquiry
Concept of knowledge	Accumulation	Transformation
Demonstration of success	Quantity	Quality
Assessment	Norm-referenced and multiple guess	Criterion-referenced and performance portfolios
Technology use	Seat work	Communication, collaboration, information access, and expression

Technology allows students to become active learners and to develop their problem solving, critical-thinking, and creativity skills. Technology offers students and teachers rapid and broad access to information and resources. Tools such as the Internet provide the means for students and teachers to engage in inquiry-based learning and to interact with a world of collaborators, information providers, and fellow learners. Computer-based simulations can engage students in open-ended explorations of *what if?* scenarios that would be impossible to recreate in the physical (as opposed to virtual) universe.

Common information-technology tools, such as spreadsheets and databases, allow the rapid and flexible manipulation of information, enabling students (and teachers) to analyze data and to form insights from a number of different perspectives and in sync with an individual's own particular patterns of mind. Also, the use of technology tools such as word processors and multimedia presentation managers help students improve communication skills and assume responsibility for the quality of their products of learning. True, all of this *could* be done without technology, but if the tools are there, and are undeniably used in the world outside of school, why *wouldn't* teachers and students want to use them?

Tools in this Chapter

Information technology such as computers, software applications, video, audio/visual multimedia, and telecommunications can be integrated into virtually any classroom situation. The key is to start with your curriculum goals and then to match them with the appropriate technology tools. Another is to examine state or national standards for learning, both for technology and in the content areas, and then to identify ways teachers may use technology to help students meet the standards.

Thus, it is with technology's particular challenges as well as its benefits in mind that we provide the following tools for integrating technology within the curriculum.

Managing One or More Computers in the Classroom without Losing Your Hair or Your Sanity. Written by SEIR•TEC members Jeanne Guerrero and Donna Ashmus, *Managing One or More Computers in the Classroom without Losing Your Hair or Your Sanity* will give you some down-to-earth suggestions for how to think about technology in the classroom.

Technology Standards for Students. *Technology Standards for Students* provides information about national standards for technology proficiency.

Integrating Technology into the Curriculum. *Integrating Technology into the Curriculum* gives you a conceptual framework for understanding four basic types of instructional technology. We have also included in each type a description of the software applications used in many educational settings.

Software Applications Commonly Used in Interdisciplinary Curriculum Units. The material details, and provides some guidance in the use of, the different types of productivity applications—such as word processors, spreadsheets, databases, and presentation managers. In our experience, these applications are among those most commonly used by teachers.

Available Technology Inventory Worksheet. The worksheet is a tool you can use before starting to create a technology-infused lesson or curriculum unit. It often helps to take stock of what technology you have and how it is arranged.

Steps Toward Infusing Technology into an Existing Curriculum Unit/ Activity. This guide includes some tips for taking your existing lessons or units and enriching them with the integration of a few technology tools and resources.

Classroom Activity Planning Template. This template is designed to assist you in identifying the key issues, outcomes, resources, and processes necessary to create a technology-infused classroom activity, regardless of whether you are starting from scratch or are diagramming and documenting an existing activity.

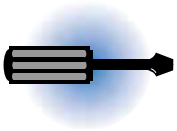
Classroom Observation Worksheet. If you have an opportunity to observe teachers' use of technology in the classroom, our *Classroom Observation*

Worksheet can help you document what you see. We have used a similar tool when conducting research on teachers' technology use.

Technology Integration Progress Gauge. To get you started on assessing technology's impact across your entire school or district, we have included the *Technology Integration Progress Gauge* and some information on how this sort of tool—and similar tools—can be used to monitor technology integration.

Online Resources and Instructional Ideas. Rather than attempting to provide an exhaustive list of lesson plans and web sites, we have compiled the *Online Resources and Instructional Ideas* section with the goal of offering one or two ideas that illustrate what we mean by technology integration. We also list several sites (out of the hundreds in existence) that comprehensively catalog lesson plans and curriculum materials. These should form a good starting point for your search for online materials.

Putting the Tools to Work



Managing One or More Computers in the Classroom without Losing your Hair or Your Sanity

To begin the discussion about technology integration, you may enjoy some tips and strategies from an article reprinted from a SEIR•TEC newsletter. The article was written by SEIR•TEC staff members Donna Ashmus and Jeanne Guerrero.

Imagine Steven Spielberg walks into your classroom with a horde of cameramen, soundmen, and technicians. They set up all kinds of moviemaking equipment around your students. Then, Mr. Spielberg looks up and gives you the signal, "Lights, camera, action!"

Although not everyone gets to be in the movies, many teachers feel that they are on camera each time they walk into their classrooms. Teachers perform not only for students, but also for principals, administrators, and parents. It can be daunting, even for the most well-trained teacher.

The progression of technology in the classroom, however, is changing the role of the teacher from one of a performer who supplies all knowledge to the role of a facilitator who collaborates with students in learning and achieving. When appropriate techniques and teaching methods are combined with technology, difficult concepts can be understandable and even exciting to the otherwise unmotivated students.

Since its inception in 1995, SEIR•TEC has been working to promote educational change through the use of technology. In the Consortium's intensive site schools, SEIR•TEC staff have witnessed educators changing from instructors afraid to touch computers to proficient technology users. These teachers are developing bold and innovative lessons for their students and community members. While many of the experiences are unique to a particular setting, there are some insights and ideas that will help teachers struggling to keep their sanity and still find ways to help their students use technology.

Relevant Questions

Teachers have long recognized that textbooks do a good job of presenting information in logical formats, but not quite as good a job in making material relevant to the students in the real world. Technology has given instructors another way to apply school knowledge to authentic events. Teachers should consider these relevant questions when beginning to infuse technology into the curriculum.

How can I use technology in the classroom? Instructors can respond to this question by using the Internet, CD-ROM-based encyclopedias, and instructional CD-ROMs to create authentic tasks. For example, one teacher uses the Internet to research an author's bibliographical and contact information. The

author responds and the class is able to ask timely and relevant questions about the book they are reading. Another teacher performs potentially dangerous chemistry experiments by using computer simulations.

How do I introduce my students to technology? Introducing students to technology is an important part of integrating technology into the curriculum. A language arts teacher uses a Microsoft PowerPoint presentation to introduce herself to the class at the beginning of the year. Using a large-screen monitor, she then creates another presentation in front of the class while directing student volunteers to actually create the slides. The students are then divided into groups and create their own presentations using the teacher's template.

How do I organize my classroom? Managing technology in the classroom is one of the greatest challenges for a teacher. A technique one teacher uses with a limited number of computers is to assign students into groups and assign each group a curriculum-related topic. The groups rotate through stations that offer a variety of books, magazines, the Internet, instructional CDs, and hands-on manipulatives. There are additional activities for groups that finish early. The teacher reviews the assigned and additional tasks at the beginning of class. A timer keeps track of how long students are at each station. When the timer rings, the group members save their work and rotate to another station.

Is technology beneficial to the learning objectives? Technology for technology's sake is not a wise strategy in the classroom. Educators need to make sure that the technology matches and enhances learning objectives. Technology can motivate students and provide a fresh and different perspective to different learning styles. As a teacher in the classroom, knowing the capability of your students is the best indicator of what can and cannot work well.

Hardware Issues

Instructors must make a variety of hardware-related decisions when managing classroom technology. For example, display and accessibility—with only one or two computers available to an entire classroom, how can all the students participate in a computerized activity during their allotted classroom time? A sixth-grade teacher in South Carolina addresses this problem by using a scan converter to project the monitor image to a large-screen TV and places the classroom's two computers on portable carts so they can be easily moved. Computers on portable carts can also be moved from one classroom to another, decreasing the computer/student ratio. When portability is an issue, so is security. What about security? Several schools secure portable carts in closets or chain the carts to an eyelet screw in the wall.

Software Issues

Many teachers and technology coordinators think that they need to purchase a plethora of specialized software packages. Although there is excellent content-specific software, most recently purchased computers are already

loaded with word processors such as Microsoft Word or AppleWorks that can be used for writing reports, tests, and quizzes, letters to parents, and recording student grades. Other programs on the computer might include software such as PowerPoint or KidPix that can generate multimedia student presentations. Spreadsheet and graphing software can aid in keeping student grades and records. Additionally, reference works, e.g., Encarta and Grolier's, as well as the World Wide Web, are excellent sources for research. Before planning any lesson, however, a teacher should keep in mind the computer software available in the classroom.

The development of many activities related to technology can be severely restricted if students don't have access to necessary software packages. The instructor must be aware of the resources or limitations they have in accordance to the software that is available to them.

Curriculum-Based Lesson Plans

When considering what kind of technology, the instructor should focus on the educational goals of the lesson. Technology cannot aid a teacher if there are no instructional goals in mind. Additionally, technology is useless without appropriate planning. Each lesson plan should be based on the curriculum and include the following points:

- Overview—a brief description of the subject and lesson plan
- Objectives—a list of what learning objectives will be achieved
- Prerequisite skills—the skills a learner should have mastered in order to begin the assignment
- Learning activities—what the teacher and students will do in order to achieve the learning objectives and how technology is an integral part of the activities
- Assessment—the evidence or products designed to indicate the extent to which students met the learning objectives
- Time allotted—length of time a lesson will last, which can span from a classroom period, a week, a month, or an entire school year
- Resources—what technologies and other materials will be used
- How to begin—the way the teacher will introduce the lesson to the students

Other Tips and Tricks

Think about these suggestions when planning technology-infused instruction:

Use cooperative learning groups or teams. Working together, students have a greater opportunity to learn to use a computer when the student/computer ratio is high. Groups also help students learn to work together amicably.

Use mentors, volunteers, and/or parents. The more individuals you have in the class to answer questions and provide guidance, the easier the task for the teacher.

Create "trained experts" in class. Students love to be the teacher. Designate one (or two) student(s) to be the class expert on word processing, presentation software, and any other commonly used software package. This student is then responsible for teaching other students how to use the software and for answering any questions a student may have. This frees the teacher from having to run to the computer every time a student has a technical question.

Preplan! Make sure that students use their time on the computer wisely. For some assignments, a teacher may want students to have a rough draft of their work before they go to the computer. This increases the students' productive time with the computer. There may be other situations in which students are allowed to compose their work at the computer.

Provide a template or sample of available graphics and fonts. Students can spend far too much time trying out graphics and fonts. While they need time to experiment with different looks and style options, some limits are needed to be sure they complete the work in a reasonable amount of time.

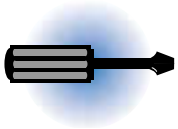
Create a project rubric. Students are more successful when they know what is expected of them. Direct the students in deciding what kind of presentation, what kinds of multimedia, and how many slides or stacks are required. When students are involved in creating their own assessment tool, they will be more likely to fulfill and surpass those requirements.

Break the project into small parts. Students can lose interest if a project lasts too long. Allowing them to work on parts of an assignment instead of the entire enterprise helps maintain enthusiasm.

Team with other teachers to create more meaningful lessons. Collaboration with other teachers can reinforce learning objectives as well as make lessons more interesting. A teacher in a science class might expand composition skills by having students write about a chemical experiment. A mathematics teacher might broaden art skills by having students draw figures that emphasize geographic relationships between shapes and objects. Teachers do not have to work in isolation. When they share their work and gain insights from others—students and teachers—learning is enhanced for everyone.

Conclusion

Throughout the work SEIR•TEC has done in the field with teachers in different classrooms and different settings, the common denominator is that the technology must be usable. No matter how cute, colorful, or nicely packaged a computer is, it will stay wrapped in bubble foam until the teacher can actually find a way to use it. Having only one computer should not be an obstacle to meaningful activities for students, although once teachers understand technology's potential, they quickly want more computers for their students. This article has provided ideas for using technology in the classroom. Remember, start small and simple. Integrate activities into existing units. Be creative. And most of all, have fun.



Technology Standards for Students

Many districts struggle with the issue of teacher and student technology competencies or standards. Overall, competencies or standards mean those things that teachers and students should *know about* technology and be able to *do with* technology. In many cases, a district may need or want to adopt standards that have been established at the state or national level. Some states, such as Florida, have standards for academic subjects and indicate specific technology uses that help students reach the standards. The standards from Florida can be found at http://www.firn.edu/doe/menu/sss.htm. Many are adapting or adopting the National Educational Technology Standards (NETS) developed by the International Society for Technology in Education, which can be viewed online at http://cnets.iste.org/.

Since we live in a time when standards, frameworks, and benchmarks are becoming increasingly prominent, it makes sense that some sort of competency or standard would be desirable for teacher and student technology use. The bottom line on adopting technology standards is that it must be done as part of the district technology-planning process. Teacher competencies are intimately related to the professional development goals and are in turn tied to the curriculum integration goals. Likewise, the student standards are parallel to the curriculum integration goals and are highly dependent upon the teacher professional development goals and, therefore, teacher competencies. Competencies, goals, and standards are linked in a cycle. And as we know, this cycle is driven by your district's *vision* for how technology will be used to support teachers, students, and the entire educational community. With this cycle in mind, it is clear that you cannot adopt or develop competencies and standards without the context of the other elements.

As a committee of stakeholders develops your plan, they need to review and consider competencies for teachers and standards for students. If your standards are ever going to be met by your teachers and students, then they must be rooted in *your* reality. We suggest the following process steps for developing teacher competencies and student technology standards:

- Engage your committee of stakeholders in a discussion about the need for competencies and standards and how these relate to other elements of the technology plan.
- Be sure that your committee has a common definition of key concepts such as technology integration. This ensures that your entire committee can have a common goal. Review your plan's vision statement to refresh your committee's understanding of the big picture for technology in your district
- Begin work on the curriculum integration portion of your plan. This helps ensure that the curriculum will drive your process of determining what students should be able to do with technology (the student standards) and what teachers need to know in order to support student use (the teacher competencies).
- Review your state's requirements regarding student standards and teacher competencies, the professional literature on standards and competencies,

and examples of other districts' work in this area. Note that we suggest taking this step later in the process rather than at the beginning. This helps avert the natural desire simply to appropriate existing work without first grounding it in your school's reality.

- As you adopt or develop competencies and standards, ask yourself if what you are developing is (1) *do-able* by teachers and students with the existing or projected resources; (2) *flexible* enough to account for changing technology; and (3) *exemplary* rather than mandatory. That is, do you provide examples of what you expect to observe, or do you just give orders with little guidance?

Establishing student standards is a bit more complex than establishing teacher standards. Part of this complexity comes from the issues surrounding any standards for student learning. Unfortunately, much of the discussion we hear in the districts struggling with this issue relates to defining what sorts of *mechanical* skills students are expected to have in order to operate various devices. What is often lost in this discussion is any reflection about *why* students might use computers, software, the Internet, and so on. Once again, educators need to think about the more important issue of helping students learn which tools are best used for a particular learning task.

The best student-technology standards—and we believe that the term *standard* is more appropriate here than *competency*—focus on ensuring that students be exposed to a wide range of situations in which technology is used as a part of an active, engaged learning experience. Naturally, this can be achieved only when technology use is thoroughly integrated throughout the curriculum rather than allowed to stand as a single curriculum subject. Students are not in school to learn technology, particularly at the elementary- and middle-school levels. Just as with teachers, total mastery of a particular software package or hardware device is only really instructive as a pathway to understanding the broader place of information technology as a tool for exploration and learning.

When viewed this way, student technology standards are very closely related to the *curriculum integration* goals of the district's strategic educational technology plan. If students are in school to master the curriculum, then the goals for their use of technology should be to help them do the same.

One thing to be very wary of is the urge to teach the standard, a practice that some districts fall into after they adopt student-technology standards. This seems to happen most often when standards are construed to be very specific skills or technology-related facts that students are expected to master by particular grade levels. Often, districts with these types of student standards feel that they have to involve their students in specific technology classes where particular applications and operation skills (e.g., keyboarding) are taught. While this *may* lead to mastery of the skills specified in the standards, it also has the effect of pulling technology use entirely out of the regular classroom and its learning activities. For many students, this diminishes technology to the level of any other class and

thereby negates many or most of its educational advantages related to inspiration, creativity, and engagement.

There are several ways to avoid isolating technology as a subject matter in itself. The first consideration is to create student technology standards that relate entirely to using technology within the curriculum. Therefore, your standards will connect technology use to actual curriculum-related projects or activities. Rather than the simple requirement "Use the World Wide Web," an appropriately focused standard would be to require that students use the World Wide Web as part of a research project that is part of an integrated language arts and social studies unit. Use your district's curriculum and its objectives for creating student technology standards.

A major weakness in the writing of student standards is the fact that few technology planners are sufficiently familiar with their district's curriculum goals and objectives. As a result, technology specialists write the technology plan and tie student standards to what they themselves know best—technology. We cannot overemphasize the importance of this issue. Student technology competencies cannot and should not be separated from curriculum goals and objectives. They are also woven into teachers' professional development, and specifically into professional development that helps teachers understand the role of technology within their classrooms and curriculum.

With all of this in mind, we offer the following guidelines for adopting student technology standards for your district. Teacher-technology standards and competencies are addressed in the next chapter, which focuses on professional development.

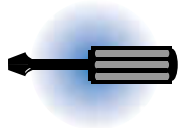
- Make sure that the same people who are writing your plan's curriculum integration goals are also working on student standards. Student standards are about how students will use technology within the curriculum. This should be consistent with integration goals.
- Avoid the urge to focus narrowly on using specific technology tools. Instead, think categorically about technology use. For example, it is better to talk about the fact that students will need to learn how to use word processors within the writing process than it is to talk about mastering a specific word processing program on a specific machine in a specific class. Keep in mind that your plan should last a number of years. If you upgrade your software or hardware, will this negate your standard?
- Think about *who* will be responsible for ensuring that students meet the standards. If the answer to this is the classroom teacher—as we advise—then make sure that you have given adequate thought and resources to how teachers will be prepared to assist all of their students in meeting the standard.
- Ask yourself, "Is the standard reasonable and achievable?" Is it reasonable to expect that classroom teachers with no technology training can provide students with opportunities to use technology tools in their learning activities? Is it reasonable to expect that a single *computer teacher* in the school will be able to *train* every student in a particular software application described in a particular student standard?

- Create student standards that evolve and escalate over time. This strategy allows you to correlate student standards to professional development for teachers and the growing technology infrastructure.

Examples of Student Competencies

- The National Educational Technology Standards (NETS) for Students project is a collaborative national effort to set student technology standards. Several nationally known nonprofits and technology manufacturers sponsor this work. The NETS standards can be viewed online at http://cnets.iste.org/.
- A related approach to developing student standards involves assessing student technology skills and assigning various levels to the skill groupings. This is the approach taken by the Bellingham (Washington) school district. The various assessments Bellingham uses form the basis for determining what skills training a given student requires. View the Bellingham assessment instruments online at http://www.bham.wednet.edu/assess2.htm.

Integrating Technology into the Curriculum



Finding the Right Tool for the Task—Four Categories of Technology Use

Information technology such as computers, software applications, video, audio/visual multimedia, and telecommunications can be integrated into virtually any classroom situation. The key is to focus on **what** you are trying to accomplish within your curriculum (i.e., your learning goals and objectives), and then to identify an **appropriate technology tool** that will help you accomplish your goal. This is not as simple as it sounds.

We believe that one path towards simplification lies in the identification of different categories of technology that can be broadly said to support different classroom strategies. Educational researchers, and in particular Barbara Means (1994) in her landmark work on technology's role in school reform, have identified four categories of software applications. While by no means exclusive, this categorical identification helps illustrate the point that not every strategy can be supported by any or every technology. More specifically, you need a variety of tools to accomplish the variety of objectives associated with a given curriculum. No single piece of software or hardware can be expected to address all of your classroom needs. Sorting educational technology by *category of use* is a step towards learning how to apply the right technology tool towards a given task. We don't maintain that this is the *only* way to separate the types, but it is comprehensive and one which we have found to work with many teachers.

Finally, please note that the software examples cited here are just that, examples. In fact there are many titles which would be equally valid examples for most of these categories, and our citations below do not imply recommendations or endorsements.

Tutorial Uses of Technology

Tutorial technologies are those that support the transmission of information from source to student. The technology itself might be a software application that presents questions, allows time for answer, and offers corrections or rewards for the right or wrong response. Often, tutorial technologies present their lessons accompanied by a variety of multimedia. Tutorial technologies are useful for the development and reinforcement of basic skills. Thus, it is not surprising that tutorial technologies are often found in lower grades (and in remedial programs at higher grades) and are used to support skills such as spelling, grammar, vocabulary development, and basic-function mathematics.

Examples

- Drill and practice games such as the MathBlaster series, Grammar Games, and SpellIt
- Integrated Learning Systems (in their most common use, one student per computer)
- Computer-based training and testing

Application Uses of Technology

Application technologies include such tools as word processors, spreadsheet programs, databases, and other data collection/manipulation/analysis programs. The operative term is *tool,* since applications such as those above have no content in and of themselves. For example, a word processor may be used at all grade levels and in every subject. The application use of technology is an interim, or process, step towards achieving an instructional goal.

Examples

- Integrated packages such as AppleWorks and Microsoft Office and their word processors
- Excel and other spreadsheet programs
- TimeLiner (as an information organization and presentation tool)
- HyperStudio, KidPix Studio Deluxe, PowerPoint, and other multimedia packages
- Multimedia encyclopedias such as Microsoft Encarta and Grolier's
- World Wide Web and student research

Exploratory Uses of Technology

Exploratory technology combines some content with a particular delivery strategy to encourage students to explore a subject and construct their own knowledge. The majority of exploratory technology applications are open-ended and can produce a variety of narrative outcomes. The primary goal when using an exploratory technology is not to get the right answer but rather to use the technology to engage with a subject and derive meaning from that engagement.

Exploratory technologies are often used to facilitate student cooperation, critical thinking, and group problem-solving.

Examples

- Simulations such as SimCity and Sim Earth
- Life and physical science simulations
- Simulated journeys, such as Oregon Trail
- Role-playing, group problem solving packages, such as The Great Ocean Rescue, Decisions Decisions, and Rainforest Researchers
- Multimedia encyclopedias, such as Encarta and Grolier's
- World Wide Web searching and student research

Communication Uses of Technology

Communications technology describes those uses of telecommunications that support teaching and learning. Communications technology can be used in any of the three modes/categories discussed above (tutorial, application, and exploratory). Often, communications technology is used in an exploratory mode to facilitate student collaboration and research across great distance. As with the application category, communications technology is a tool which in itself is content-neutral. On the other hand, the use of this tool can enable the teaching of certain content and the fulfillment of certain learning goals that would otherwise be more difficult if not impossible.

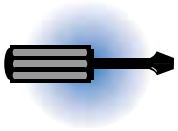
Examples

- E-mail (student-to-student, student-to-professional, etc.)
- Collaborative, online projects, such as The Journey North or those found at EnviroNet
- Teleconferencing (CUSeeMe, satellite, compressed video, etc.)
- World Wide Web searching and student research
- Student publishing on the World Wide Web

A list of software publishers that includes the resources mentioned above is provided in Chapter 6. For more information on these four categories and technology's role in school reform, see Barbara Means's seminal works:

Jossey-Bass Education Series. 1994. *Technology and education reform: The Reality Behind the Promise.* San Francisco: Jossey-Bass.

Means, Barbara; Olson, Kerry. 1994. The Link Between Technology and Authentic Learning. *Educational Leadership* 51 (April): 15–19.



Software Applications Commonly Used in Curriculum Units

Applications technology describes software programs that in themselves have no subject-matter content. These programs are tools in the classic sense. Therefore, not surprisingly, the software application tools used in education are the same tools used in other settings such as business. Spreadsheets, database programs, word processors, and presentation authoring tools are commonly used by all personal computer users and are readily available for many teachers and students.

Applications tools are often bundled together by a manufacturer or distributor and arrive as part of a new computer purchase. These bundles are often referred to as *integrated software* or *application suites* and are sold under brand names such as Microsoft Office, Microsoft Works, or AppleWorks. The programs that comprise the bundle are determined by the manufacturer. Nevertheless, the basic idea behind bundled applications is the same. Central to the concept of integrated-software bundles is the idea of a menu interface that is common among the elements of a bundle (i.e., the word processor, spreadsheet, and other programs have the same menus and icons). This simplifies learning the different commands that work across the programs, and it allows the user to move data easily among different application tools.

Please note that the following software applications are just examples. In fact there are a number of titles that would be equally valid examples for most of these categories, and our citations below do not imply recommendations or endorsements.

Spreadsheets

Examples: Microsoft Excel, AppleWorks

A spreadsheet is a program that organizes cells of numerical data into tables of rows and columns much as one would find in an accounting ledger. Through the use of equations (written in a simple programming language unique to the particular spreadsheet program in use), the spreadsheet program is able to perform basic mathematical functions across the rows and columns. For example, it is possible to total a column of numbers, divide that total by cells within the column, and report the resulting average elsewhere on the spreadsheet. Most spreadsheet programs provide a capacity for graphing data. Graphs can range from simple X-Y line graphs to more complex three-dimensional representations.

Spreadsheets are excellent tools for collecting and analyzing data and thus work well in curriculum units that call for students to address both interdisciplinary content and process/information analysis tasks. Students can design spreadsheet layouts, collect the data to fill in the various rows and columns, and then write equations to analyze the data they have collected. In this way, a spreadsheet becomes a vehicle for learning about and representing both simple and complex relationships between numbers and pieces of information.

While the use of spreadsheets is common in mathematics and science curricula, they can be used whenever data collection and analysis are required.

Many teachers use spreadsheets in social studies curricula where students might collect numerical information and organize it chronologically. Projects on genealogy and immigration make particularly good use of spreadsheets.

Database Management Programs

Examples: Microsoft Access, FileMaker Pro

A database-management program is used to create, organize, and manipulate information in databases. Databases work much like spreadsheets, although they are often used where textual information is more important than numerical data. Databases are primarily used for creating records of collected information. Most database-management programs allow for some degree of numerical analysis of the collected information (e.g., counting, grouping, sorting by rank order, etc.).

Databases are often used in interdisciplinary curriculum units. They become a vehicle for information collection and organization. The manipulation of information within a database calls for mathematics and critical-thinking skills. These skills are further enhanced when a student designs a database using a database-management program.

Word Processing Programs

Examples: Microsoft Word, AppleWorks

Most teachers are familiar with word processing programs as tools for producing lesson plans, student/parent communications, and personal correspondence. Students make use of word processors in similar ways. Certainly, research papers, projects, and other written communications can be accomplished with the use of a word processor.

Aside from simply making student work appear neater, word processors have pedagogical importance in that they have been found to encourage students to write more, with greater ease in editing and revising their work. Thus, word processors are powerful tools in developing writing, critical-thinking, and research skills. Furthermore, the word processor as a technology-based tool encourages and motivates certain students who have difficulty with the manual task of handwriting. Finally, many students take greater pride in work that has been produced with a word processor, and this motivates them to continue writing and performing the other learning tasks associated with their writing.

Word processors are not just used within language arts curricula. Students often use these tools to produce work related to any subject area, and this work often becomes the source document for importing data into databases, spreadsheets, and presentation programs. In this way, the word processor is often the cornerstone application within integrated application suites such as Microsoft Office, Microsoft Works, or AppleWorks.

Presentation Tools

Examples: Microsoft PowerPoint, Hyperstudio

Presentation tools allow students and teachers to take text, numerical data, graphs, sounds, and visual images and organize this information into multimedia presentations. While it is possible to use multiple media (e.g., sounds and images) within a presentation, it is also possible to create a text-only presentation. It is important to remember that although most presentation tools support the creation of very sophisticated products, the degree of sophistication and complexity is very much under the control of the author.

Almost any student project can result in a presentation. Presentations can be made before an entire class or be designed for individual viewing. Multimedia presentation tools can be integrated into any lesson or unit that would otherwise result in a paper-and-paste-project product.

While a presentation tool such as PowerPoint is simply software, this software usually requires the use of particular hardware to acquire digital images/sound, including digital cameras or scanners, and to display the resulting multimedia presentations. Quite often, the material that makes its way into presentations is imported from other software applications such as word processors and spreadsheets that create tables and graphs.

Additional Information

Previously in this section, we presented software tools teachers can use to support learning in different content areas. The next question that many teachers would have relates to finding specific curriculum-unit ideas for teaching and learning in the one-computer classroom. In fact, this is where the *real* fun lies. Fortunately for those who want to see what other teachers have done, many informational resources are available that provide lesson and unit ideas. Following are just a few to get you started:

Great teaching in the one computer classroom, David Dockterman. Tom Snyder Productions, 800-342-0236, http://www.teach.tsp

Productivity in the classroom, Microsoft and Scholastic, http://www.microsoft.com/education.

More classroom tips can be found at http://www.microsoft.com/education/lesson/productivity/acknow.asp.

Available Technology Inventory Worksheet

Do you have technology resources such as those listed here to use in curriculum-based projects? When considering the way in which technology can enrich your curriculum, it is first necessary to inventory your available technology so that you will know what is possible in terms of access for you and your students. In other words, "available" refers to a particular device or software program that

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Available Technology Inventory Worksheet (page 1 of 3)

Remember that you might have access to technology that is not physically located in your classroom. Check with your librarian, school technology coordinator, and/or other teachers to find out if resources exist that you might borrow or share with other teachers.

Computers

- Computers for teacher use (where and how many?)

  Classroom computers-one per class

  Four Computers in LMC. Computer in staff workroom

- Computers for student use (portables, AlphaSmarts, lab computers, classroom computers, etc.; where and how many?)

  Classroom computers-one in each classroom

  Macintosh Lab-20 computers.

Presentation and output devices

- Projection devices (e.g., scan converter, LCD, video projector)

  Scan converter-TV-view-to use with large-screen TV on cart

  Video projector can be checked out from district office-Media Dept.

- Printers

  Inkjet printer in classroom. Laser printer on LAN in Mac lab

Input Devices

- Scanners

  Scanner in LMC

- Digital cameras

  No

- Digital video cameras

  No (What is a digital video camera??!!)

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is actually accessible to you. This is differentiated from existing technology to which you have no ready access. A reproducible version of the worksheet is found in the Appendix.

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Available Technology Inventory Worksheet (page 2 of 3)

Internet

- Teacher access

  Internet available in Mac Lab and on machine in LMC. First-come, first-served access.

- Student access (Existence of Internet acceptable use policy)

  District tech. coord. says that the Board will vote on this next meeting! Until then, be careful about controlling student access.

Software and applications (Note: identify what is available for teacher, students, or both)

Applications technology

- Basic productivity (word processor, spreadsheet, database)

  ClarisWorks on every machine. MS Office on the machines in the LMC and teacher workroom. ClarisWorks on every machine. MS Office on the machines in the LMC and teacher workroom.

- Presentation manager (e.g., PowerPoint)

  ClarisWorks Slide Show???

- Multimedia production (e.g., HyperStudio)

  No.

- Reference materials (e.g., multimedia encyclopedia such as Encarta)

  World Book, Encarta, Grolier's CD-ROMs. "The Animals" CD-ROM.

Subject area—specific technology (Note that many applications are multidisciplinary.)

- Math software applications

  Math Blaster, Number Munchers

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Appendix

Available Technology Inventory Worksheet (page 3 of 3)

- Science software applications

- Language arts software applications

- Social studies software applications

  Carmen San Diego

- Visual Arts (e.g., drawing) software applications

  KidPix Studio, clipart CD-ROMs, Banner-Maker Deluxe

- Music software applications

Communications technology

- World Wide Web/Internet

  Can get to WWW on two machines. Netscape is loaded on all machines, but only works on the Internet-connected ones.

- E-mail

  Teachers have personal accounts. District tech. coord. says not to allow students to have access e-mail (??)

- Internet-based videoconferencing

  Huh? What is this?

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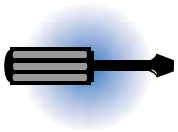

Steps Toward Infusing Technology into an Existing Curriculum Unit/Activity

Many teachers find it useful to explore the process of technology integration by modifying an existing curriculum unit to make use of technology tools. In this way, the teacher is not so much creating new curriculum activities as using technology to improve the delivery of the current curriculum.

1. **Examine the unit/activity. Think about how technology can be added to this unit to support and improve student learning.**

   - Combine technology with traditional resources: Use electronic resources along with traditional print-based materials.

     Example: Use CD-ROM encyclopedias, atlases, or web sites for research.

   - Substitute or add a technology element to an existing project.

     Example: Instead of creating graphs using pen and pencil, use a graphing program to display information.

   - Adjust or expand a project to reach higher student expectations.

     Example: Have students use multimedia presentations to get across ideas and increase enthusiasm.

   - Use the appropriate tool at the appropriate time.

     Example: Use e-mail when introducing the concept of friendly letters. Introduce presentation software when needed for public speaking.

   - Critically evaluate the quality and quantity of your instructional materials. Recognize essential activities that support critical learning objectives and eliminate the nonessential.

     Example: Eliminate an assignment on a topic already presented.

   - Recognize that technology use takes time. Rearrange and prioritize unit activities and assign a time frame that reflect changes in the time it takes to perform certain activities.

     Example: Shorten, eliminate, or rearrange tasks.

2. Rewrite the lesson unit. If necessary, revise your goals to reflect changes due to technology infusion.

- A lesson planning template, such as the one that follows, helps you focus on what changes are brought to your activity through the infusion of technology.

  Example: What technology tools and resources will you use in the unit?

- In what ways does technology add value to the curriculum activity? Think about why the use of technology improves student learning in this redesigned unit.

  Example: Use of a technology tool (e.g., a spreadsheet program) allows students to manipulate data and produce graphs more easily.

3. Prepare your unit/activity materials. Develop instructional materials, handouts, and assessments. Create a schedule that allows students maximum use of technology.

- You will need instructional materials that take into account the new tools used by students.

  Example: Create step-by-step instructions for using technology with which students may not already be familiar.

- Create new assessment materials, such as rubrics, that assess both content learning *and* technology skills.

  Example: When students create an electronic presentation (e.g., Hyperstudio stack) for a research project, the assessment should be on the quality of their research and the quality of their presentation.

Classroom Activity Planning Template

Teachers can use this format to develop technology-enhanced lessons. A reproductible version of the worksheet is found in the Appendix.

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Classroom Activity Planning Template (page 1 of 3)

Description of the proposed classroom activity

Grade 7, Earth Science
Rock identification–classifying rocks as either igneous, sedimentary or metamorphic based on physical characteristics and then entering that information into a ClarisWorks database.

Student learning objectives

What is the purpose of this activity? What sorts of student dispositions and/or attitudes will this activity support? How does this activity impact student interactions with others?

This activity will help students organize data that they are collecting. Students will observe rock samples and enter the data into the database. By sorting according to various characteristics they can see that different types of rocks have certain common characteristics. They will be able to draw their own conclusions about how a rock's classification is determined. Students will work in cooperative groups when observing the rock samples and entering the data.

Specific curriculum objectives

How does this activity support particular curriculum objectives, framework elements, and so forth?

State and District Science Benchmark ES7.5–Identify the differences between sedimentary, metamorphic, and igneous rocks, and describe the formation of each.

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Classroom Activity Planning Template (page 2 of 3)

Assessment

How do you plan to assess student achievement of learning objectives? Rubrics, indicators, and so forth?)

As the students enter their observations into the database, I will be able to assess their observation skills (are they seeing what they say they are seeing?)

Technology to be used in this activity

State *why* this particular technology will be used.

ClarisWorks database. Maybe a digital camera or scanner to insert pictures of their rocks into the database.

Nontechnology resources or materials to be used in this activity

e.g., books, original sources, manipulatives, etc.

Students will need background information about the 3 different types of rocks. This can be through their text book, or through discussion, or through a slide show. Rock samples will also be required for them to classify.

Time necessary to complete this activity

Class days required, start to finish

This actual activity will take 3 class periods, although it comes at the culmination of a month-long geology/earth science unit where students learn the principles they demonstrate knowledge of in this activity.

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Classroom Activity Planning Template (page 3 of 3)

Activity timeline/procedure

As specifically as possible, please describe this activity on a day-by-day, step-by-step basis. Be sure to include student directions, expectations, and teacher instructions. Please use additional sheets as necessary.

1. Start with an activity that has the students identify various physical characteristics of rocks. Give groups of students several rock samples and ask them to make observations and define some ways to tell them apart. This will lead to a discussion of characteristics and properties. We will generate a list of characteristics that are useful (e.g., size is not a useful characteristic because two pieces of the same rock can be different sizes).
2. The students will take that list of characteristics and use it to make observations and then enter their data into the database.
3. Students can then sort their data by various characteristics. They will be asked to look for patterns–is there a relationship between certain characteristics and the type of rock that it is? Can you determine the type of rock by looking at the characteristics? Can you say something about the characteristics if you know the type of rock?
4. Students will be asked to write a conclusion based on what they did.

Ideas for extended activities

How might this particular activity be extended to cover other curriculum units? If time were available, how might you expand this activity?

Classifying is an important science skill and is included in many of the curriculum frameworks (classifying living things into kingdoms, phyla, and classes, etc.) This type of activity could be adapted for use in many other areas.

Assessment/evaluation

What are your criteria for success? How will you know that this unit has had the student impacts related to the identified learning objectives?

As the students enter their observations into the database, I will be able to assess their observation skills (are they seeing what they say they are seeing?). By assessing their conclusions I can determine whether or not they know the characteristics of each rock type, and whether they understand the differences between them.

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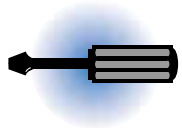

Classroom Observation Worksheet

As a technology planner you will want to know what kind of technology teachers are using and how they are using it in their classrooms. If teachers in your school or district do not yet use technology, we recommend that you locate a school that does and plan a visit to that school. Take time to observe teachers and students interacting with the technology during an actual classroom session. Follow up that observation with an interview with the teacher you observed. Also, interview other educational professionals in various schools to gather their thoughts and recommendations regarding technology use in the classroom. A reproducible version of the worksheet is included in the Appendix.

Appendix

Classroom Observation Worksheet

School _____ **Teacher** _____

Grade Level _____ **Subject** _____

Describe the types of computer applications the students are using in the classroom (tutorials, applications, exploration, or communication).

Technology was combined with traditional resources; the students were using electronic resources along with traditional print-based materials.
CD-ROM encyclopedias, atlases, and the WWW for research.
They were also using email to communicate with pen pals.

What is the instructional purpose of the activity?

Using electronic presentations to present ideas and information and to practice speaking skills.
Using e-mail to introduce letter writing and perhaps some social studies objectives as well.

Describe how technology is contributing to learning.

Students were able to express their ideas with visual aids that looked professional!

Other students were writing to children in other parts of the world–I need to remember to ask some of them what they are learning about other countries. I've never seen such long letters from children this young.

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Technology Integration Progress Gauge

SEIR•TEC developed another useful tool for planners to determine a school's or district's current status in five areas or domains impacting technology integration. The five domains are (1) Student Engagement, (2) Teacher Engagement,

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Technology Integration Progress Gauge (page 1 of 12)

State _____

School System _____

School _____

Completed By
(Circle all that apply)

a. District Staff School Staff
b. Administrator(s) Coordinator(s)
Teacher(s) Media Staff
Other: _____
c. Entire Faculty Tech Team
School Improvement Team
Other: _____

School Contact

Person: _____

Phone: _____

E-mail: _____

Reporting For (circle)

Fall 1999 Spring 2000

SEIR•TEC Coordinator

_____

Completion Date

_____

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Technology Integration Progress Gauge

Intensive Site Project—Site Profile

The intent of this instrument is to provide a simple tool to help school leaders (a) reflect on activities to date vis-à-vis effective practices in technology integration, (b) think about what needs to be done in order to impact teaching and learning through the use of technology resources, and (c) consider strategies for maximizing the impact of technology. The instrument is not to be used as an evaluation tool or an instrument to determine a grade. SEIR•TEC will not attempt to collapse individual intensive site profiles into a single figure, such as an average or grade. Similarly, there will be no attempt to rank intensive site schools according to the profile data. Instead this instrument is to be used as a tool to develop a school profile of technology integration and impact at periodic times during the intensive site project.

The instrument consists of the five domains presented in a table format. The domains (labeled I, II, etc.) are described by two or more indicators. Each indicator has four levels of implementation. The four levels are:

- **Minimal:** Little or no evidence of implementation.
- **Beginning:** Implementation is occurring and evidence exists of capacity-building strategies in place.
- **Intermediate:** Plans exist and activities have begun for scaling up to a higher or sustainable level.
- **Advanced:** Strategies and activities are institutionalized and evidence exists that changes made will be sustained.

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(3) Availability and Accessibility of Appropriate Resources, (4) Organizational Support, and (5) Community Involvement. A reproducible copy of the Technology Integration Progress Gauge is included in the Appendix. The one that follows is an example of how the tool might be completed for one district.

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Technology Integration Progress Gauge (page 2 of 12)

Instructions to SEIR•TEC Intensive Site Coordinator and District and/or School Contacts

Preparation:

1. Discuss the purpose of the instrument with district and/or school contacts.
2. Determine which school team or school staff will complete this instrument. Those selected should have responsibility for technology integration at the school.
3. Provide the group an overview of the instrument and the instructions for completing the form. Emphasize that this is a tool for reflection and marking current status of technology integration.
4. Establish a process for completing the instrument (e.g., individually first, then as a group; as a total group; parts by individuals, then consensus by the group).
5. Retain one copy of the instrument for final reporting.

Instructions to Intensive Site Staff

Completion:

1. Read the indicators for each domain and determine which of the four levels of implementation of each indicator **best describes** your school at this point in time.
2. **Circle the number** corresponding to that level of implementation. Do not circle more than one number or mark a halfway point. Select the level that **best represents your current level.** Interpret "few," "some," "many," and "most" as follows:
   a. few = less than 25% of the indicated group
   b. some = 25% to 75% of the indicated group
   c. many = more than 75% of the indicated group
   d. most = almost all of the indicated group
3. In the Comments/Supporting Information block, add information to describe the status of your project and list the sources for your decision. The responses in the Comments/Supporting Information block will be useful on subsequent completions of the Gauge in order to establish progress.
4. Use the three empty tables at the end of this instrument to add indicators that help describe other technology-related activities at your school. Completion of these empty tables is optional but may be necessary to provide a complete profile of technology integration and impact at your intensive site school.

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Technology Integration Progress Gauge (page 3 of 12)

Instructions to Intensive Site Staff and SEIR•TEC Coordinator

Reporting:

1. Prepare a final copy based on the decisions by the group.
2. Verify the contact and completion information at the top of page 1.
3. Make copies and distribute as follows:
   a. Original to SEIR•TEC Director
   b. Copy to intensive site school contact and/or district contact
   c. Copy for SEIR•TEC Intensive Site Partner
   d. Copy for SEIR•TEC Intensive Site Coordinator

Glossary

Community—Group including school members as well as public and private individuals, businesses, and /or agencies in the area served by the school.

Higher-level learning—Student activities involving one or more of the following: peer collaboration, integration of higher-order thinking skills, self-directed tasks, multidisciplinary assignments, authentic learning opportunities (based on real-world events or tasks).

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Technology Integration Progress Gauge (page 4 of 12)

Domains and Indicators

1 Level of Student Engagement

There is evidence that:

A. Students are involved in higher-order thinking skills activities supported by technology.

1	2	3	4
Few, if any, students are involved in learning activities requiring peer collaboration and interaction, technology applications, or higher-order thinking skills.	Some students are participating in technology-based learning activities requiring peer collaboration and interaction as well as higher-order thinking skills. A few students are sharing their technology skills in collaborative groups.	Many students are involved in authentic, technology-based learning activities requiring peer collaboration and interaction as well as higher-order thinking skills to solve real problems.	Most students are involved in self-directed, authentic, technology-based learning activities that are multidisciplinary and require peer collaboration and interaction as well as higher-order thinking skills to solve real problems. New products and understandings are evolving.
Comments/Supporting Information:			

B. Students are meeting the school's expectations for levels of technology use.

1	2	3	4
A few students are achieving levels of appropriate, initial technology use in learning activities, as defined by the school or school/district technology plan for their grade and the stage of implementation of the plan. Some students are exploring more advanced uses of technology.	Some students are engaged in activities to build the technology use skills expected for their grade and the stage of implementation of the school/district plan. Many students are achieving the expected levels and some students are developing skills in more advanced uses of technology.	Many students are applying the technology use skills and have documented mastery of the school expectations for their grade and the stage of implementation of the school/district plan. Many students are exploring more advanced uses of technology and some are demonstrating mastery.	Most students have met the school's expectations for technology use for their grade and for the stage of implementation of the school/district plan. Most are using regularly the skills mastered and are continuing to develop skills in more advanced uses of technology.
Comments/Supporting Information:			

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Technology Integration Progress Gauge (page 5 of 12)

2 Environment for Teacher Engagement

There is evidence that:

A. Teachers design and implement technology-based learning experiences that promote higher-level learning for students and authentic assessment.

1	2	3	4
Few or no teachers design and implement student activities that require peer collaboration or integration or use of higher-order thinking skills. They are using technology mainly for demonstrations with minimum adaptations and little integration into their ongoing program. Most teachers plan and teach in isolation.	Some teachers design and implement student learning activities requiring peer collaboration and interaction as well as use of higher-order thinking skills. Groups of teachers are collaborating on use of specific technologies and resources and some are implementing the ideas individually or as a team. Some teachers are using technology for assessment.	Many teachers design and implement authentic learning activities requiring peer collaboration and interaction as well as use of higher-order thinking skills to solve real problems. Many teachers are planning and teaching collaboratively, using specific technologies and resources. Some teachers are designing authentic assessment tools using technology resources.	Most teachers design and implement technology-based, self-directed, multidisciplinary, authentic learning opportunities requiring peer collaboration and interaction as well as use of higher-order thinking skills. Many use technology resources to plan and teach collaboratively and to design authentic assessment tools.
Comments/Supporting Information:			

B. Teachers demonstrate the expected level of technology use. (Levels from ACOT Study.)

- Entry: Teachers are inexperienced and, possibly, inefficient in the use of technology. Many have misgivings regarding technology innovation, and frustration is common.
- Adoption: Teachers begin to incorporate technology into existing teaching practice, primarily to teach about technology and as a means of delivering traditional instruction.
- Adaptation: Teachers are integrating technology into the traditional teaching day. Classroom practices are still primarily traditional, but use of the computer as a tool is pervasive. Productivity and increased performance on traditional measurements are used as indicators of success.
- Appropriation: Teachers use technology in everything they do, to the point that the use of the technology in the lives of teachers and students is almost transparent.

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Appendix

Technology Integration Progress Gauge (page 6 of 12)

Invention: Teachers are experimenting with new roles and new instructional strategies. The entire classroom is transformed and students are more engaged in learning and more self-directed.

1	2	3	4
Almost all of the teachers are engaged in activities typical of the entry stage. A few, if any, are beginning to model actions typical of the adoption stage.	A majority of the teachers has reached the adoption stage. Some teachers are beginning to discuss how to adapt the technology to teaching and learning with a few beginning to try customized versions of existing resources.	A majority of the teachers is engaged in the activities typical of the adaptation stage. Some of the teachers are beginning to combine technology resources and instructional strategies using technology in all learning activities.	A majority of the teachers is engaged in activities typical of the appropriation stage. A few teachers have begun exploring areas associated with the invention stage.
Comments/Supporting Information:			

C. Teachers integrate technology into all subject areas, using resources that map technology to curriculum.

1	2	3	4
Few teachers are aware of technology resources that support specific topics or lessons. There is no correlation or mapping of the existing resources to the curriculum. Few or no teachers are integrating technology into subject areas.	Teachers have access to a school inventory of available technology tools and resources. Mapping the technology resources to the curriculum has begun. Some teachers are piloting technology integration strategies and lessons.	Mapping the technology resources to the curriculum has been completed. Many teachers have been introduced to the guides that map technology to all subject areas. Some teachers have begun using them in their day-to-day instruction. Many teachers have begun limited technology integration lessons.	Most teachers are integrating technology into all subject areas, using the guides that map existing technology resources to the curriculum.
Comments/Supporting Information:			

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Technology Integration Progress Gauge (page 7 of 12)

3 Availability and Accessibility of Appropriate Resources

There is evidence that:

A. Technology resources are available and are being used to support a variety of student and teacher experiences.

1	2	3	4
Few teachers and staff know what technology resources are available and how to operate them. Few technology resources exist. They have not been inventoried recently nor checked for operational status.	Some teachers and staff are learning to operate specific technology equipment. Some technology resources have been checked and inventoried by location and primary use.	Many teachers have received information on the technology resources available. Some teachers have used selected resources for instructional activities.	Most teachers are using a wide variety of the available technology resources.
Comments/Supporting Information:			

B. Technology has been allocated in such a way as to support its constructive use in the teaching and learning environment.

1	2	3	4
No plan exists to allocate technology resources to maximize the impact on teaching and learning. Location of existing technology resources is based on past use, initial program purchase, or personal request. Few, if any, teachers have expressed an interest in a change in the allocation of the technology resources.	Some discussions have occurred to design an allocation and replacement schedule to support constructive use of technology in the classroom, labs, and media center. For example, a school technology team is studying the current allocation of technology resources and the related allocation policies.	A plan is being implemented to allocate the existing technology resources for maximum use and impact on student learning. Work is in progress to design an allocation schedule for future purchases and routine upgrades. Individuals are identified to be responsible for maintaining this allocation process.	The technology resources in the school are available for just-in-time learning experiences, whether through a checkout standalone mode or by a networking environment. School staff has input on allocation of existing and new technology resources.
Comments/Supporting Information:			

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Technology Integration Progress Gauge (page 8 of 12)

C. School individuals have equitable access to technology.

1	2	3	4
Limited access to the technology resources is available to the school staff during school hours and from school locations. Discussions may be occurring on extending access, from off-school sites and beyond the school day.	A group of school staff is testing access to school technology by checkout and by telecommunications after school hours and from homes. The school is developing policies on access to school technology by staff and students.	A policy exists for use of school technology by staff and students and has been shared. Guidelines on equitable use are being developed. As a result of the pilot testing, an expanded number of staff and students are now using school technology resources.	Technology resources are accessible to the school staff and students on an equitable basis and from off-site locations and beyond school hours. Access is based on policies in the school technology plan. Staff members are making routine use of the resources.
Comments/Supporting Information:			

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4 Organizational Support

There is evidence that:

A. Organizational structure exists for support of all aspects of technology integration.

1	2	3	4
Within the school and the district, there is little to no organizational structure to support technology use or set direction for technology integration.	The need for support of technology integration has been recognized and school staff members have been assigned to provide minimal support. A group has formed to identify what type of support is needed for technology integration.	Individuals are identified to provide hardware and instructional support to staff. The school is addressing reports on or requests for support needed for successful technology integration.	School and district leaders have designated personnel and approved a process for supporting technology integration via training, maintenance, technical assistance, purchasing consultation, and instructional modeling. Periodic input on the support needed is gathered.
Comments/Supporting Information:			

B. Organizational capacity fosters transformations in school leadership to support technology and the changes it brings to teaching roles and methodologies.

1	2	3	4
No policies exist at the school or district level that encourage school leaders to use technology. Few opportunities occur for school leaders to gain technology skills or to witness use of technology in the instructional program at model schools or conferences.	School leaders are beginning to use technology for work and to participate in meetings and sessions on technology use in changing teaching and learning in the classroom. Discussions have occurred about developing policies on the use of and support for technology by school leaders.	Many school leaders are using technology routinely for their work and are supporting requests from teachers to gain technology skills or participate in events focusing on technology integration. The school is developing policies that will foster use by and support from school leaders for technology and change.	Policies exist and opportunities occur regularly from the district and/or regional level that encourage school leaders to be users of technology and to support technology in the instructional program. As a result, most school leaders routinely use technology themselves, initiate reviews of technology use, and encourage use by staff.
Comments/Supporting Information:			

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C. Policies exist that support the equitable availability and use of technology.

1	2	3	4
Neither school nor district policies exist on equitable availability and use of technology.	School and/or district policies have been developed for equitable availability and use of existing technology. Random strategies are being implemented to ensure equity.	A school plan for implementing technology to ensure equitable availability and use for teaching and learning is in place. Successful strategies for equity are being identified.	Schools are following district policies on equitable availability and use of technology. Technology activities based on equitable availability and use are incorporated into school improvement plans and staff professional development plans.
Comments/Supporting Information:			

D. Effective and ongoing staff-development opportunities exist to support capacity building for using technology to improve teaching and learning.

1	2	3	4
Although technology-based staff-development topics have been identified, only a few, unrelated technology-based staff-development activities have occurred.	Some technology-based staff-development sessions have occurred and initial activities resulting from the sessions have been tried in classrooms. Teachers have begun seeking ways to integrate technology.	A staff-development plan, including evaluation of student and staff needs, exists for using technology to improve teaching and learning. Some teachers are collaborating on best practices in using technology in teaching and learning. Teachers are being evaluated on their effective use of technology as a result of training sessions attended.	School and district administrators support continuous staff-development opportunities for improving teaching and learning, with seamless technology uses. A committee exists to provide long-range planning on technology-based staff development and sharing of best practices. Use of technology effectively is an integral part of the teacher evaluation process.
Comments/Supporting Information:			

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E. Teachers and administrators use technology as an information management tool.

1	2	3	4
Although teachers and administrators are aware of information management tools, few, if any, staff members are using such tools.	Some school staff members have access to and have received training to use information management tools.	Many school staff members use information management tools for daily classroom tasks and for submitting reports and documents. Some staff members are seeking new tools and additional uses for existing tools.	Most school staff members prepare and submit reports and documents using information management tools as required by administrators. Many school staff members provide regular input on new tools needed.
Comments/Supporting Information:			

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5 Community Involvement

There is evidence that:

A. Community supports the school's integration of technology in teaching and learning.

1	2	3	4
Plans may have been developed but not implemented to inform the community of the school's efforts to integrate technology.	Some segments of the community are knowledgeable of the school's efforts to integrate technology into teaching and learning.	Many community groups have plans in place and have begun activities to enhance the current technology integration activities of the school. Community members are meeting with school groups to plan technology integration activities.	Most community groups support technology integration into the school's teaching and learning environment by maintaining a consistent presence in school activities. Ongoing school committees are required to include community members.
Comments/Supporting Information:			

B. Community shares in the use of the school's technology.

1	2	3	4
Few or no plans exist for the community to use the school's technology.	Some school and community members are developing policies and strategies for community members to use the school's technology; e.g., for after-hours adult literacy training or e-mailing with teachers.	Several community groups are beginning to use the school's technology according to approved policies and guidelines.	The school and community members actively promote community groups' use of the school's technology.
Comments/Supporting Information:			

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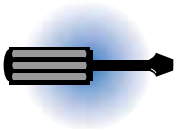

Resources for Integrating Technology into the Curriculum

To help you further understand how technology is being integrated into the classroom, you can see what teachers have written about their work by going to the Internet. Online resources do not always have to incorporate telecommunications technology. Often, it is possible to find places where teachers have posted information about projects that in and of themselves use only stand-alone, non-networked hardware and software.

The following URLs are locations on the Internet where you can view entire lesson plans that make use primarily of applications technology such as spreadsheets, word processors, database management programs, and presentation tools. You may want to use many of these sites for ideas, and then proceed to adapt these ideas for your own classroom needs.

Online Resources with Specific Project/Lesson Ideas

http://www.schoollife.net/schools/ggl
What do you eat in your country? This site is an interdisciplinary project in which students can learn about other countries. Students go to a grocery store and compile a list of items, then put these items on a spreadsheet. Through e-mail and the Internet, students are able to compare the prices in different countries to their own. A variety of technology tools can be integrated within the project's activities.

http://www.microsoft.com/education/lesson/productivity/aknow.asp
The activity guide is organized first by major subject area (social studies, language arts skills), then into more specific categories (history, mathematics, and creative writing). The links will take you to a list of lessons organized by primary and secondary activity focus. Here you may choose to view individual lessons online or download a file containing all lessons related to the subject. The lessons make use of basic Microsoft productivity applications (word processors, spreadsheets, etc.). Most lessons would be adaptable to using any publisher's software, not just Microsoft's.

Sites that Compile Project Ideas and Resources

http://henson.austin.apple.com/edres/ccenter/curriccenter.shtml
Apple Computer's Curriculum Center is an excellent resource. It is organized by grade level and subject area.

http://www.kn.pacbell.com/wired/bluewebn/
Blue Webb'n is a site that links to several hundred curriculum projects, lesson plans, and general-curriculum resources that make use of Internet technology. The resources are organized by subject, grade level, and type and are ranked by a panel of reviewers. An excellent resource!

http://www.ed.gov/offices/OERI/ORAD/KAD/expert_panel/index.html
The US Department of Education has established its *Expert Panels* program to identify promising and exemplary educational practices. One panel has been devoted to identifying programs related to educational technology.

http://www.enc.org
The Eisenhower National Clearinghouse is a federally funded resource that links to resources for K–12 math and science teachers.

http://www.solutions.ibm.com/k12/teacher/activity.html
IBM has a well-organized site that supports K–12 teachers. Many of the activities are related to the Internet but can be adapted to nontelecommunications technology as well.

http://discoveryschool.com/schrockguide/
Kathy Schrock's Guide for Educators is one of the most comprehensive, best-organized guides to online resources available to K–12 teachers. This site is actually a subject guide to resources organized by curriculum area.

Print Resources

Sandholtz, Judith H.; Ringstaff, C.; and Dwyer, David C. 1997. *Teaching With Technology: Creating Student-Centered Classrooms.* NY: Teachers College, Columbia University.

Putting It All Together

A conversation about curriculum integration

What are most teachers actually doing with technology in the curriculum?
This is very interesting, and it would be great if more teachers could see what their peers were actually doing versus what the technology industry *hopes* that they are doing. Based on our observations in schools, we find that most technology-using teachers are using tutorial software applications.

I see this starting to change as more staff-development sessions focus more on *curriculum development and technology integration,* instead of technology training. It's not news, but it's *hard work* to figure out a valuable use of a spreadsheet or a World Wide Web resource that really warrants the use of that resource. Most teachers just have not had the time or been motivated to do that work. On the other hand, they've been told to use technology as a sort of blank directive. Without some serious work and reflection on curriculum and the value of technology in teaching and learning, most will go for the easiest known approach, which is to use prepackaged software targeting single curriculum objectives. So it's not surprising to see a lot of drill and practice, low-level technology projects, and electronic recess (playing games).

Fortunately, technology such as the Internet and productivity applications (word processors, presentation managers, etc.) are becoming so prevalent in both schools and the community that *students* are beginning to lead teachers in terms of suggesting ways that technology can be used in processes and procedures of learning. So we are beginning to see more use of World Wide Web resources, word processing, and electronic presentations by both students and teachers. When a student suggests that technology might be used as a tool for collecting, analyzing, or reporting some information, that student is demonstrating a keen understanding of the value of technology. I have met many teachers who are picking up on this trend and thus beginning to encourage a tool approach to technology. Of course, the problem is that not all students have access outside of school and thus are not making these suggestions. This is certainly the case in many of the disadvantaged communities that SEIR◆TEC serves. In these cases, the teacher truly must lead the way. Therefore, improving the skills of these teachers becomes our biggest challenge.

What kinds of issues do you see confronting teachers working to integrate technology?
We'll talk about infrastructure—that is, hardware, networking, equipment, and that sort of thing—later. So putting aside infrastructure issues for a moment, let's turn directly to issues of curriculum.

We firmly believe that any exploration of technology integration absolutely must start with an examination of curriculum. In other words, what do we want students to know, and when do we want them to know it? If you don't have

definitive answers to that question, then you really have no basis for deciding what, if any, technology should be integrated. The curriculum and its alignment with either district or state standards is the key issue.

Teachers who are not masters of their curriculum often end up teaching technology for technology's sake. So often, in fact, that I've concluded that some teachers simply do not realize that they are *teaching* technology versus *integrating* technology. Simply stated, technology in itself is not a substitute for a well-designed curriculum. Furthermore, technology will not improve weak instruction or poor planning. As we have stated previously, the goal of technology integration is to *support* instruction with tools that bring new meaning to learning and discovery.

Since you mentioned it, what about managing the hardware as part of technology integration? I guess that's what you mean by *infrastructure*.
Well, this is actually the subject of Chapter 6, and that's probably the best place to fully discuss the issue. But, yes, managing hardware (infrastructure) represents a major problem to many teachers. This is why one of the first steps we recommend toward implementing technology is an inventory of available technology, including hardware and software. Many teachers assume that they have nothing. While this may be true in some cases, an inventory of available technology often brings some surprises. A good example of this is the belief by one of our school districts that they didn't have any good hardware, or software. Because of a strict policy limiting network access, teachers didn't know how to use what they had. However, after we spent some time with them, the teachers found that some of the technologies they already had could be used for instructional purposes.

First you talk about curriculum integration in a classroom context and then you talk about integration in the school or district. Is there a difference?
Good observation! Technology integration has both a broad meaning and a more specific meaning. In the broadest way, it means the use of technology every day by everyone to support work, leisure, or learning. Curriculum integration is more specific to classroom settings. For some schools, curriculum integration is synonymous with the broader definition of integration. However, you can choose to apply it to your situation as you see fit. But keep in mind that successful integration depends on a lot of things happening to support it—appropriate staff development, appropriate hardware and software, adequate funding, and communication. Our experience shows that integration is mostly about people and attitudes and has less to do with buying and installing hardware. After all, everyone in a school or district will be affected, one way or another, when technology is introduced.