TECHNOLOGY COACH

HANDBOOK

A Resource to Support Effective Technology Integration

Deborah Lowther • Michael Grant
Eric Marvin • Fran Clark • Blake Burr

Sponsored by
ATEC
The Appalachian Technology
in Education Consortium

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PREFACE

Welcome to the Technology Coach Handbook! This resource has been written and reviewed by educators who use and help other teachers to use technology to support everyday teaching and learning. The Appalachian Technology in Education Consortium (ATEC) sponsors the development and distribution of the Handbook. ATEC's overall goal is to provide research-based assistance and practical solutions to educators striving to integrate technology into the classroom experience.

We hope the information and ideas shared in this Handbook will enhance and better enable you to foster meaningful use of technology in today's schools.

Rationale & Intended Users

Many of today's schools are using a Technology Coach model as a way of meeting the No Child Left Behind (NCLB) goal to "improve student academic achievement through the use of technology in elementary schools and secondary schools" (United States Department of Education, 2001). This approach typically involves the designation of a teacher or technology coordinator as a full-time technology coach who assists schools with technology integration initiatives. It is believed that the use of an on-site technology coach that provides on-going and embedded support will result in teachers being better able to integrate student use of technology as a tool to enhance learning (McKenzie, 2003). Although most technology coaches can easily use a variety of technology resources and are familiar with classroom uses of technology, their effectiveness is often inhibited by a lack of resources and support that specifically address the needs of coaches (Ross & Lowther, 2002). With steady use, we hope technology facilitators will find this handbook an invaluable resource, resulting in dog-eared pages and personal notes.

The content of this Handbook is targeted toward technology coaches, technology facilitators, technology resource teachers, and technology coordinators all of whom are responsible for developing and providing teacher training, one-on-one mentoring, and facilitating school-wide technology integration efforts. Individual school coaches and district-wide coordinators will find the explanation, descriptions, examples, templates, handouts and references useful. Districts or schools considering a technology coach model may use this resource as a roadmap for achieving successful technology integration.

Objectives

The Technology Coach Handbook is based on the assumption that technology coaches need to understand and be able to model the most effective research-based instructional practices and technology integration strategies. In order to be a teacher trainer/mentor, coaches need the skills to create professional development environments where teachers feel safe and comfortable, yet are challenged and inspired to improve their level of technological competence to enhance classroom practices. Since coaches need to assist teachers with computer skills, and most schools do not have adequate support to address technical problems in a timely manner, it is essential for the coaches to also have basic trouble-shooting skills.

Therefore, the major objectives of this Handbook are to provide technology coaches with the knowledge and skills to:

- Create technology integration environments in which students effectively use computers as tools to enhance learning.
- Assist teachers to integrate effective student use of technology into everyday teaching and learning.
- Facilitate the successful implementation of a school-wide technology integration initiative.

Content

The Technology Coach Handbook is divided into the following six sections:

Section 1: Technology Coach Roles and Responsibilities

This section provides a rationale for implementing a technology coach model. It describes the traits of a successful technology coach, job responsibilities, and what a successful technology program looks like when national and state standards are achieved.

Section 2: From Theory to Practice

The content for this section covers NCLB, national and state technology and curriculum standards, research-based practices, and effective integration approaches (e.g., enGuage, NTeQ).

Section 3: Effective Technology Integration

This section provides step-by-step guidance for knowing when it is appropriate to have students use technology. It also provides several different approaches for developing technology integration lesson plans.

Section 4: The Computer as a Tool

The focus of this section is on how to use basic software applications to engage students in higher-level thinking to improve student learning. Multiple examples and practice sheets are provided for each tool.

Section 5: Planning Professional Development

This section of the handbook switches the focus from integration techniques to professional development. It provides suggestions, strategies, and hands-on activities that coaches can use to assist teachers with technology integration efforts. It also provides support for facilitating a school-wide technology initiative.

Section 6: Managing Technology Resources

The final section of the Handbook provides coach-to-coach tips for managing a school's technology resources, including hardware and software record keeping, maintenance and purchases.

Structure

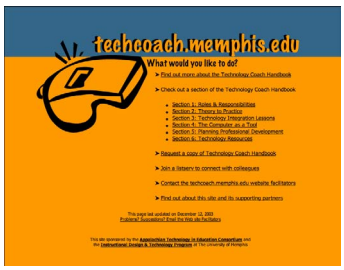
Each handbook section includes:

- *Concise, easy-to-understand information*
- *Hands-on practice*
- *Numerous examples*
- *Coach-to-coach tips*
- *Step-by-step guidelines*
- *References*
- *Templates*
- *Reproducible materials*

Organization

These materials have been formatted for insertion into a 3-ring binder to allow for the easy removal and replacement of reproducible templates and handouts used for reproduction of materials. The three-ring binder format also allows coaches to add resources and reorganize the materials into an individualized system. Coaches may find it useful to append additional tabs or sections in order to maintain a single resource that meets individual needs.

Technology Coach Website



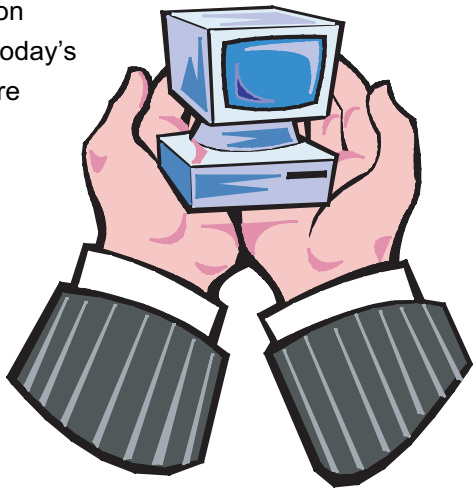
ATEC (http://www.the-atec.org) has a companion web site (http://techcoach.memphis.edu) that directly aligns with and extends the resources found in the Technology Coach Handbook. For example, full-text articles for those that are summarized or referenced in the handbook, additional resources for each topic, example student work for lesson plans presented in handbook, and PDF and Word documents of all templates are included on the website. In addition, this site offers an online community and up-to-date resources specifically targeted to meet the needs of technology coaches.

SECTION 1

Roles & Responsibilities

Introduction

The world in which we live thrives on brainpower and the ability to acquire and effectively analyze information (Moe & Blodgett, 2000). During the Industrial Age of years past, it was sufficient for our educational system to prepare students to complete individual tasks, memorize work, and to obey, rather than question authority (Morrison & Lowther, 2002). In that labor-intensive society, assembly-line education was appropriate. Today, however, in our Information Age, our educational system is rightfully facing pressures to embrace deeper, higher-order thinking. Information, as the "basic currency" of our economy, is abundant and literally only a mouse-click away (Web-based Education Commission, 2000). With these realizations, today's educators must be doing all they can to prepare students for the workforce they will soon be encountering.



Unfortunately, however, a shift to this new, knowledge-based educational approach will not happen without planned effort and implementation. If our nation's high school graduates are to be individuals who can analyze situations, solve problems, and develop new solutions, we as educators must devote time to showing them how to become such thinkers (Healy, 1999).

As someone who is reading this handbook, it is likely that you have an interest in helping students become the type of learners that our new economy demands. Regardless, you may still have many questions about what this specifically means for your role as an educator. Don't fret; you are in the right place. The purpose of this handbook is to provide educators like you with some specific, practical advice regarding what it means to be a leader in the implementation of a school-wide initiative that will enable teachers to facilitate the type of learning environments that today's students deserve.

Although it has only been implied up to this point, it is important to clearly recognize that the Information Age in which we live is highly reliant on the use of information and technology. Effective uses of technology are present because they have entered our world to solve real-world problems. In an educational context, there have been many exciting new possibilities for school organization, curriculum design, teacher professional development, and digital technology use (Chen, 2002). In other words, the emphasis on the use of technology within schools as a means of enabling students to become the thinkers of our economy is not by chance, but by purposeful necessity.

The role of a technology coach

It is within this context that the role of a technology coach becomes readily apparent. If schools are to purposefully prepare students for the Information Age workforce, someone within each local school or school district must be leading educators and students in the direction of the future. This is the role of a technology coach.

Merely placing someone within a school district and calling her or him a "technology coach" does not necessarily mean that that school or school district will be properly preparing students for the Information Age. There are three general areas for which a technology coach is responsible. This handbook explores the roles and responsibilities for technology coaches with respect to:

- Understanding effective technology integration,
- Enabling teachers to effectively integrate technology, and
- Facilitating a school-wide technology effort.

Technology coaches must be effective within all three of these areas, which will be described in greater detail throughout the context of this handbook. While these three general areas define the role of a technology coach, there are traits unique to a technology coach, as well as signs that a technology coach has facilitated a healthy and robust program that supports the teacher and his or her school.

Traits of a successful technology coach

Overall, there are several traits that exemplify an effective technology coach. For the most part, being an effective technology coach requires an ability to help teachers learn new technologies within an adult learning environment by offering them great amounts of "informal, highly customized support" (McKenzie, 2002). Specifically, this implies an ability to be someone that colleagues trust to help them with the development of necessary technology-related skills and lesson planning (McKenzie, 2002).

A technology coach's particular interactions with specific teachers will undoubtedly vary according to specific needs and levels of experience. This point is especially relevant when considering the task of reaching reluctant, technologically skeptical teachers. After all, they are at the core of individuals a coach would like to reach, despite their resistance to suggestions and input. Although more will be said in a later section about how to reach such teachers, it is of primary importance to recognize that one of the last things a coach wants to do is upset or alienate such reluctant teachers (McKenzie, 2002).

Nevertheless, considering the way in which a coach interact with such skeptical teachers highlights one of the many hats of an effective technology coach. Obviously, at times a coach must be a cheerleader, encouraging all teachers to move forward; a fan, providing recognition to those doing a good job; and an ally, promoting a path in which implementation can work. But perhaps not as obvious, a coach must also at times be a sidekick, allowing teachers to take the lead; a listener, customizing support services to individual needs; and a confessor, admitting when things do not work as planned (McKenzie, 2002).

Beyond the traits a coach must possess in order to be effective, it is likely that he or she will want some signs that things are going as planned. After all, how will a coach know if his or her efforts are working? Although there are a variety of ways to make such a determination, some of the more practical methods can be casually witnessed. As a coach begins to see teachers use technology appropriately on a daily basis, assume the role of a facilitator, discern how and why technology is used, and emphasize standards-based, student-centered research and questioning, he or she will begin to realize that such efforts are fully worthwhile.

With all of this said, it is hopeful that a clearer idea about the role of technology coaches and their relevance to today's educational system has been presented. With this understanding, attention is now turned to the three roles of a technology coach.

Introduction adapted from: Marvin, E. D. (2003, November). *Does teacher confidence in technology skills vary based on grade level of instruction or teaching experience?* Paper presented at the meeting of the Mid-South Educational Research Association, Biloxi, MS.

Why Technology Integration?

In order to be an effective technology coach, it is critical to have an understanding of the purpose for technology integration. Later chapters will illustrate how to mentor, support and enable teachers to succeed at technology integration, as well as how to plan and implement a technology integration effort.

This chapter deals with comprehending the responsibilities technology coaches have for technology integration. This chapter will examine:

- Workforce expectations
- National benchmarks
- Content guidelines

Workforce requirements, national legislation, and educational standards all play a part in what is expected regarding technology integration.

What is expected?

Technology coaches should be aware of the expectations for their job. Workforce requirements, national legislation, and educational standards all play a part in what is expected regarding technology integration.

Regarding workforce requirements, the Secretary's Commission on Achieving Necessary Skills (SCANS) report from the United States Department of Labor provides some insight. According to this report, five competencies are needed by today's workforce. One of these competencies is the ability to work with a variety of technologies. Specifically, this report identifies three areas in which employees should be competent: selecting technology, applying technology to task, and maintaining and troubleshooting equipment (U.S. Department of Labor, 1991). Further research has identified the most common uses of computers by employees who use computers. They are as follows: bookkeeping/invoicing (66%), word processing (57%), communications (47%), analysis/spreadsheets (41%), and calendar/scheduling (38%) (Snyder and Hoffman, 2002). If today's students are going to be prepared to effectively use these tools, they must begin by gaining hands-on experience with them. Technology coaches must recognize these workforce requirements in order to provide the necessary direction to their schools.

National benchmarks

In addition, government leaders expect to see technology effectively integrated into our nation's schools. In his educational reform plan, *No Child Left Behind*, President George W. Bush is advocating support for technology. According to this plan, his administration has a primary goal to "improve student academic achievement through the use of technology in elementary schools and secondary schools" and to ensure that "every student is technologically literate" (United States Department of Education, 2001). No doubt, the federal government realizes the importance of reform within our educational system and the importance that technology plays in ensuring that the next generation is properly prepared to meet the demands of the information age.

Furthermore, educational standards set expectations for technology to be effectively integrated into our nation's schools. The International Society for Technology in Education (ISTE), one of the leading organizations responsible for creating national educational technology standards, has researched and devised what it believes is the type of learning environment that is needed to prepare students for a knowledge-based society. They rightfully address school reform from a highly regarded perspective that blends traditional and new approaches to learning. They suggest the following characteristics as components of the type of learning environment that is needed to prepare students for the information age:

- Communicate using a variety of media and formats
- Access and exchange information in a variety of ways
- Compile, organize, analyze, and synthesize information
- Draw conclusions and make generalizations based on information gathered
- Use information and select appropriate tools to solve problems
- Know content and be able to locate additional information as needed
- Become self-directed learners
- Collaborate and cooperate in team efforts
- Interact with others in ethical and appropriate ways (International Society for Technology in Education, 1998, pg. 2).

With these guidelines, one can more clearly understand the expectations of a technology coach and the type of environment that is needed to be effective in K-12 technology integration.

Additionally, ISTE's standards include six broad categories as "Technology Foundation Standards" (ISTE, pg. 5). The six standards are as follows:

1. Basic operations and concepts
2. Social, ethical, and human issues
3. Technology productivity tools
4. Technology communications tools
5. Technology research tools
6. Technology problem-solving and decision-making tools

These foundation standards also clearly identify what leaders in the field of educational technology recognize as key components of technology use within all K-12 schools. They therefore, provide technology coaches with a clearer understanding of the expectations for their role within the K-12 environment.

Content specific guidelines

In addition, national discipline-specific organizations have established national curriculum standards in which they recommend the use of technology to support learning. The National Council of Teachers of English includes in its standards that students should "use a variety of technological and information resources to gather and synthesize information and to create and communicate knowledge" (National Council of Teachers of English, 2003). Similarly, the National Council for the Social Studies recommends as a part of its pedagogical standards that teachers should ensure that students are able to use "media communication techniques that foster active inquiry, collaboration, and supportive interaction in the classroom" (National Council for the Social Studies, 2003).

Likewise, according to the National Science Education Standards, K-4 students should be able to develop skills in the use of computers "for conducting investigations" (National Academy of Sciences, 2003), while 5-8 students should be able to use "computers for the collection, summary, and display of evidence" (National Academy of Sciences, 2003). And, finally, the National Council of Teachers of Mathematics recommends that K-2 students "represent data using concrete objects, pictures, and graphs", 3-5 students "represent data using tables and graphs such as line plots, bar graphs, and line graphs", and 6-8 students use bar graphs and histograms to represent data and decide which display is appropriate (National Council of Teachers of Mathematics, 2003).

State standards

State departments of education also provide standards to educators within their state regarding their expectations of technology use in K-12 schools. The Virginia Department of Education, for example, recommends that by the end of grade five students be able to:

- Demonstrate a basic understanding of computer theory, including bits, bytes, and binary logic;
- Develop basic technology skills;
- Process, store, retrieve, and transmit electronic information; and
- Communicate through application software Virginia State Standards of Learning for Computer/Technology Skills (2001).

The West Virginia Department of Education holds similar expectations regarding what they expect regarding technology use within K-12 schools. Their state board of education recommends that students use technology tools for the following purposes:

- To be actively involved in critical thinking and problem solving;
- To collaborate and cooperate;
- To develop as productive citizens; and
- To enhance academic achievement and workplace readiness (West Virginia Department of Education, 2003).

Although these are only two examples of state expectations for technology use within K-12 schools, they exemplify the role states have in encouraging the use of technology in education. Further, they provide direction to the type of leadership that technology coaches should provide when implementing the use of technology in local school environments.

Clearly, the issue of technology integration is addressed by people who hold many expectations. Workforce requirements, national legislation, and educational standards all have expectations regarding what should be occurring within our nation's schools concerning the issue of technology integration. Although these influences may appear too overwhelming to implement, one must remember that such expectations are in place to assist and provide direction to the way in which local goals should be implemented. That is, the variety of expectations are not there as stumbling blocks or purposeful hindrances to technology integration. Rather, they are a road map providing direction to success.

Let's Practice

In my state, when should students use technology?

This chart, along with your state technology standards, can be used to determine when students should be introduced to specific types of computer hardware and/or software. See the example below. Follow the directions below to create a chart that is specific for your state.

Sample: Technology by Grade Level Introduced

Software Used	Grade Levels			
	K-2	3-5	6-8	9-12
Word Processing	X	X	X	X
Spreadsheets	X	X	X	X
Internet Browser	X	X	X	X
HTML			X	X

Directions:

- Determine the grade level divisions of your State Technology Standards and add them as column headers under Grade Level Divisions.
- Begin reviewing the technology standards with the lower grades and each time a specific hardware or software is mentioned, add the name to the chart and place an "X" in the appropriate grade level column.
- Continue the same process with each grade level division, adding software as it is mentioned.

Software Used	Grade Levels			
	K-2	3-5	6-8	9-12

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SECTION 2

Theory to Practice

What Are Research-Based Best Practices?

How to Create New Learning Environments

How to Create Critical Thinking Activities

How to Create Problem-Based Learning Activities

How to Achieve Successful Problem-Based Learning

How to Go from Objectives to Problem Statements

How to Use Technology to Improve Student Learning

How Do Teachers and Students Use Computers?

What Is Effective Student Use of Technology?

The enGauge Model

The NTeQ Model

What Are...

Research-Based Best Practices

The *No Child Left Behind* (NCLB) policy is structured upon an education blueprint of four priorities. This section of the Handbook is focused on the second priority which states:

Focus on What Works:
Federal dollars will be spent on effective research-based programs and practices. Funds will be targeted to improve schools and enhance teacher quality.

The context for examining "What Works" comes from the NCLB Enhancing Education through Technology proposal (NCLB, 2001) which states that, "schools should use technology as a tool to improve academic achievement…"(p. 22). For schools to implement this type of approach, classroom environments need to modify traditional instructional practices to create new learning environments that better prepare our youth to actively contribute to today's society. The following section provides research-based approaches that provide guidance for transitioning from a traditional learning environment to one that is student-centered and actively engages students in higher-order learning. To address these issues, two approaches are presented: generative learning strategies and problem-based learning.

How to...

Create New Learning Environments

The International Society for Technology in Education (ISTE) suggests that an "essential condition" for successful use of technology is to implement a student-centered approach to learning. The underlying reasoning is that today's workforce requires employees to actively participate in a collaborative environment that utilizes multiple resources and technology tools to solve a variety of problems. To prepare our youth for this world, our classrooms must incorporate new, research-based components into traditional approaches that are proven to be successful. Below is a chart that illustrates these needed changes.

ESTABLISHING NEW LEARNING ENVIRONMENTS

Traditional Learning Environments	New Learning Environments
Teacher-centered instruction	Student-centered learning
Single sense stimulation	Multisensory stimulation
Single path progression	Multipath progression
Single media	Multimedia
Isolated work	Collaborative work
Information delivery	Information Exchange
Passive learning	Active/exploratory/inquiry-based learning
Factual, knowledge-based learning	Critical thinking and informed decision-making
Reactive response	Proactive/planned action
Isolated, artificial context	Authentic, real-world context

In order to achieve the new, student-centered environments, ISTE suggests that it is important to engage students in learning experiences that require them to:

- Communicate using a variety of media and formats
- Access and exchange information in a variety of ways
- Compile, organize, analyze, and synthesize information
- Draw conclusions and make generalizations based on information gathered
- Know content and be able to locate additional information as needed
- Become self-directed learners
- Collaborate and cooperate in team efforts
- Interact with others in ethical and appropriate ways

As can be seen, many of these activities involve students utilizing technology as a tool needed to achieve the intended outcome. As this is true, attention is turned to the more relevant issue: How can teachers create these new learning environments (Source: http://cnets.iste.org/students/s_esscond.html)?

How to...

Create Critical Thinking Activities

When students are engaged in critical thinking activities that require them to process and apply new knowledge and skills in a meaningful context, they are better able to generate deeper understanding. This higher level of comprehension helps students to retain and utilize the newly gained knowledge and skills in a variety of ways. These types of activities can be done with or without computers. However, computers enable students to focus on the critical elements of processing information rather than on the tedious, organizational tasks that are not directly related to the overall learning task. Here is an example problem that students from a social studies class might be asked to solve:

> Examine the population growth patterns of the United States, Europe, and Asia, and predict the status of these in 50 years.

If using a calculator, students would have to re-enter information multiple times to examine each trend – thus increasing the possibility of errors and the level of student frustration. If a computer with spreadsheet software were used, the data would only be entered once and students could then concentrate on creating formulas that extract the needed information to examine the differences in population growth and predict future trends – the ultimate goal of the lesson.

An easy way to ensure that your students engage in critical thinking activities is to include one or more of the following **generative learning strategies** in each lesson: recall, integration, organization, and elaboration (Whittrock, 1990). A detailed description of these strategies and some practice items are presented below.

Generative Learning Strategies

- Recall
- Integration
- Organization
- Elaboration

Generative Learning Strategies

Generative learning strategies require students to generate or construct meaningful relationships between their prior knowledge and new information being taught. Each strategy has students interact with the information by processing it in different ways, thus reinforcing deeper understanding and better supporting the transfer of knowledge and skills to new situations.

Level of Thinking	Type of Generative Strategy	Suggested Student Activities
Requires **LOWER-LEVEL** Thinking	**RECALL** Helpful for learning facts and lists for verbatim recall	• Repetition • Rehearsal (e.g. mental practice) • Review • Mnemonics
Requires **HIGHER-LEVEL** Thinking	**INTEGRATION** Useful for transforming information into a more easily remembered form	• Paraphrase • Generate questions • Generate examples
	ORGANIZATION Helps learner identify how new ideas relate to existing ideas	• Analyze & interrelate key ideas • Outline • Categorize
	ELABORATION Requires learner to add his/her ideas to the new information	• Generate mental images • Create physical diagrams • Expand sentences or stories

Adapted from: Morrison, G. R., Ross, S. M. & Kemp, J. E (2004). *Designing effective instruction: Applications of instructional design* (4th. Ed.).

Let's Practice

Identifying Generative Learning Strategies

This activity will help you determine if the listed classroom activities will engage students in higher or lower levels of learning as you identify the type of generative strategy used for each one.

Generative Learning Strategies Handout

Directions: Complete the following table by listing a computer application that could be used with the learning activity. Then, identify the type of Generative Learning Strategy that is being used. Some activities may use more than one strategy.

Ideas for Enhancing Learning	Possible Computer Application	Generative Learning Strategy
Write the " Pledge of Allegiance" .	Word Processor	Recall
Rewrite information from a CD encyclopedia on insects to be used in a report on local pests.	Word Processor	Integration
Write a five-minute play in which the characters reflect life in an Aztec village.	Word Processor	Elaboration
Categorize the food you have eaten in the past week according to calories, fat and protein content.	Database	Organizational
Draw five common objects that contain an isosceles triangle.	Draw	
Make a list of questions and possible answers to be used in interviewing an Indian chief from the 1800' s.		
Name the planets that revolve around the sun, beginning with the one closest to the sun.		
Compare and contrast two themes found in Romeo and Juliet.		

Ideas for Enhancing Learning	Possible Computer Application	Generative Learning Strategy
Create a presentation using only graphics to accompany Martin Luther King' s " I Have a Dream" speech.		
Classify items in your refrigerator as liquid, solid, or gas.		
Recite the multiplication tables from 5 to 8.		
Create your version of a Monet painting.		
Create a timeline of the Civil War.		
Group the pictures by time of year: Spring, Summer, Fall, Winter.		
Rewrite the " Preamble" to the Constitution so a 3rd grade student could understand the meaning.		
Compare circulatory systems of three animals.		
Determine if electricity or gas is the most economical fuel in your community.		
Which route is the shortest from your home to Washington, DC?		
Draw and label the main parts of a flower.		
Write a poem.		
Give three examples of an equation using negative expressions.		

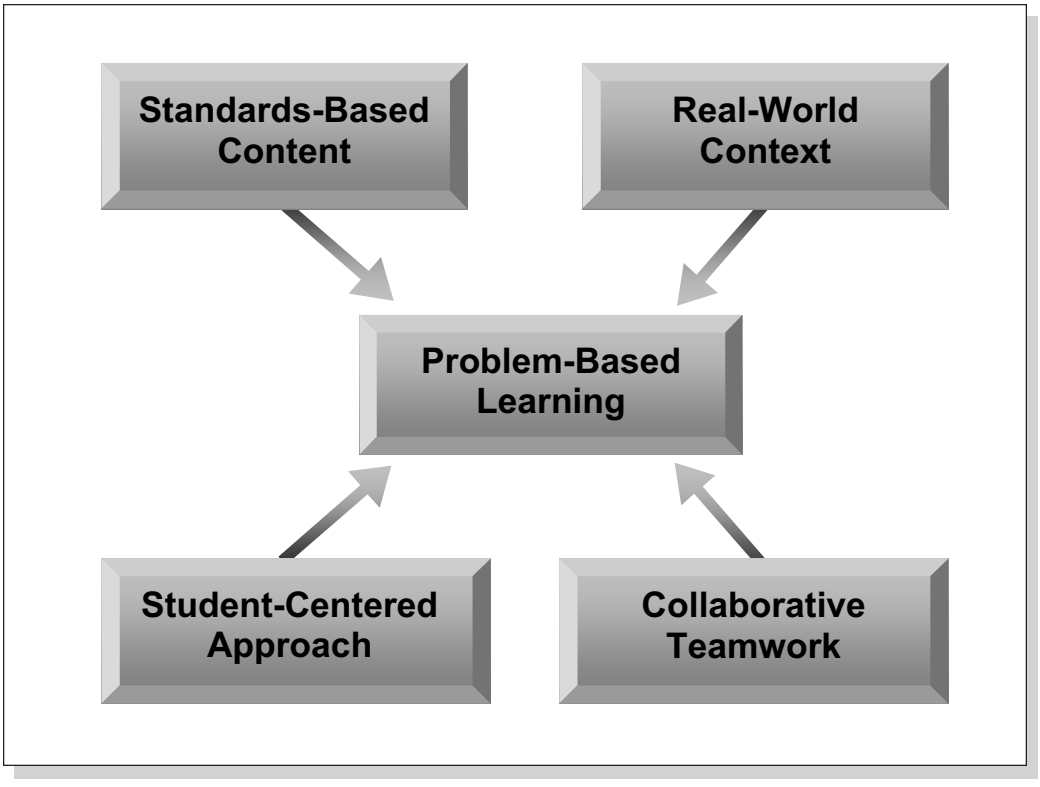
How to...

Create Problem-Based Learning Activities

The renewed emphasis on student performance and accountability, as seen in NCLB, increases the need to ensure that all classroom activities result in improved student achievement. In the past, this meant that students were able to recall memorized facts or solve math problems. As mentioned throughout this handbook, measures of academic achievement for today's students go beyond rote responses by requiring students to apply critical thinking skills to solve complex problems. Therefore, classroom environments can no longer consist of teachers providing factual information through lectures and students "learning" the information through the completion of worksheets and end-of-chapter questions. Instead, students need learning opportunities that equip them with the knowledge and skills to not only to perform well on more demanding standardized tests, but also to meet the challenging requirements of today's society. Problem-based learning (PBL), when well structured, is one way to meet these needs.

Components of Problem-Based Lessons

So, how do you create a "well-structured" problem-based learning environment? You begin with four major components: standards-based content, real-world context, student-centered approach, and collaborative teamwork (see diagram below).



Standards-Based Content. When planning problem-based learning, it is critical to ensure that the "problem" which drives the lesson addresses core content from your curriculum standards (Jones, Rasmusen, & Moffit, 1996; Bridges & Hallinger, 1995). This should be fairly easy, as most PBL lessons require the application of knowledge and skills from multiple content areas that are covered in local standards. Noteworthy to avoid, however, is focusing a lesson on a really interesting problem that only results in student achievement of one or two learning objectives covered on the students' standardized test. For example, a 4th grade teacher may want to avoid spending three weeks on a unit about the migration habits of Monarch butterflies, when only one of 48 district science standards for 4th grade requires students to understand the migration habits of animals. However, if the PBL lesson also has students incorporate math skills to examine migration trends over time, map skills aligned to geography objectives, symbolism of butterflies for language arts, and life cycles for science, then a three-week unit may be justified.

Real-World Context. Next, problem-based learning needs to have a real-world context – or as close to one as possible (Checkley, 1997; Barrows & Myers, 1997). This "reality" can be achieved through the structure of the problem itself, as well as the context. When you examine the structure of issues that occur in the "real world," very seldom is there only one solution achieved by using one source of information. Rather, these problems are ill structured, in that more than one solution is workable and a variety of resources can be used in reaching the different solutions. Therefore, problem-based learning needs to reflect this same structure. With regard to achieving a "real-world" context, you can use information directly related to the students or the community. For example, students can create an "Our Heritage" book that highlights the native countries of the children's ancestors. Community members can work with students to investigate solutions to local problems such as low voter participation, crowded landfills, or graffiti. To expand the focus beyond the community, student groups can assume roles of employees who must solve realistic problems encountered in the workforce. For example, they might be asked to design a smaller cereal container for a food manufacturing company; create an information brochure for a Cherokee Indian museum exhibit; or create a plan to reduce transportation costs of produce.

When you examine the structure of issues that occur in the "real world," very seldom is there only one solution achieved by using one source of information.

Student-Centered Approach. For PBL to be successful, the learning environment must center on the students (Bridges, 1992; Delisle, 1997). This means that students need to be actively engaged and responsible for completing the tasks necessary to "solve" the problem. The students also need to be provided opportunities for self-reflection/evaluation to assess personal progress and determine areas of needed improvement (Barrows & Myers, 1997). The teacher "sets the scene" by ensuring student ownership of the problem and access to needed resources, and by providing "just-in-time" guidance and support that meets the individual needs of each student (Hobgood & Walbert, 2001).

Collaborative Teamwork.

The last critical component of PBL is collaborative teamwork (Bridges, 1992; Delisle, 1997). When students are working together to achieve a common goal, many learning opportunities are enhanced. For example, in this type of learning context, students collaboratively define variables of the problem that need to be investigated, determine what resources are needed and where to get them, decide how to use the collected information, and discuss newly gained knowledge with each other, thus helping to identify misconceptions. Considering that teamwork is a common practice in the workplace, student use of this approach provides better preparation for future employment.

Summary

Learning is enhanced when students are engaged in well-structured PBL that:

- addresses standards-based content,
- is structured on real world content, and
- utilizes a student-centered approach that requires teamwork.

In order to achieve this type of learning environment, however, a key component must be implemented. That is, successful PBL must begin with a good problem, which will serve as the driving force behind the implementation. The next section presents multiple examples of problems and practice exercises.

How to...

Achieve Successful Problem-Based Learning

There are several ways to better ensure that your students have successful experiences when engaged in problem-based learning activities. Some key ideas are outlined below:

Prior to the PBL Lesson.
Prepare students for the problem-based lesson by reviewing prior knowledge and skills that will be required during the lesson (Bridges & Hallinger, 1995). For example, before the PBL lesson, make sure that the students:

- practice setting-up and solving similar math problems (e.g., calculating the area, volume, or average, dividing fractions),
- practice data collection techniques (e.g., using a ruler, keeping time, logging Internet searches),
- review content that will be used during the problem-solving process (e.g., parts of a letter, government structure, classes of animals).

During the PBL Lesson. Morsund (1996) recommends four student-centered strategies to better ensure successful implementation of PBL. The four suggestions are that students need to:

- have a clear understanding of the problem,
- know the intended goal – or problem solution,
- know what resources are available and the purpose of each one,
- feel ownership of the problem and responsibility for reaching a solution.

To accomplish these, you may want to provide students with a Problem-Solving Worksheet to help guide the process.

How to...

Go from Objectives to Problem Statements

As seen in the previous section, for PBL to be successful, it must begin with a well-structured problem that results in student attainment of standards-based knowledge and skills. Likewise, it must reflect a real-world context, be taught in a student-centered environment, and support students working in collaborative teams. The following chart provides examples of problem statements that have been developed to align with state curriculum standards. The examples range from kindergarten to sixth grade and cover language arts and social studies. The chart also points out the type of technology that is used in each problem.

Benchmarks by Grade and Subject Area	Sample Problem and Technology Used
KINDERGARTEN SOCIAL STUDIES	
Benchmark: The student will identify and demonstrate how using civic values will increase their citizenship skills. Indicators - The student: • knows how various symbols are used to depict American' s shared values, principles, and beliefs (eagle, flag, seals, pledge).	**Problem Statement:** We have some new friends who live in Brazil. I would like each group to create a HyperStudio Stack that tells them about our country. You will need to include our flag, The Pledge of Allegiance, and other symbols that represent our shared beliefs. Please use the computer to draw the symbols and to type a short description of each item that you include. The Brazilian children are doing the same thing for our class. **Technology Used:** • HyperStudio • PowerPoint • KidPix
1ST GRADE LANGUAGE ARTS	
Benchmark: The proficient reader uses literary concepts to interpret literature. Indicators - The student will: • identify and describe the main characters in narrative literature • restate the main idea in narrative literature • describe the setting in narrative literature • identify the problem and solution in narrative literature • identify the concept and supporting details in expository literature.	**Problem Statement:** Our class is going to create a web site just for children. This site will have book reviews that are written by 1st grade students. I would like for you and your partner to use the word processor to create a review of the book you just read. You must include graphics that help to illustrate the story. **Technology Used:** • Word Processing/Graphics

Adapted from Kansas USD 265 Curriculum Outline

Benchmarks by Grade and Subject Area	Sample Problem and Technology Used
2ND GRADE SOCIAL STUDIES	
Benchmark: The student will understand the rule of law as it applies to family, school, local, state and national governments. Indicators - The student: • describes the need for rules in the family, school, and community.	**Problem Statement:** I would like for you to write a story about a 2nd grade student who decided he/she would move to the " Land of No Rules" because he/she was tired of following other people' s rules. After you write the story, make a list of good and bad reasons for living in the " Land of No Rules" . **Technology Used:** • Word Processing/Bullet List
3RD GRADE LANGUAGE ARTS	
Benchmark: The proficient writer uses effective word choice. Indicators - The students:• use a variety of nouns, verbs, and adjectives in writing.	**Problem Statement:** I want our third grade class to be known as the BEST writers in our school. But, to do that, we will have to prepare some special writing tools. We will start with a Writer' s Database that will have lots of exciting word choices you can use when writing. You will create this database. Every time you read a story you must choose three nouns, three verbs, and three adjectives to add to the database. Once a week we will print the list of words (and who added them), so you can use the new words in your weekly paper. **Technology Used:** • Database

Adapted from Kansas USD 265 Curriculum Outline

Benchmarks by Grade and Subject Area	Sample Problem and Technology Used
4TH GRADE SOCIAL STUDIES	
Benchmark: The student will identify and demonstrate how using civic values will increase their citizenship skills. Indicators - The student: • recognizes how the Declaration of Independence, the Constitution of the U.S., and the Bill of Rights are the concept which form the basis for democratic values in the U.S.	**Problem Statement:** Some political activists feel we need a new Bill of Rights. Your group is to create a concept map that shows the basic civic values as seen in the Bill of Rights and show how each value impacts your family. Use this map to write an argument discussing whether or not a new Bill of Rights is justified. **Technology Used:** • Concept Mapping • Word Processing
5TH GRADE LANGUAGE ARTS	
Benchmark: The proficient reader comprehends whole pieces of narration, exposition, persuasion, and technical writing. Indicators- The students: • link causes to effects.	Problem Statement: Your group must create a presentation that shows the causes and effects from the story we just read. Each cause/effect must consist of two cards, one for the cause and one for the effect. Your group must choose or create appropriate graphics and use a creative title. **Technology Used:** • PowerPoint

Adapted from Kansas USD 265 Curriculum Outline

Let's Practice

From Problem Statement to Standards

Below are multiple problem statements that could be solved by students in a range of grade levels and content areas. Review each problem and list standards from your local curriculum that students would achieve by reaching a solution.

Problem Statements Handout

Directions: List the local standards that would be addressed with the solution of this problem.

Problem Statements		Local Standards Addressed
How would your life be different if you were born in India rather than the US?		
Does the size of a continent impact the population?		
What is the most common shape used in our classroom, in your bedroom, in your car, in your favorite toy? Describe how shape can be related to purpose.		
Your boss has given each of her four work teams $5,000 to invest in mutual funds. She is going to give an extra $1,000 to the team that makes the most profit in three months. Where is your team going to invest?		
We have $50 for our end-of-the-year class pizza party. Where can we buy the most pizza for our money?		

Problem Statements		Local Standards Addressed
How many trees does it take to supply our school with paper for one year, and how can we reduce that amount?		
Draw a 10-step flow chart that shows how milk ends up as cheese in the dairy section of your supermarket.		
Have the efforts for equality had an impact on who has been elected as governors of our nation' s states? Which states have shown the greatest increases in the number of minority governors elected? Which states have never had a female or non-white male as its governor?		
A large city park in Tennessee has a herd of buffalo that live on a restricted tract of land. The herd has outgrown the area of land, so some of them need to be relocated to another state where buffalo can survive on their own. What US locations would be good options?		
It seems that an increased number of animals are becoming endangered. Do these animals have similar characteristics that make them more vulnerable than other species?		
What are the similarities and differences between the works of William Shakespeare and Ernest Hemingway?		

Self-Assessment

How good is your problem statement?

Developing good problem statements can sometimes be challenging, especially if problem-based learning is a new approach. To make the process more fun and rewarding, you may want to create your problem statements with one or more of your fellow teachers. This will help to expand and refine everyone's ideas. The following check sheet can be used to assess whether or not problem statements meet recommended guidelines.

What is the "real-world" context of this problem? _____

_____

_____

What will make this problem interesting to your students? _____

_____

_____

What curriculum standards does this problem address? _____

_____

_____

What makes this problem ill structured? _____

_____

_____

In what activities will students work together? _____

_____

_____

How can you ensure that each student is responsible for his or her own learning? _____

_____

_____

How are you ensuring that students have access to multiple resources? _____

_____

_____

Problem-Solving Worksheet

Date: _____

Group Members: _____

_____

_____

_____

_____

Directions: Use the following chart to plan how your group will approach this problem-solving task.

Component	Student Action
What do we know about the problem?	List ideas stated as facts.
What do we need to know to solve the problem?	List as questions.
What data do we need to collect to solve the problem?	Write as action statements and indicate how to collect.
How do we manipulate the data?	Describe how the data will be manipulated to develop a solution.
What are some possible solutions?	List solutions that are based on results of the data manipulation.
How will each solution be evaluated?	List criteria that will be used to select the best solution.
How will the best solution be selected?	Consider each solution and identify the implications of each.
How will the findings be presented?	Describe how the results will be published.

Morrison & Lowther (2002)

How to...

Use Technology to Improve Student Learning

As seen in the previous section, learning is enhanced or improved when students engage in activities that require higher-order, critical thinking and processing. When looking at a computer, the primary component is the processor. Therefore, it is a natural tool to enable students to more easily reach higher-levels of understanding. This section of the handbook will help you understand how technology can be used to improve student learning.

This section begins with an examination of teacher vs. student use of computers within an educational context. These ideas are supported with two technology integration models: enGauge and NTeQ.

Following this, three approaches for planning technology integration lessons will be considered. The first integrates computer use into existing lessons – or lessons that teachers already use. The second is a quick three-step plan for teachers who have a basic understanding of integration techniques. It offers an easy-to-use template to plan computer activities. The final lesson template provides step-by-step guidance for creating a new lesson that integrates student use of computers.

The Computer-as-a-Learning-Tool section provides basic guidelines and ideas for using common software applications to support academic learning. Included are word processing, spreadsheets, databases, concept maps, presentation, web browsers, and communication tools. Each tool has a list of classroom ideas for how the software can be used in a variety of subjects, a place to add ideas, and a sample lesson appropriate for professional development activities.

The section ends with a discussion of how to implement a lesson that has students using computers. This includes how to plan ahead, how to manage student rotation to the computers, and how to manage the computer resources.

How do...

Teachers and Students Use Computers

The following chart depicts typical differences between how teachers use technology and how students use technology for school-related tasks. You will note that three of the teacher tasks are *supportive* of the instructional process, while one reflects direct use of technology for instructional purposes. The student tasks, on the other hand, are all directly related to classroom activities. The differences in student tasks are in the degree to which students utilize "real-world" software applications (Resource and Learning Tools) vs. pre-programmed educational software (Teaching/Testing Tools).

Teacher Use

Management
- Grades
- Student Information
- Parent Communication
- Student Communication

Production
- Classroom Posters
- Student Handouts
- Tests

Instructional Support
- Display Notes
- Show Internet Sites
- Demonstrate Concepts
- Whole-class Drill & Practice

Student Use

Teaching/Testing Tool
- Drill & Practice
- Tutorial
- Problem-solving
- Individualized Testing

Resource Tool
- Retrieve Information
- Communication with Experts
- Communicate with other Students

Learning Tool
- Calculate
- Organize
- Graph
- Illustrate
- Sequence
- Model
- Narrate
- Animate

How do...

I use Technology in My Classroom?

This chart will help you to plan and keep track of how you use technology as a professional tool.

My Professional Use of Computers Worksheet

Directions: For each Column, record the date then check each computer use.

- Use Column 1 to show current use of technology.
- Use Column 2 to show new uses you would like to try this year.
- Use Column 3 to show your progress at mid-year.
- Use Column 4 to show technology used by the end-of-the-year.

	1 What I use now Date _____	2 What I want to use this year Date _____	3 My Mid-Year Uses Date _____	4 My End-of-Year Uses Date _____
CLASSROOM MANAGEMENT				
Grades				
Student Information				
Parent Communication				
Student Communication				
Other: _____				
PRODUCTION OF CLASSROOM MATERIALS				
Classroom Posters				
Student Handouts				
Tests				
Other: _____				
INSTRUCTIONAL SUPPORT				
Display Notes				
Show Internet Sites				
Demonstrate Concepts				
Whole-class Drill and Practice				
Other: _____				

How do...

My Students Use Technology?

This chart will help you plan and keep track of how your students use technology during the school year.

My Students' Uses of Computers Worksheet

Directions: For each Column, record the date then check each computer use. Use Column 1 to show current student use of technology. Use Column 2 to show new uses students would like to try this year. Use Column 3 to show students' progress at mid-year. Use Column 4 to show technology used by students at the end-of-the-year.

	1 What I use now Date _____	2 What I want to use this year Date _____	3 My Mid-Year Uses Date _____	4 My End-of-Year Uses Date _____
TEACHING/TESTING TOOL				
Drill and Practice				
Tutorials				
Problem-solving				
Individualized Testing				
Other: _____				
RESOURCE TOOL				
Retrieve Information				
Communicate with Experts				
Communicate with other students				
Other: _____				
LEARNING TOOL				
Calculate				
Organize				
Graph				
Illustrate				
Sequence				
Model				
Narrate				
Animate				
Other: _____				

Classroom Ideas

Students Uses of Technology

Below are examples of student uses of computers as teaching/testing, resource, and learning tools. Next to each example is an idea for classroom implementation of the approach.

TEACHING/TESTING TOOL	Examples	Teaching Ideas
Drill and Practice	• Math Blaster®	• Display for whole-class problem solving
Tutorials	• PLATO®	• Students keep journal of challenges
Problem-solving	• SimCity® • Oregon Trail®	• Groups compete to solve the same problems
Individualized Testing	• Accelerated Reader®	• Students choose target book above current reading level as goal
RESOURCE TOOL	**Examples**	**Teaching Ideas**
Retrieve Information	• CD Encyclopedias • National Geographic	• Find state most opposite of the state in which student lives
Communicate with Experts	• Scientists • Government Officials • Writers	• Compare job requirements of experts • Compare opinions of key issues
Communicate with other students	• Same class • Same school • Same city • Same state • National • International	• Homework buddies • Plan recycle plan for school • Debate local issue • Share weather information • Compare fresh water samples • Compare course requirements

LEARNING TOOL	Examples	Teaching Ideas
Calculate	• Spreadsheet	• Cost of pizza per square inch • Gallons of paint for 10 X 12 room • Population density of Mexico vs. U.S.
Organize	• Database	• States by date of entry • Shapes by number of sides • Elements by atomic weight
Graph	• Spreadsheet	• Speed by incline • Number of fall leaves by type • Population growth by decade
Illustrate	• Draw • Kid Pix®	• Cell division • Chemical bonding • Sentence structure
Sequence	• PowerPoint® • Word processing	• Steps for writing a book review • How to divide fractions
Model	• Draw • PowerPoint® • HyperStudio®	• Rotate vs. revolve • Erosion • A tornado
Narrate	• PowerPoint® • HyperStudio	• The birth of a frog • The making of “ The Thinker”
Animate	• HyperStudio® • PowerPoint®	• The water cycle • Even and odd

What is...

Effective Student Use of Technology

Effective student use of technology requires both an overall understanding of the environment in which technology is to be integrated and a specific philosophy of action for integrating such technology. The **enGauge** and **NTeQ** models, respectively, provide guidance with both of these concerns.

The enGauge Model

As previously mentioned, student learning is enhanced when students are able to engage in higher-order critical thinking. Based on this understanding, the North Central Regional Educational Lab (NCREL) established the enGauge Model as a framework for effective technology use within schools. This model identifies six essential components for effective technology use: vision, educator proficiency, equity, effective practice, systems and leadership, and access (North Central Regional Educational Laboratory [NCREL], 2000). Based on the broader level of thinking that such conditions provide, technology coaches should have a clear understanding of how these conditions contribute to effective student use of technology.

Components for Effective Technology Use:

- Shared Vision
- Educator Proficiency
- Digital Age Equity
- Effective Practice
- Systems & Leadership
- Robust Access
- Forward-Thinking, Shared Vision

Forward-Thinking, Shared Vision

A shared vision is highly relevant to the overall success and implementation of effective technology use. Without a shared vision it is difficult to imagine that a school's leadership can be united in its implementation of technology in a truly cohesive and effective manner. As a technology coach considers a school's level of a shared vision, it is highly appropriate to seek a clearer understanding about how that school system as a whole views the preparation of students. Is the education system promoting a vision to prepare students to learn, work, and live in a knowledge-based, global society? If so, how well is this vision being communicated? How committed to this vision are the stakeholders? Is this vision rooted in community connections and research-based best practices? Overall, what is the message that the school system is portraying regarding the preparation of students for the new, knowledge-based, global society (NCREL, 2000)?

Educator Proficiency with Effective Teaching and Learning Practices

Beyond this vision, how well prepared are educators to effectively teach and help students learn in this knowledge-based environment? When considering educator proficiency, several key questions apply: Do educators understand what students need in order to be successful in the digital age? Are educators prepared to effectively use technology to support learning? Are teachers prepared to assist students with the social, ethical, and legal issues of a technology-rich global society (NCREL, 2000)?

Digital Age Equity

Furthermore, regarding digital age equity, how well prepared is the school system in providing a shared opportunity for digital-age preparedness? Regarding socioeconomic status, gender, and race, is the school system ensuring equity for all students? Additionally, are teachers properly prepared to use and assist special needs students with assistive technologies? And finally, how is the school system as a whole sharing its access to technologies? Do schools and classrooms within the district have equal access to the tools needed for knowledge-based society preparation (NCREL, 2000)?

Effective Teaching and Learning Practice

How well is the school system's vision being translated into effective teaching and learning practice? Are student projects truly relevant for the type of preparation they need? Do students have a wide range of access to supportive technologies? Do classroom learning environments promote higher-level, critical thinking (NCREL, 2000)?

Robust Access Anywhere, Anytime

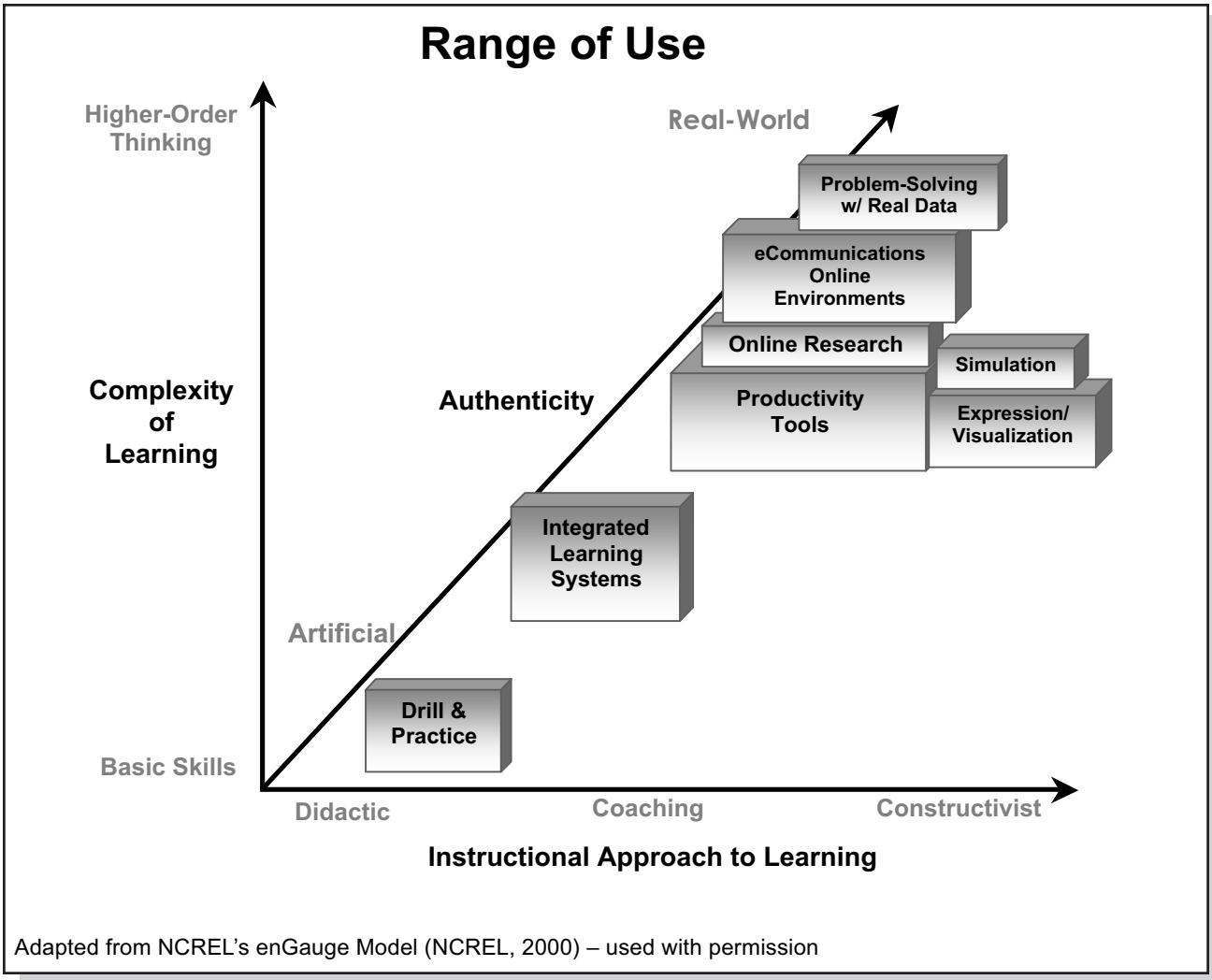
What about anytime, anywhere access to technology? Is such access present to effectively support students and school staff in teaching and learning? Regarding this issue, how well connected is the learning community? Does such access extend beyond the school site? Is technical support provided for hardware, software and learning applications? Overall, how robust is such access (NCREL, 2000)?

Systems and Leadership

Along this line of thinking, how effective is the overall school system regarding these issues? Is the proper leadership in place to properly move the entire system in the desired direction? Are community connections being fostered? Is professional development being properly implemented? Are financial considerations and prioritizations being used to provide for the most important needs (NCREL, 2000)?

Range of Use Model

Obviously, what has been presented is a wealth of questions that are relevant to effective uses of technology in learning. The enGauge Model, as it focuses on system-wide thinking regarding effective technology use and its six essential conditions, also considers the range of use of such technology. This range of use, as presented in the following graph, seeks to assist educators as they consider the range in which technology is being used within their educational system. As you consider your school system and the graph below, consider how various technologies can promote different levels of learning and instructional approaches.



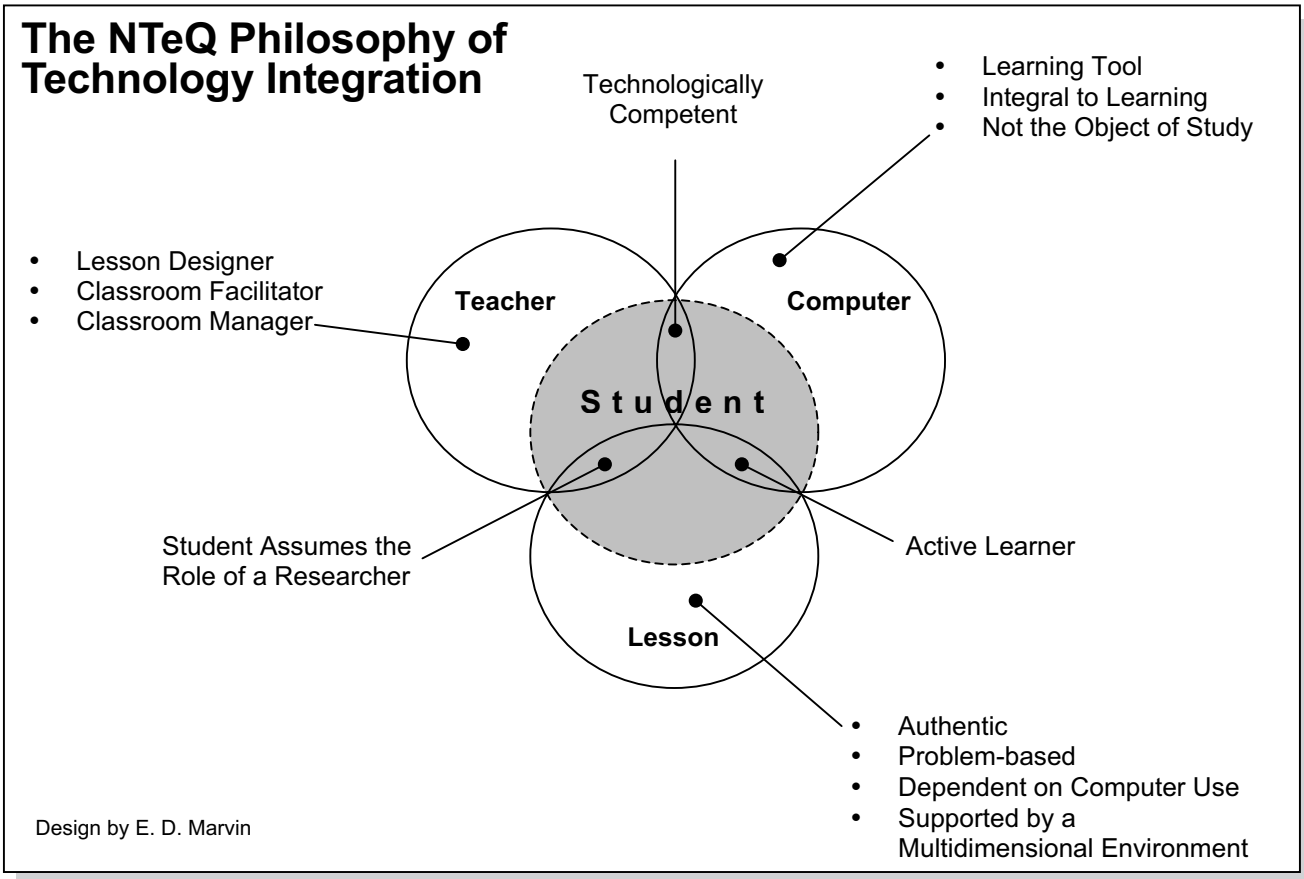
Adapted from NCREL's enGauge Model (NCREL, 2000) – used with permission

The NTeQ Model

Knowing how to use technology for student learning requires an understanding of how to establish an effective learning environment. Traditionally, technology use within schools has emphasized and centered on the use of the computer. At first consideration, this focus appears most appropriate. After all, what could possibly be wrong with emphasizing computers? Aren't they, after all, at the center of the workforce, standards-based, and political expectations for technology use within K-12 schools? Why wouldn't technology coaches want to lead schools down the path of computer-centered instruction?

The danger with this traditional, computer-centered view of instruction is that it fails to place students at the center of learning. Technology, given its very nature, will always continue to be at the cutting-edge of society and learning. However, such new developments should not become a distraction to what is important. That is, educators must always continue to focus on students and their learning needs. They are most important.

The iNtegrating Technology for inQuiry (NTeQ, pronounced "in-tech") approach to technology integration recognizes this underlying philosophy of computer use within K-12 schools (Morrison & Lowther, 2002). It provides a specific role for the important individuals and components involved in K-12 classroom learning — including students, teachers, computers, and lessons.



NTeQ and Students

With the NTeQ approach, students are placed at the center of learning. This means that instead of sitting at their desks, taking notes, listening to their teacher, students are collaborating in small groups, solving problems with authentic resources. In this way, students are "actively engaged in the learning process".

In addition, with the NTeQ approach, students assume the "role of researcher." That is, they become responsible for investigating solutions to problems. Instead of their teacher telling them what is most important, students are given situations to investigate. Through collaboration with other students and hands-on examination of real-world problems, students are able to investigate solutions to problems.

It is particularly important for a teacher to gain experience using the computer as a learning tool.

And finally, the student role in the NTeQ model allows students to become technologically competent. This means that students who are engaged with an NTeQ lesson become skilled with the tools used in workforce environments. Students learn how to use word processors, databases, spreadsheets, Internet applications, e-mail tools, and presentation software. But even further, students who become technologically competent understand the capabilities of these tools and when and where to use them. These understandings extend beyond their K-12 years. Students can use this knowledge into their college and workforce careers.

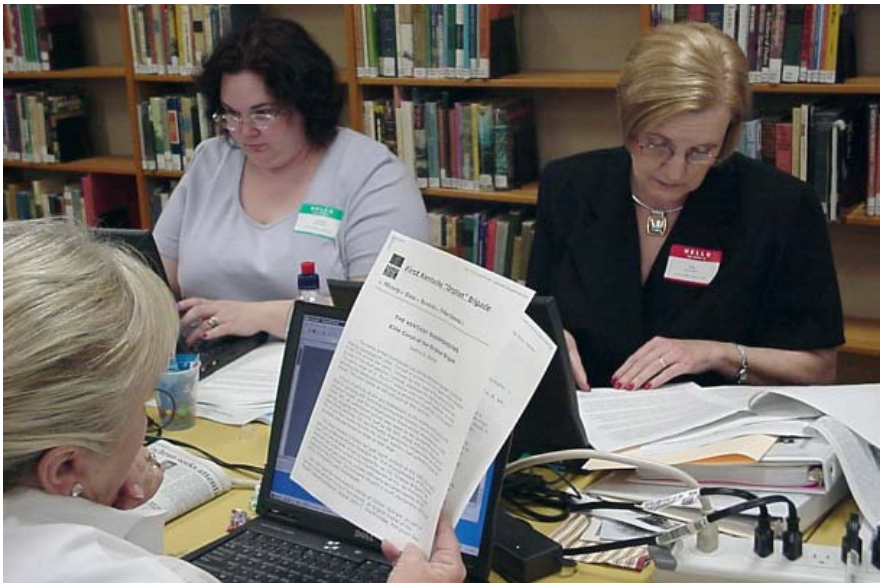
NTeQ and the Teacher

The role of the teacher with the NTeQ approach is also different than what is found in traditional classroom environments. Underlying this perspective is that teachers must become, if they are not already, technologically competent. Technological competence requires teachers to move beyond a basic understanding of computer skills to more insightful, classroom-relevant knowledge. Specifically, this means that teachers need to:

- experience using a computer as a learning tool.
- understand how computer functions can assist student learning.
- apply their knowledge of technology and learning to design, manage, and facilitate a multidimensional classroom learning environment.

In preparing for the teacher's role with the NTeQ approach, it is particularly important for a teacher to gain experience using a computer as a learning tool. Most of us are

familiar with traditional learning environments. We know what it is like to sit in a classroom, listen to a teacher, and take notes. Unfortunately, this understanding shapes the way in which we often view classroom learning and instruction. For this reason, it is especially relevant for a teacher to experience what it is like to learn something new with a computer as a learning tool. More specifically, such experience provides teachers with the pleasures and frustrations associated with such learning.



Teachers need to understand how computer functions can assist student learning.

In addition, teachers need to understand how computer functions can assist student learning. By understanding how computers can ease the problem-solving aspect of learning, teachers can begin to integrate the use of technology into their classroom with more relevance. Teachers who have an understanding of how computer functions (and software functions, in particular) can assist student learning will be more prepared to use technology effectively within their classroom. Instead of using a computer merely for the sake of using a computer, such teachers will begin to use technology as a tool to facilitate student-centered learning.

Once teachers begin to understand how computer functions can assist with learning, teachers need to assume the roles of a designer, facilitator, and manager. As a designer, the teacher can carefully consider and plan a classroom environment that embraces technology-enabled student learning. In such planning, the teacher should think about what students would be doing as they are actually using the computer during a particular lesson. But even further, the teacher also needs to consider what students will be doing both before and after their use of classroom computers. Along these same lines, teachers must also plan objective-based supporting activities. After all, classroom computer use does not mean that all other resources and research activities are irrelevant. Rather, quite the opposite is true. Such supporting materials and activities can be used to enhance the use of the computer as a tool. But the key point of understanding on this issue is that other, non-computer related activities are intended to support the objectives of the given lesson. Focusing on lesson objectives will reduce the likelihood that classroom activities are nothing more than busywork.

In addition to being a designer, teachers who use the NTeQ model also need to know how to assume the role of a facilitator. Crucial to this role is that teachers view themselves as guides in a resource-rich environment. Instead of being individuals who are telling students the information they need to know, teachers become facilitators who guide students in their own learning process. Another component of this role is the need for teachers to frequently model important processes and demonstrate what it means to be a learner. By showing students how to enter information into a database or outline a plan of action for solving a problem, teachers are able to demonstrate to students some of the excitements and pleasures of learning.

Teachers need to assume the roles of a designer, facilitator, and manager.

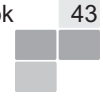
And finally, the NTeQ model asks teachers to become classroom managers. In a management role, teachers oversee student rotation schedules, equity of computer use, and similar supervisory issues. In this role, teachers may also want to practice their own lesson plans to ensure that they are designed in a way that will enhance student learning of the specified objectives.

NTeQ and Computers

Although it has been only implied up to this point, the role of the computer with the NTeQ approach is also different from that of traditional learning environments. The computer from the NTeQ perspective is viewed as a learning tool. Much like a hammer is an extension of one's arm, a computer is used as an extension of one's mind. In this way, students are able to focus on analyzing information, contemplating issues, and solving problems. Instead of organizing data or sorting note cards, students can put their minds to more relevant learning tasks. Once again, according to the NTeQ approach, the student – not the computer – is at the center of learning.

NTeQ and the Lesson

Much of what has been said to this point regarding the NTeQ approach for technology integration points to classroom lessons that are student-centered, authentic, problem-based, and reliant on the use of technology. This is true, because these are the components that characterize NTeQ lessons. As students are placed at the center of learning and given an authentic, real-world problem to solve, teachers are able to guide students down the path of learning. Computers, from this perspective, become tools to enhance problem solving and enable deeper levels of learning. Although it is important to recognize that NTeQ lessons are not intended to be used with every lesson, they can be used whenever lesson objectives can be matched with computer functions. Knowing when to apply an NTeQ lesson requires technological competence. As a technology coach, you can lead teachers to understand what the NTeQ philosophy is about and why it is relevant (Morrison & Lowther, 2002).



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SECTION 3

Technology Integration Lessons

How Are Technology Integration Lessons Different?

How to Know When to Use Computers

How to Plan Integration Lessons

How to Integrate Computers into Existing Lessons

How to Create New Computer Lessons

Implementing Integration Lessons

The Multi-computer Classroom

The One Computer Classroom

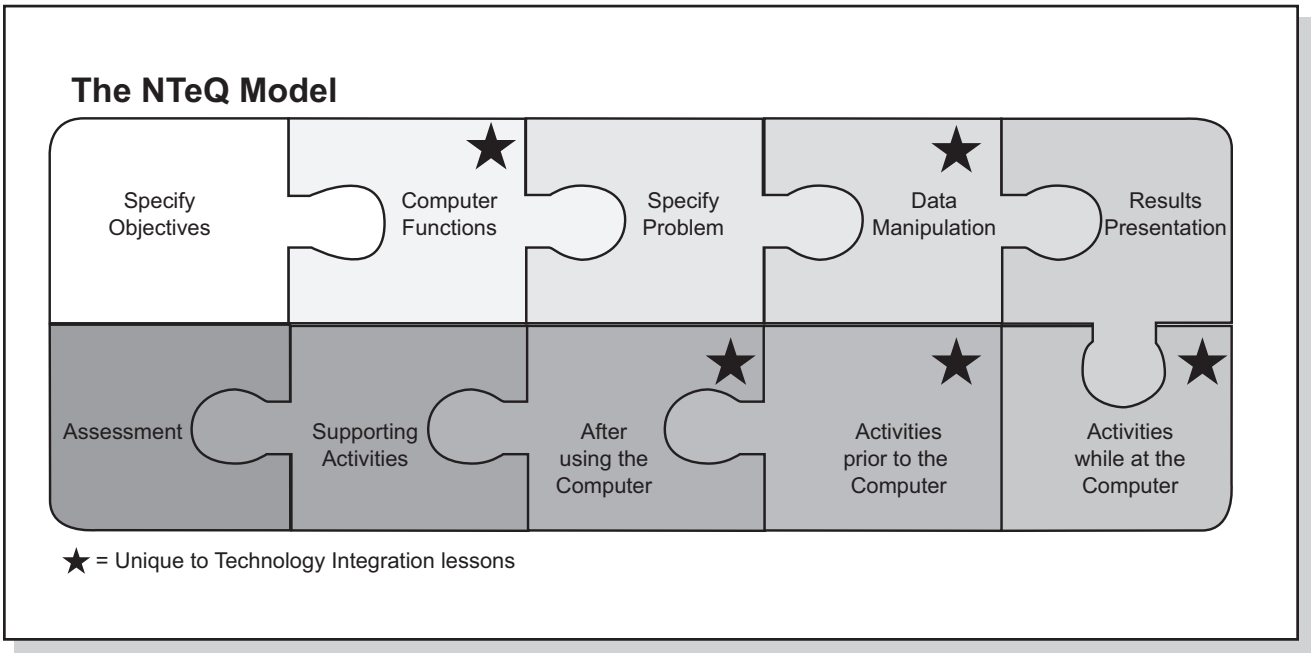
How are...

Technology Integration Lessons Different?

Well-structured lesson plans address what students will be learning (specify objectives), how they will let the teacher know what they have learned (results presentation), how the teacher will evaluate achievement (assessment), and a description of the activities (supporting activities). When the lesson is problem-based, it will also include the problem statement. So, how does a lesson need to be changed to integrate student use of computers?

The NTeQ 10-Step Lesson Plan

As seen in the NTeQ (Morrison & Lowther, 2002) 10-Step Lesson Plan below, there are five components that are unique to technology integration lessons. Descriptions of those five and the other lesson components are included in the model.



STEP 1: Specify Objectives

Based on national and/or local standards for curriculum and technology use.

STEP 2 : Match with Computer Functions

Identify verbs from objectives that match with computer functions.

Analyze ▸ Spreadsheet

Identify ▸ Database

Design ▸ Draw

Step2, Step 4, Step 6, Step 7 and Step 8 are unique to technology integration lessons.

STEP 3 : Specify the Problem

Identify the problem (consider using student input) to solve a problem that is relevant to the students and based on real-world data.

STEP 4 : Data Manipulation

What is the data source? Will students collect and enter the data? Will you provide them with the data? Will they use data from the Internet or a CD-ROM? How will the students manipulate the data - sort, graph, draw, etc.?

STEP 5 : Results Presentation

How will the students present their findings? Poster, presentation, paper, magazine, web page?

STEP 6 : Activities while At the Computer

What will the students do while at a computer? Enter data, write a report, create a graph, etc.

STEP 7 : Activities Prior to Using the Computer

What tasks must the students complete before they use a computer, e.g., identify search terms, organize data, outline a report, prepare a rough sketch?

STEP 8 : Activities After Using the Computer

What will the students do with the information they generated/ obtained while using a computer? Analyze their results, prepare a report, etc.

STEP 9 : Supporting Activities

What other activities will be used to support achievement of all the objectives? Reading, practice, small group discussions, manipulatives, etc.

STEP 10 : Assessment

How will you assess student achievement? Rubrics, portfolios, objective tests, projects, etc.

(Morrison & Lowther, 2002)

How to...

Know When to Use Computers

The NTeQ 10-Step Lesson Plan provides guidance for creating technology integration lessons, but does not really tell you when it is appropriate to have students use computers or which type of computer use would be the most appropriate. The following chart describes the basic functions of each type of software tool and general suggestions for when to use the software (Morrison & Lowther, 2002).

Software	Functions	When to Use
Word Processing	• Edit and Format Text • Create Outlines • Create Columns • Generate Tables • Insert Graphics	Use with information that can be paraphrased and/or organized in meaningful ways.
Spreadsheet	• Perform Calculations • Sort Data • Create Graphs/Charts	Use with sets of numbers that have repetitive patterns that can be described with at least two variables (Row & Column).
Database	• Store Data in Records • Sort Data • Match Data • Merge Data • Create Special Reports	Use with information that has repetitive patterns and can be easily described.
Web Browser	• Searches by Key Words • Bookmarks Web Sites • Hyperlinks to Text, Virtual Tours, etc. • Provides Interactive Feedback	Use to access information or to engage in interactive learning.
Communication	• Allows Synchronous/Asynchronous Communications • Sends/Receives Text • Sends/Receives Video/Audio • Sends/Receives Attachments • Archives Messages	Use when interactivity with others will enhance learning
Concept Mapping	• Connects Ideas • Creates Sequences • Adds Graphics	Use with content that can be categorized, linked, or contrasted.
Presentation	• Displays Text • Supports Navigation • Creates Animation • Inserts and Creates Graphics • Inserts Video • Inserts Sound	Use to display information that can be enhanced by motion and interactivity

How to...

Plan Integration Lessons

This section discusses three ways to plan lessons that integrate student use of computers:

- Into Existing Lesson Plans,
- A Three-Step Approach,
- and Creating New Lessons.

Lesson plan templates are included for each lesson approach.

Integrating Technology into Existing Lessons

One of the easiest ways for teachers to begin integrating technology into their instruction is to begin with lessons that they already teach. Similarly, externally produced lessons that are developed but do not include student use of computers can be a great place to start. Below are a few general guidelines for integrating technology into existing lessons.

1. Choose an existing lesson plan that involves student collection, generation and/or manipulation of data/information. Multiple examples can be found in the Computer-as-a-Learning Tool section that follows.
2. Use the ICU Lesson Template to design your lesson. This template is seen on the next page.
3. Prior to lesson implementation, create a sample of the computer product(s) students will generate to make sure everything "works" as planned. The created sample can be shown to students as an example of what they will produce.

How to...

Integrate Computers into Existing Lessons

Lesson plans are readily available to teachers via educational web sites, textbook companies, and fellow teachers. Lesson plans that integrate student use of computers are less common. The following lesson plan template is designed for use with lesson plans that are already developed but lack a technology component.

Integrating Computer Use (ICU) Template

Directions: Use this template when integrating student use of computers into **existing** lesson plans.

Lesson Title: _____

Subject: _____

Grade: _____

Lesson Plan Source (e.g. curriculum guide, URL): _____

Problem students will solve: _____

_____

_____

_____

Computer Functions and Data Manipulation

Briefly describe the computer function(s) and list the name of the computer application that will be used (e.g., sort - database, write – word processing, calculate percents - spreadsheet). Next, determine specifically how students will use the identified computer functions to help solve the problem. Think carefully about the problem to be solved and how the data need to be manipulated to find a solution. Briefly describe each manipulation activity.

Example

Computer Function	Computer Application	Data Manipulation
Sort information	Database	Students will use a database to sort descriptive information about the leaves they collect (color, type, etc.)
Enter and format text	Word processing	Students will use word processing to write a report describing how they identified the most common leaf type.

Computer Function	Computer Application	Data Manipulation
•	•	•
•	•	•
•	•	•

Planning Computer Activities

The section below contains space for up to three computer activities (e.g. 1. Internet search, 2. create spreadsheet graph, 3. write report). For each activity, briefly describe what students need to do before they go to the computers, while they are at the computers, and what they do after they finish computer work (Morrison & Lowther, 2002).

Computer Activity 1

Activity Title (e.g., Insect Database): _____

Activities ***Prior*** to going to the computer

_____

_____

Activities ***At*** the computer

_____

_____

Activities ***After*** going to the computer

_____

_____

Computer Activity 2

Activity Title: _____

Activities ***Prior*** to going to the computer

_____

_____

Activities ***At*** the computer

_____

_____

Activities ***After*** going to the computer

_____

_____

Computer Activity 3

Activity Title: _____

Activities ***Prior*** to going to the computer

_____

_____

Activities ***At*** the computer

_____

_____

Activities ***After*** going to the computer

_____

_____

Computer Activity 4

Activity Title: _____

Activities ***Prior*** to going to the computer

_____

_____

Activities ***At*** the computer

_____

_____

Activities ***After*** going to the computer

_____

_____

How to...

Integrate Computers in 3 Steps

Use this quick, 3-step plan for integrating technology into your favorite lessons. This plan is best for teachers who are familiar with the basics of using computers to support student learning (Morrison & Lowther, 2002).

3 Step Lesson Plan Tempate

Lesson Title: _____

Lesson Overview: _____

_____

_____

What Do Students Do?

1. Activities ***Prior*** to going to the computer

_____

_____

_____

_____

2. Activities ***At*** the computer

_____

_____

_____

_____

3. Activities ***After*** going to the computer

_____

_____

_____

_____

How to...

Create New Computer Lessons

Use this lesson plan when you want to fully develop a lesson or unit that has students use technology. This lesson plan is based on the NTeQ Model (Morrison & Lowther, 2002) and includes basic guidelines for completing each section.

NTeQ Lesson Plan Template

Lesson Title: _____

Subject Area(s): _____

Grade Level: _____

Learning Objectives

At the end of this lesson, the students will...	District Standard/Benchmark
•	•
•	•
•	•

Materials

It is helpful to include a "**Think Sheet"** of questions that requires students to use critical thinking skills.

•	•
•	•
•	•

Computer Functions and Data Manipulation

List computer function(s) that will be used, the related computer application (e.g., database, spreadsheet), and describe how the data are to be manipulated (e.g., sorted, charted, placed in tables, drawn)

Computer Function	Computer Application	Data Manipulation
•	•	•
•	•	•
•	•	•

Specify Problem

Write in language you will use with students. For example, "Today, we are going to investigate…" "What would you do if…?" _____

_____

_____

Results Presentation

Write a brief description of how the students will demonstrate achievement of the objectives. For example, a written report, presentation, poster, web site.

_____

_____

Computer Activities

Activity 1	Activity 2	Activity 3
Activities to be completed... 1. ***Prior*** to going to the computer	Activities to be completed... 1. ***Prior*** to going to the computer	Activities to be completed... 1. ***Prior*** to going to the computer
2. ***At*** the computer	2. ***At*** the computer	2. ***At*** the computer
3. ***After*** going to the computer	3. ***After*** going to the computer	3. ***After*** going to the computer

Supporting Activities

Activity 1	Activity 2	Activity 3
Activities to be completed...	Activities to be completed...	Activities to be completed...

Rotation Plan

Briefly describe how students will rotate to and from the computer(s) and supporting activities.

_____

_____

Assessment with Rubrics

Use a template similar to the one below to develop your rubric(s). A sample is provided to guide your writing. To develop rubrics, place performance objectives in the first column, and then create descriptions of each level of performance.

Objective or Performance	Beginning 1	Developing 2	Accomplished 3	Exemplary 4	Score
1.	Description of identifiable criteria that reflect a beginning level of performance	Description of identifiable criteria that reflect progress toward mastery of performance	Description of identifiable criteria that reflect mastery of performance	Description of identifiable criteria that reflect exceptional performance.	
2.	Repeat with next item	"	"	"	

Sample Rubric: Newspaper Article on Seatbelt Safety

Objective or Performance	Beginning 1	Developing 2	Accomplished 3	Exemplary 4	Score
Students will write a persuasive article on why drivers should wear seatbelts.	Persuasive arguments are not clear or concise and had very poor references made to supporting graphics.	Persuasive arguments are fairly clear and concise. References made to graphics provide limited support.	Persuasive arguments are clear, concise, and articulate. References made to supporting graphics are useful.	Persuasive arguments are very clear, concise, and articulate. Excellent references made to supporting graphics.	
Students will create spreadsheet charts that demonstrate a trend.	The charts show very little about seatbelt use. The title, labels, legend are missing or incomplete.	The charts show limited aspects of seatbelt use. The title, labels, legend, and type of chart provide incomplete support.	The charts demonstrate trends in seatbelt use. The title, labels, legend, and type of chart support understanding.	The charts clearly demonstrate trends in seatbelt use. Excellent choice of title, labels, legend, and type of chart.	

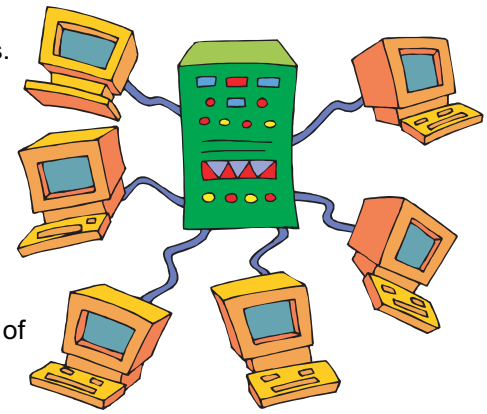
Rubric Template

Objective or Performance	Beginning 1	Developing 2	Accomplished 3	Exemplary 4	Score

Implementing Integration Lessons

The Multi-Computer Classroom

A classroom model that uses “learning stations” works well in a multi-computer classroom. Small groups of students rotate from one station to another during a portion of the day or throughout the school day. Another type of rotation that is also effective in the multi-computer classroom is independent rotation. In this rotation approach, small groups of students are assigned to a computer on a scheduled basis. The teacher creates a weekly rotation schedule. This rotation plan allows each student group to have access to a computer several times a week or even daily. One of the advantages of this rotation plan is that student work can be ongoing, and does not necessarily have to be completed by the end of a group’s specified daily time.



Multi-Computer Classroom Management Tips

- Establish student behavior expectations for working in a cooperative group and taking turns.
- Introduce students to basic computer skills before sending them to the computer.
- Assign students specific tasks such as keyboard operator, recorder, and screen reader, and rotate tasks to ensure equitable computer use.
- Use a non-verbal signal, such as a cup turned upside down, to indicate need for teacher assistance.
- Be specific about what students are to do when the lesson is finished.
- Have clear and consistent expectations regarding care of hardware and software.
- Have specific software ready when students go to the computer.
- Create a direction sheet for students.
- Create bookmarks for frequently used web sites.
- Assign a “peer expert” to assist students who need help.
- Post step-by step instructions for common computer functions near the computer.
- Place a timer next to the computer. Have students set the timer for a specified amount of time. When timer goes off, students rotate.

- Post a daily or weekly computer schedule. This schedule should be created so that students move by means of turns rather than an assigned time of day or day. With this type of schedule, a student would not miss his/her turn if there were a school holiday, a class field trip, or a student assembly.
- Plan a related activity that may be done by students who are not at the computer in another area of the classroom. For example, have students use printed resources to research the same questions as students who are using the Internet.
- Have students keep a journal of what they accomplished during their scheduled computer time. Some suggested topics are:
  - New vocabulary words
  - Questions that they may have when working on the computer
  - Web site addresses that were used and what they found at the site
  - Summarization of what they have learned
- Make sure that student assignments are age appropriate and at the appropriate reading level, so the help needs are minimal.
- Use 3 x 5 recipe card file with student names to identify computer users for each day.
- Create two folders, one for completed projects and one for work in progress. Have a checklist available so that, after each session, students can indicate whether the project is complete or additional time is needed.
- Make sure that activity centers have a clearly written description of the student tasks that are to be completed. Use an 8 x 10 plastic sheet protector to hold the directions for the activity, and place it near the computer. This will eliminate the need for verbal directions and will allow the students to begin their tasks as soon as they sit down at the computer.
- Prepare task cards that define the student roles required to complete the assignment. This will help to ensure that all students are actively engaged. Always relate computer assignments to the curriculum that is being covered in the classroom.

Multi-Computer Classroom Rotation Schedules

Scheduling student use of the computer is an effective method for implementing the integration of technology into the curriculum and ensuring that every student has an equal opportunity to benefit from the use of computer technology. The number of students in the class, the number of computer workstations available, and the number of students who will be at each of the computes helps determine the rotation schedule. The length of time necessary for a lesson/activity must be calculated and activities must be created for the students who are not at the computer. Please see the example of a computer rotation schedule created for a multi-computer classroom that has twenty-four students and four computers.

Sample Weekly Rotation Schedule

Day	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Day One	Center 1	Center 2	Center 3	Center 4	Center 5	Center 6
Day Two	Center 2	Center 3	Center 4	Center 5	Center 6	Center 1
Day Three	Center 3	Center 4	Center 5	Center 6	Center 1	Center 2
Day Four	Center 4	Center 5	Center 6	Center 1	Center 2	Center 3
Day Five	Center 5	Center 6	Center 1	Center 2	Center 3	Center 4
Day Six	Center 6	Center 1	Center 2	Center 3	Center 4	Center 5

Adapted from Scheduling Activities available at http://www.nycenet.edu/oit/mgmt/scheduling.htm

Check the "Sample Day One Activities" table below to see an example of which activities each group would be participating in on Day One. This table also specifies in which areas of the classroom where each group should be located.

Sample Day One Activities

Group 1	Group 2	Group 3	Group 4	Group5	Group 6
Center 1 Computer 1	Center 2 Computer 2	Center 3 Computer 3	Center 4 Computer 4	Center 5 At the TV	Center 6 At desk
Research on the Internet the effects of pollution on the environment.	Use CD ROM encyclopedias to find information about water and air pollution.	Prepare a PowerPoint presentation about the effects of pollution on the environment.	Use simulation software such as Tom Snyder' s " Decisions Decisions-The Environment."	Watch a video about the effects of pollution on the environment.	Read chapter in textbook about pollution and answer study guide questions.

Adapted from *Scheduling Activities* available at http://www.nycenet.edu/oit/mgmt/scheduling.htm

The One Computer Classroom

In the one computer classroom, the teacher creates a schedule where students take turns or have a special weekly time on the computer. The student on the computer is excused from the work the rest of the class is doing. There are several ways to set up the computer rotation schedule for the one computer classroom. One way is to schedule students based on their academic strengths. For example, if a student was especially strong in math, math time would be a good time to schedule his/her computer time. Another way is to rotate students through the computer as a one student "station." Students rotate according to a posted list.

Whole Class Management Tips

- Group students in front of the computer in the most comfortable arrangement possible.
- Make sure that all students are able to see the monitor.
- Introduce a web site or software program to the whole class with a projection device before having students access the web site or program independently.
- Demonstrate how to use a computer application before the students use it independently.
- Demonstrate loading and running a software program.
- Prepare students for what they will be learning and what will be expected of them.
- Give students opportunities to respond to and interact with the computer when appropriate.
- Use a selected web site or software program to serve as a catalyst for a class discussion.

Individual Work Management Tips

- Present familiar concepts. Choose attitudes/ideas with which the student has experienced prior success.
- Make sure that the student is familiar with the menu, prompts or special commands before she/he begins the assignment. This can be done in a large group, with a peer tutor, or by the teacher.
- Be specific about which program the student is to use. Make sure the student knows where to find directions.

- Establish a non-verbal signal, such as placing a plastic cup upside down, for the student to get the teacher's or peer-tutor's attention without disturbing others.
- Establish clear guidelines regarding how long the student is to stay at the computer and which student is to go next. Teach the student how to use a timer and have a rotation schedule posted near the computer.
- Be clear and consistent in your expectations regarding the student's behavior at the computer.
- Model the computer project for the class. Provide a sample of the completed work for the specified project along with a checklist that students can use to check off tasks as they work. Have students attach the checklist to their completed work.
- Create a template when teaching a new computer skill. The students will be able to rotate through the activity, and the original file will not be lost or altered.

You can use a progress chart to help you and your students monitor their progress as they rotate through the computer.

References

Morrison, G. R. & Lowther, D. L. (2002). *Integrating computer technology into the classroom* (2nd. Ed.). Upper Saddle River, NJ: Merrill Prentice Hall.

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SECTION 4

The Computer as a Tool

How Students Can Use the Computer as a Learning Tool

Word Processing

Spreadsheets

Databases

Concept Maps

Presentations

Web Browsers

Communication Tools

Implementing Integration Lessons

The Multi-computer Classroom

The One Computer Classroom

How to...

Use Word Processing as a Learning Tool:

Word processing software is commonly used in schools because it easily supports traditional types of student activities that require writing. Students normally enjoy using a word processor to "write" their assignments because it automatically checks spelling, makes it easier to fix mistakes, and with a little practice, takes less time than writing a paper by hand. Word processing software also has several functions that make it an excellent critical thinking tool, as seen below.

When to use Word Processing

Use for creative writing or with information that can be paraphrased, illustrated and/or organized in meaningful ways.

Using Word Processing for Higher-Order Thinking

The following chart contains the basic functions of word processing software and example activities for which students could use these functions to engage in higher-order thinking.

Word Processing: Basic Functions	Examples of Higher-Order Thinking Activities
Edit and format text • Track Changes & Comments • Spelling • Grammar • Readability	• Summarize • Paraphrase • Select appropriate font, style, color
Create Outlines	• Determine key ideas • Sequence
Create Columns	• Determine the appropriate flow of text
Insert and Create Graphics	• Match graphics to ideas • Create graphics to demonstrate ideas
Generate Tables	• Determine appropriate column and row names • Create categories • Group into categories

Classroom Ideas : WORD PROCESSING

Below are examples of how students can use word processing as a tool to better learn subject area content. Also included is space for you to add ideas for your students to use word processing.

Student Word Processing Activities	My Ideas for Student Use of Word Processing
Create a " vocabulary word" table that includes a graphic for each word and a description of why it represents the word.	•
Download a CNN editorial and replace the adjectives with ones that have a similar meaning.	•
Rewrite the Bill of Rights to a level that is more easily understood by 2nd grade students.	•
Download a picture of the Statue of Liberty and create a list of 50 words that describe its features.	•
Locate clipart of two birds that are very different, and then write a paragraph that highlights those differences.	•
Use weather data from the Internet to create the " Window on Weather" section of the school newspaper.	•
Compose a letter to the Mayor regarding the poor air quality of your neighborhood. Include digital photos to support your argument.	•
Write a one page story that predicts what life in the United States will be like in 75 years.	•
Use the " Track Changes" tool to suggest edits on your partner' s report.	•
Use a different color text to add your part of a " chain" story written by students in your group.	•
Choose three graphics that represent key features of the main character in today' s story and describe why you chose each one.	•
Use the " Highlight" tool to mark each noun yellow and each verb blue.	•
Lower the reading level of the 1st paragraph of Abraham Lincoln' s presidential acceptance speech by using different adjectives and adverbs.	•

Example Ideas: WORD PROCESSING

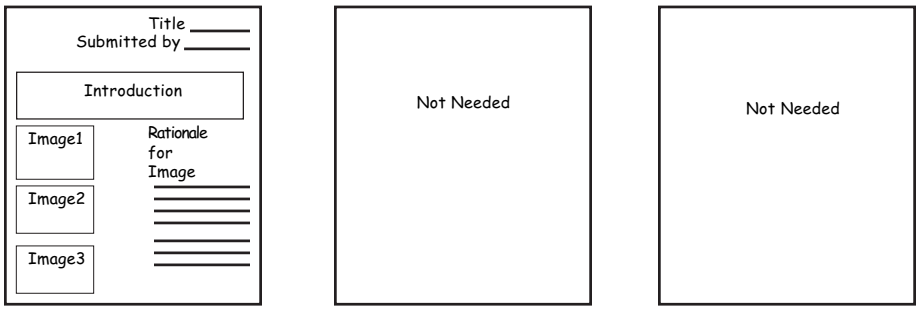
Directions: Use this form to expand and personalize two of the Classroom Ideas for Word Processing (from the previous page). Select two ideas that are similar to topics you teach. List the key learning objectives that would be achieved, if students completed these tasks. Create a problem that would result in student attainment of the objectives by reaching a solution. Create a sample layout of the final word-processed document that students would produce.

Lesson Idea: Choose three graphics that represent main character in the story and explain.

Learning Objective(s): Identify main character; describe feature of main character you chose; represent ideas with graphics.

Problem(s) that could be solved with this data: The book publisher would like to produce an advertisement for our story and wants to include graphics that illustrate the main character. The advertisement has space for three graphics. Your team is to locate three clipart images and write a one-page proposal for why they should be used in the advertisement.

Briefly sketch the key features of the word-processed document the students will create.

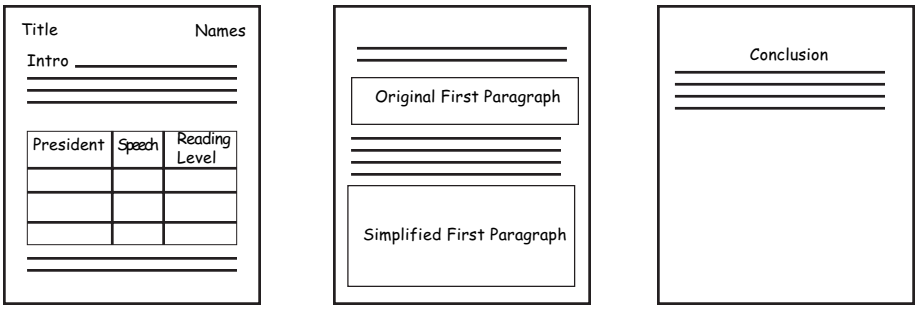


Lesson Idea: Change the reading level of presidential acceptance speeches

Learning Objective: Identify and use grade appropriate vocabulary

Problem(s) that could be solved with this data: There is a concern that most Presidential speeches are not easily understood by the majority of adults in the US. Provide data discussing this issue and an example of how the speech could be more understandable.

Briefly sketch the key features of the word-processed document the students will create.



My Integration Ideas: WORD PROCESSING

Directions: Use this form to expand and personalize two of the Classroom Ideas for Word Processing. Select two ideas that are similar to topics you teach. List the key learning objectives that would be achieved, if students completed these tasks. Create a problem that would result in student attainment of the objectives. Create a sample layout of the final word-processed document that students would produce.

Lesson Idea: _____

Learning Objective(s): _____

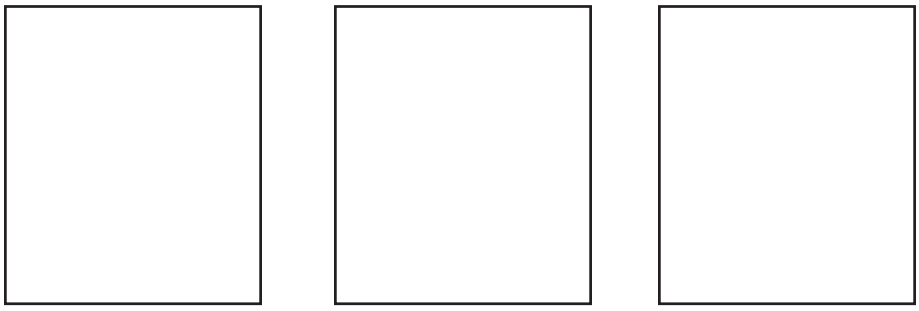
_____

_____

Problem(s) that could be solved with this data: _____

_____

Briefly sketch the key features of the word-processed document the students will create.



Lesson Idea _____

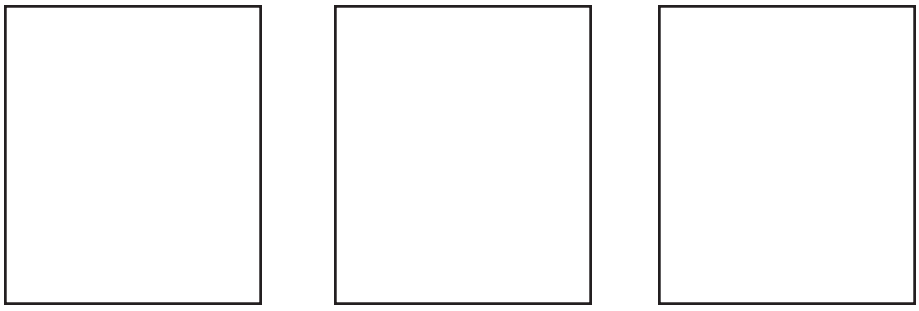
Learning Objective: _____

_____

Problem(s) that could be solved with this data: _____

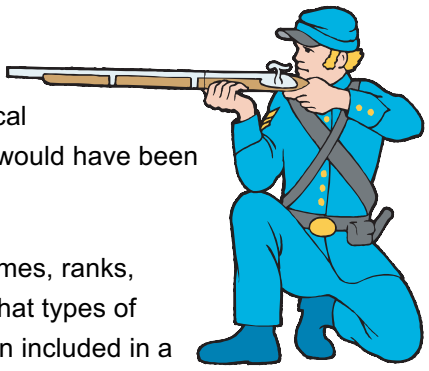
_____

Briefly sketch the key features of the word-processed document the students will create.



Practice Lesson: WORD PROCESSING

Civil War Journalist



The Problem:

While many of us think of television, radio and the Internet as sources of news, during the 1800s, newspapers were the primary source. Our local museum wants to present realistic accounts of Civil War battles, as they would have been reported during the mid-1800s.

What would have been reported about battles of the Civil War? Were names, ranks, locations reported? What would an eyewitness reporter have written? What types of lifestyle issues, such as clothing and entertainment, would also have been included in a newspaper? What kinds of photographs and images were included? Design a newspaper with at least two original articles and two graphic images in a word processor that reflects the events of the mid-1800s.

Brainstorm events on which you will focus?	What do you know about these events?	What will you need to find out about these events?	What graphics or photographs could go with these events?
1.			
2.			
3.			
4.			

Sketch three possible layouts for your newspaper in the spaces below. Use a word processor to write and design your newspaper.

How to...

Use Spreadsheets as a Learning Tool:

Spreadsheet software is commonly used in workplace settings for tasks that involve numbers (e.g., budgets, inventory, population growth, voter returns, and employee turnover). A spreadsheet is a tool that can also enhance classroom learning by allowing students to concentrate on the critical issues of problem-solving, such as creating formulas, examining trends, and making predictions. Spreadsheet software reduces the tediousness of re-entering information into a calculator each time a new question is asked. The following section discusses how to use spreadsheets for higher-order thinking. Additionally, it provides ideas for classroom use.

When to Use Spreadsheets

Use with sets of numbers that have repetitive patterns that can be described with at least two variables (Row & Column).

Using Spreadsheets for Higher-Order Thinking

The following chart contains the basic functions of spreadsheet software and example activities for which students could use these functions to engage in higher-order thinking.

Spreadsheet: Basic Functions	Examples of Higher-Order Thinking Activities
Perform Calculations	• Identify key variables • Determine appropriate formula(s) • Analyze results • Make modifications
Sort Data	• Identify key variables • Determine appropriate sort direction • Determine number of sorts • Analyze results • Make modifications
Create Graphs/Charts	• Select data to be plotted • Arrange data in most meaningful manner • Determine the most appropriate graph or chart to depict data • Label chart to enhance understanding of results

Classroom Ideas: SPREADSHEETS

Below are examples of how students can use spreadsheets as a tool to better learn subject area content. Also included is space for you to add ideas for your students to use spreadsheets.

Student Spreadsheet Activities	My Ideas for Student Use of Spreadsheet
Plot average yearly precipitation in your county for the past 50 years.	•
Compare miles traveled during migration for 10 different birds.	•
Compare the number of adjectives and adverbs used in the first 300 words of a non-fiction book and a fiction book.	•
Compare the number of U.S. vs. Asian yearly earthquake occurrences for the past 50 years.	•
Compare grams of sugar in breakfast cereals.	•
Calculate the maximum price per square yard that could be paid, if the PTA gave your class $300 to carpet your classroom.	•
Determine the shortest driving route from New York City to San Antonio, Texas.	•
Determine the number of dump trucks needed to transport soil removed for a competition-sized swimming pool.	•
Create a budget that would result in at least $100 profit from selling hot dogs at $1.00 each.	•
Graph the cost differences between using natural gas vs. electricity for heating a home.	•
Use data to demonstrate whether or not the environmental protection efforts are working.	•
How much time would the hare have to waste for the tortoise to win a 1-mile race?	•
Plot the yield per acre for grain crops grown in the Midwest.	•

Example Ideas: SPREADSHEETS

Directions: Use this form to expand and personalize two of the Classroom Ideas for Spreadsheets. Select two ideas that are similar to topics you teach. List learning objectives that would be achieved if students completed these tasks. Create a problem that would result in student attainment of the objectives by reaching a solution. Then create a sample spreadsheet by filling in column and row names and plausible data entries.

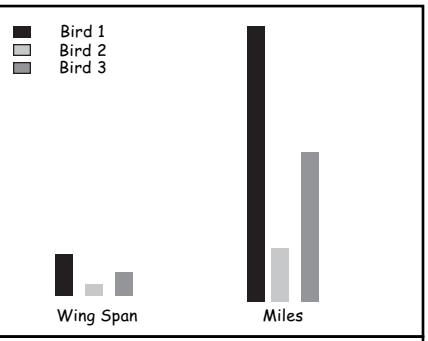
Lesson Idea: Compare miles traveled during migration for 10 different birds

Learning Objectives: Compare relationship between animal structures and purpose; Construct graphs to represent data from real-world problems

Problems that could be solved with this data: Do birds with wider wing spans fly farther during migration?

Fill in the row and column names for a spreadsheet that would be used with this lesson.

	A	B	C	D
1	Bird Name	Wing Span	Miles	
2	Bird 1 (e.g., Hawk)	49 inches	5,600	
3	Bird 2	10 inches	1,000	
4	Bird 3	23 inches	3,000	



Sketch a sample graph for this lesson

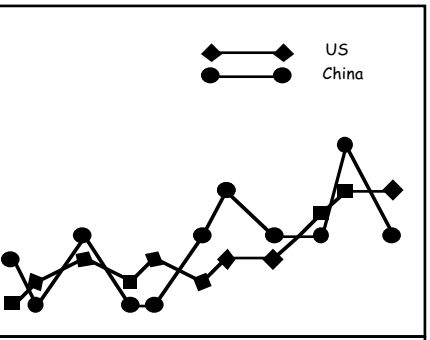
Lesson Idea: Compare number of earthquakes per year in the US vs. China over the past 50 years

Learning Objectives: Construct graphs to represent data from real-world problems; research past geographic conditions (e.g., earthquakes, flooding, volcanoes) and their impact on societies.

Problems that could be solved with this data: Earthquakes…Is one side of the world safer than the other?

Fill in the row and column names for a spreadsheet that would be used with this lesson.

	A	B	C	D	E	F	G	H	I
1	Year	2002	2001	2000	1999	1998	1997	1996	1995
2	US	55	40	70	62	45	65	100	80
3	China	65	53	61	50	48	72	85	68



Sketch a sample graph for this lesson

My Integration Ideas: SPREADSHEETS

Directions: Use this form to expand and personalize two of the Classroom Ideas for Spreadsheets. Select two ideas that are similar to topics you teach. List learning objectives that would be achieved if students completed these tasks. Create a problem that would result in student attainment of the objectives by reaching a solution. Then create a sample spreadsheet by filling in column and row names and plausible data entries.

Lesson Idea: _____

Learning Objective(s): _____

_____

_____

Problem(s) that could be solved with this data: _____

_____

_____

Fill in the row and column names for a spreadsheet that would be used with this lesson.

	A	B	C	D
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Sketch a sample graph for this lesson

My Integration Ideas: SPREADSHEETS *continued*

Directions: Use this form to expand and personalize two of the Classroom Ideas for Spreadsheets. Select two ideas that are similar to topics you teach. List learning objectives that would be achieved if students completed these tasks. Create a problem that would result in student attainment of the objectives by reaching a solution. Then create a sample spreadsheet by filling in column and row names and plausible data entries.

Lesson Idea: _____

Learning Objective(s): _____

_____

_____

Problem(s) that could be solved with this data: _____

_____

_____

Fill in the row and column names for a spreadsheet that would be used with this lesson.

	A	B	C	D
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Sketch a sample graph for this lesson

Practice Lesson: SPREADSHEETS

Quality Control Engineers

The Problem

You are a Quality Control Engineer for Mars® Incorporated, which manufactures M&M® candies. Mars has Quality Control Engineers for three areas: taste, packaging, and contents. You are on the team for contents. You and your team must inspect a random sample of M&M® packages to ensure that the contents are of high quality. Some indicators of high quality are located at: http://www.m-ms.com/factory/

You're to summarize the results of your study in a report to the Vice President of Quality Control. She expects data to be displayed in the report.

M&M® Spreadsheet Template

Use the following template to plan how to set up a spreadsheet to analyze the M&M data.

	A	B	C	D	E	F
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

Practice Lesson: SPREADSHEETS

The Nutty Competition

The Problem

Competition between airlines is increasing as more people are starting to travel. As a result, airline companies are looking for ways to offer more incentives for travelers. One company is considering switching from offering peanuts as a snack to offering cashews. The company must decide which of two brands provides the highest quality of nuts.

You have been asked to serve on a special task force to conduct an investigation of two leading brands of cashew nut snack packages. The task force is to submit an Executive Brief that describes the study and provides a recommendation that is supported with tables and graphs.

What is known about the problem?	What do you need to know?

Spreadsheet Planning Template

Use this template to design the spreadsheet needed to solve the problem.

	A	B	C	D	E	F
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

Formulas needed to solve this problem

Use the space below to plan each formula needed to solve the problem.

Example:

Name Average nuts per bag

Formula = G9/10 (Note – G9 has the total number of nuts; 10 is the total bags of nuts)

Name_____

Formula = _____

Name_____

Formula =_____

Name_____

Formula = _____

Name_____

Formula =_____

Name_____

Formula = _____

Name_____

Formula = _____

Spreadsheet Charts

Sketch, label, and title two different types of charts for imaginary data that would be generated on the Nutty Competition Spreadsheet.

How to...

Use Databases as a Learning Tool:

A common instructional strategy requires students to create note card sets of important information. These can be called “non-digital” databases. The topics of the cards could be for U.S. Presidents, planets in the Solar System, endangered species, or leading authors. The cards of information are one step better than having the information remain in encyclopedias, but are quite limited when wanting to examine trends and patterns across the records. However, if students use database software to record information, they can easily find answers to multiple questions that would take hours to find using note cards. For example, finding differences between large and small planets; looking for relationships between accomplishments while in office and past positions held by U.S. Presidents; or comparing writing themes by gender of author or year of publication. Further database examples are provided in this section.

When to Use Databases

Use with information that has repetitive patterns and can be easily described.

Using Databases for Higher-Order Thinking

The following chart contains the basic functions of database software and example activities for which students could use these functions to engage in higher-order thinking.

Database: Basic Functions	Examples of Higher-Order Thinking Activities
Store data in records	• Examine variables to identify appropriate fields and record format • Assess data entry process to ensure accuracy
Sort data (alpha or numeric)	• Arrange data to yield needed results
Merge data	• Assemble critical data components
Create specialized reports	• Organize results to demonstrate solution

Classroom Ideas: DATABASES

The following list contains suggestions for databases that can be created by elementary, middle, and/or high school students. Numerous problem statements can be generated from each database.

Student Database Activities	My Ideas for Student Use of Databases
Digestive systems of organisms – from bacteria to mammals	•
Experimental approaches of famous scientists, e.g., Edison, Watt, Bell.	•
Dinosaur characteristics	•
Genetic traits of students	•
Features of U.S. state flags	•
Government structures of different countries	•
Features of the tallest mountains	•
Similarities of fairy tales, e.g., setting, theme, characters	•
U.S. Wars	•
Shapes around us	•
Female authors of the 1800' s	•
Parts of speech examples	•
Real world examples of fractions	•
Nutrients of common food	•
Governors from our state	•

Example Ideas: DATABASES

Directions: Use this sheet to create lesson beginnings from the Classroom Ideas for Databases. Select two ideas that would be applicable, or that are similar to topics you teach. List learning objectives that would be achieved if students completed these tasks. Create a problem that would result in student attainment of the objectives by reaching a solution. Then, create a sample database by filling in the field names and two records to demonstrate how the information would be configured.

Lesson Idea: Shapes Around Us
Learning Objective: Analyze characteristics of geometric shapes.
Problem(s) that could be solved with this data: What is the most common shape inyour kitchen?

Create a sample database for this lesson by filling in Field Names and plausible entries for two records.

Field Name	Record 1	Record 2
Shape Name	Sphere	Rectangle
Object Name	Orange	Cereal Box
Number of Sides	1	6

Lesson Idea: Governors From Our State
Learning Objective: Identify political leaders from current nations, including the United States
Problem(s) that could be solved with this data: If our state wanted to elect a governor that best represents the traits of past governors, what type of person would be needed?

Create a sample database for this lesson by filling in Field Names and plausible entries for two records.

Field Name	Record 1	Record 2
Name	Mike Smooth	Sue Serious
Number of Terms	1	1
Party	Democrat	Independent
Home City when First Elected	Metropolis	Country Side
Highest Degree	MBA	Ph.D. Political Science
Previous Job	Corporate CEO	Professor
Age when First Elected	42	38
Key Accomplishment	Tax Reduction	School Reform
Key Accomplishment	Improved Highways	Stronger Drug Penalties

My Integration Ideas: DATABASES

Directions: Use this sheet to create lesson beginnings from the Classroom Ideas for Databases. Select two ideas that would be applicable, or that are similar to topics you teach. List learning objectives that would be achieved if students completed these tasks. Create a problem that would result in student attainment of the objectives by reaching a solution. Then, create a sample database by filling in the field names and two records to demonstrate how the information would be configured.

Lesson Idea: _____

Learning Objective(s): _____

_____

_____

Problem(s) that could be solved with this data: _____

_____

_____

Create a sample database for this lesson by filling in Field Names and plausible entries for two records.

Field Name	Record 1	Record 2

My Integration Ideas: DATABASES *continued*

Directions: Use this sheet to create lesson beginnings from the Classroom Ideas for Databases. Select two ideas that would be applicable, or that are similar to topics you teach. List learning objectives that would be achieved if students completed these tasks. Create a problem that would result in student attainment of the objectives by reaching a solution. Then, create a sample database by filling in the field names and two records to demonstrate how the information would be configured.

Lesson Idea: _____

Learning Objective(s): _____

_____

_____

Problem(s) that could be solved with this data: _____

_____

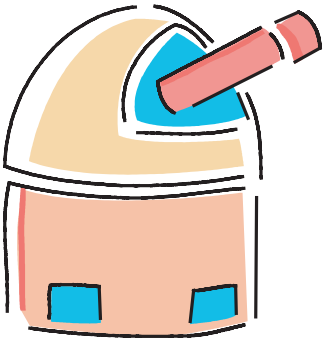
_____

Create a sample database for this lesson by filling in Field Names and plausible entries for two records.

Field Name	Record 1	Record 2

Practice Lessons: DATABASES

Solar System Mysteries



The Problem

Why are the planets in our solar system so different? Does the size of planets change as they get farther from the sun? Do bigger planets have more moons? Do planets with rings have similar atmospheres? How old would you be and how much would you weigh on each planet?

Planet Database

Directions: Create a sample database that would contain information needed to solve the *Solar System Mysteries*.

Sample:

Field Name	Record 1
Planet Name	Earth
Revolution Period	1 Earth Day

Field Name	Record 1	Record 2

How to...

Use Concept Maps as a Learning Tool:

Concepts maps are useful tools for documenting brainstorming sessions, planning a project, structuring a report, or plotting a timeline. Computer-generated concept maps are advantageous because students can easily change labels, move and/or change component shapes, add graphics, and convert ideas into an outline that can be imported into a different software application, such as a word processor.

When to Use Concept Maps

Use with content that can be categorized, linked, sequenced, or contrasted.

Using Concept Mapping Functions for Higher-Order Thinking

The following chart contains the basic functions of concept mapping software and example activities for which students could use these functions to engage in higher-order thinking.

Concept Maps: Basic Functions	Examples of Higher-Order Thinking Activities
Physically displays information	• Determine most appropriate shape to represent information
Connects ideas	• Integrate information into meaningful connections
Creates sequences	• Assess information to identify and create meaningful sequences
Adds Graphics	• Review available graphics to identify the image best represents the desired concept
Outlines	• Arrange information in meaningful structure

Classroom Ideas: CONCEPT MAPS

Below are examples of how students can use concept maps as a tool to better learn subject area content. We've included three activities for concept maps that incorporate the skills from the list of higher order thinking skills. Also included is space for you to add ideas for your students to use word processing.

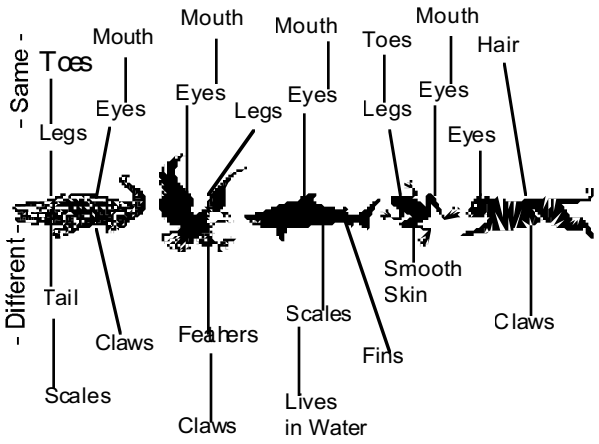
Student Concept Map Activities	My Ideas for Student Use of Concept Maps
Compare and/or Contrast	•
• Pilgrims vs. Native Americans	•
• Matisse vs. Monet	•
• Oceans vs. Seas	•
• Farm life vs. City life	•
• Plant cells vs. Animal cells	•
• City vs. State vs. National Government	•
Create a TimeLine	•
• Seed to Plant	•
• Sunlight to Food	•
• Your Life	•
• Civil Rights in the U.S.	•
• Space Program	•
• Rise and Fall of Dinosaurs	•
Plot Main Ideas	•
• Four seasons	•
• Punctuation	•
• Money	•

Example Ideas: CONCEPT MAPS

Directions: Use this form to expand and personalize two of the Classroom Ideas for concept maps. Select two ideas that are similar to topics you teach. List the key learning objectives that would be achieved if students completed these tasks. Create a problem that would result in student attainment of the objectives by reaching a solution. Then create a sample layout of a concept map that students could produce.

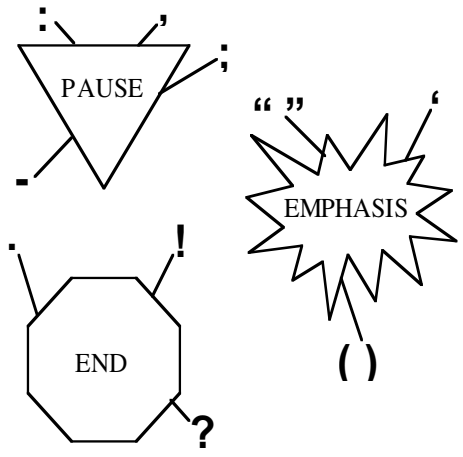
Lesson Idea: Vertebrates
Learning Objective(s): Compare characteristics of amphibians, reptiles, fish, birds, and mammals; Classify objects by observable properties.
Problem(s) that could be solved with this data: How do alligators, eagles, sharks, frogs, and tigers look like you and look different than you?

Briefly sketch the key components of a concept map that students might create for this lesson.



Lesson Idea: Punctuation
Learning Objective(s): Demonstrate correct understanding of punctuation; Use correct punctuation when writing
Problem(s) that could be solved with this data: How can punctuation marks be displayed?

Briefly sketch the key components of a concept map that students might create for this lesson.



My Integration Ideas: CONCEPT MAPS

Directions: Use this form to expand and personalize two of the Classroom Ideas for concept maps. Select two ideas that are similar to topics you teach. List the key learning objectives that would be achieved if students completed these tasks. Create a problem that would result in student attainment of the objectives by reaching a solution. Then create a sample layout of a concept map that students could produce.

Lesson Idea: _____

_____

_____

Learning Objective(s): _____

_____

_____

Problem(s) that could be solved with this data:

_____

_____

_____

Briefly sketch the key components of a concept map that students might create for this lesson.

Lesson Idea: _____

_____

_____

Learning Objective(s): _____

_____

_____

Problem(s) that could be solved with this data:

_____

_____

_____

Briefly sketch the key components of a concept map that students might create for this lesson.

Practice Lesson: CONCEPT MAPS

Here is a Concept Map lesson idea that can be used as hands-on practice for classroom teachers and as a technology lesson that can be implemented in the classroom.

Does History Repeat Itself?

The Problem

Some have said that there are many similarities to Abraham Lincoln and John F. Kennedy beyond the fact that they both were assassinated while serving as US President. Your team is to use concept mapping software to create a parallel timeline that depicts key events from birth to death of both presidents. Make sure to highlight similarities. Provide a word processed paper that answers the question: Does History Repeat Itself?

Prior to the Computer Planning Sheet

List the key events for each president, then use the following blank timeline to briefly plan your timeline.

Lincoln Key Events	Kennedy Key Events

Birth — **LINCOLN** — Death

Birth — **KENNEDY** — Death

How to...

Use Presentations as a Learning Tool

Presentation software, such as Microsoft PowerPoint®, is commonly used by teachers and students to share information. However, the software has several functions that, when used appropriately, can engage students in higher-order thinking. For example, the animation feature can be used to demonstrate movement during a chemical reaction, change of geographical boundaries over time, or changing a square to a rectangle. The text build tool and slide sorter tools require students to plan the most effective sequence for presenting information. More examples are given below.

When to use Presentations

Use to display information that can be enhanced by motion and interactivity

Using Presentation Functions for Higher-Order Thinking

The following chart contains the basic functions of presentation software and example activities for which students could use these functions to engage in higher-order thinking.

Presentaitons: Basic Functions	Examples of Higher-Order Thinking Activities
Displays Text	Summarize/paraphrase • Titles • Bulleted lists • Labels
Supports Navigation	Determine sequence • From one slide to the next • To designated slides
Creates Animation	Demonstrate concepts • Bring in text or graphics from different locations • Show text or graphics with different effects
Inserts or Creates Graphics or Motion Clips	Match, select, create • Insert clipart and photos from the MS Gallery • Inserts clip art and photos from student-generated files
Inserts Sound	Match, select, create • Insert sound from Microsoft Gallery or music CDs

Classroom Ideas: PRESENTATIONS

The following list contains suggestions for presentations that can be created by elementary, middle, and/or high school students. Space is provided for you to add ideas for how your students can create presentations.

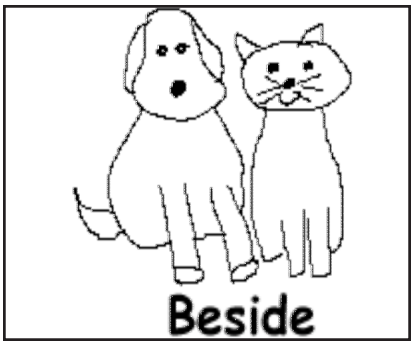
Student Presentation Activities	My Ideas for Student Use of Presentations
Graphically depict parts of speech	•
Showcase items of interest within 100 miles of our school	•
Use graphics to demonstrate different types of symmetry	•
Demonstrate the before and after of key chemical reactions	•
Illustrate the difference between electrical vs. chemical energy	•
Create a virtual elevator ride to the Earth' s center	•
Illustrate prepositions in action	•
Document the history of money	•
Explain why it rains	•
Showcase postcards from Asia	•
Depict math concepts in motion	•
Compare the role of insects' antennas to humans' five senses	•
Create a " Countries of Our Heritage" for our class	•
Show tessellations through time	•
Visualize what happens to a vote	•

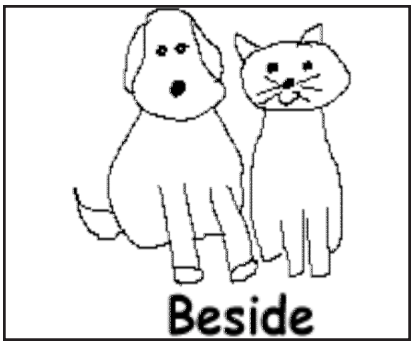
Example Ideas: PRESENTATIONS

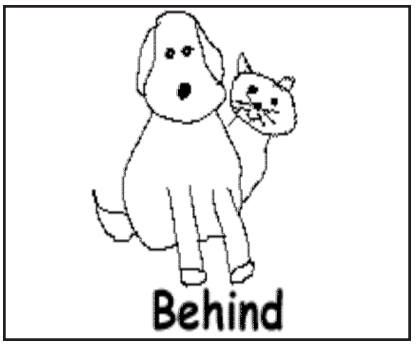
Directions: Use this form to expand and personalize two of the Classroom Ideas for Presentations. Select two ideas that are similar to topics you teach. List the key learning objectives that would be achieved, if students completed these tasks. Create a problem that would result in student attainment of the objectives by reaching a solution. Then, create a sample layout of three main presentation slides that students would produce.

Lesson Idea: Prepositions in Action
Learning Objective(s): Identify and use prepositions; recognize the function of prepositional phrases
Problem(s) that could be solved with this data: How many different places can Felix the cat sit with Max the dog?

Briefly sketch three main presentation slides that students would produce.

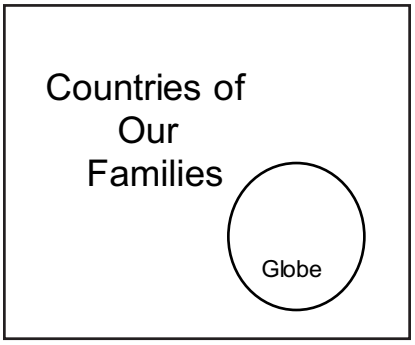


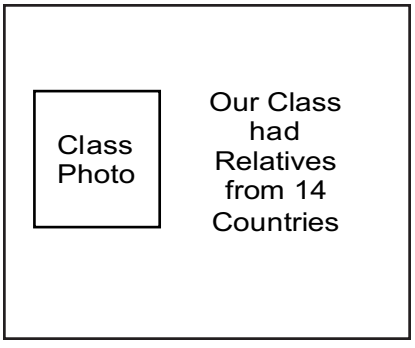


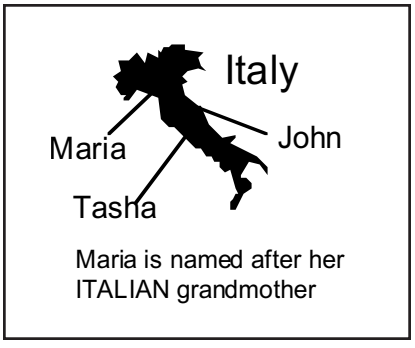


Lesson Idea: Countries of our Heritage
Learning Objective: Recognize how migration influences the culture of world societies
Problem(s) that could be solved with this data: From how many countries did our ancestors come?

Briefly sketch three main presentation slides that students would produce.







My Integration Ideas: PRESENTATIONS

Directions: Use this form to expand and personalize two of the Classroom Ideas for Presentations. Select two ideas that are similar to topics you teach. List the key learning objectives that would be achieved, if students completed these tasks. Create a problem that would result in student attainment of the objectives by reaching a solution. Then, create a sample layout of three main presentation slides that students would produce.

Lesson Idea: _____

_____

Learning Objective(s): _____

_____

Problem(s) that could be solved with this data: _____

_____

_____

Briefly sketch the main presentation slides that students would produce.

My Integration Ideas: PRESENTATIONS *continued*

Directions: Use this form to expand and personalize two of the Classroom Ideas for Presentations. Select two ideas that are similar to topics you teach. List the key learning objectives that would be achieved, if students completed these tasks. Create a problem that would result in student attainment of the objectives by reaching a solution. Then, create a sample layout of three main presentation slides that students would produce.

Lesson Idea: _____

_____

Learning Objective(s): _____

_____

Problem(s) that could be solved with this data: _____

_____

_____

Briefly sketch three main presentation slides that students would produce.

Practice Lesson: PRESENTATIONS

Here is a presentation lesson idea that can be used as hands-on practice for classroom teachers and as a technology lesson that can be implemented in the classroom.

Six Sensational Similes

The mission of your team is to create a PowerPoint presentation of Six Sensational Similes that display digital photos to graphically enhance each one.

Sample Slide

His thoughts reached to the sky

like a large, old tree.

Prior to going to the Computer

Create a storyboard for the six similes that show the types of photos your team needs to take.

How to...

Use Web Browsers as a Learning Tool

One of the key changes to today's educational environment is the Internet. Students now have access to almost any type of information – from historical archives to up-to-the-minute news. Since the information is in a digital format, it can often be downloaded to student computers that allow for information to be more closely examined and deeper understanding to be gained. This section provides ideas for using a web browser to not only access information, but also to take advantage of its interactive functionality.

When to use Web Browsers

Use to access information or to engage in interactive learning.

Using Web Browser for Higher-Order Thinking

The following chart contains the basic functions of web browser and communication software. Additionally, it includes example activities for which students could use these functions to engage in higher-order thinking.

Web Browser: Basic Functions	Examples of Higher-Order Thinking Activities
Searches for information	• Clarify intended outcome(s) • Identify related descriptive search terms • Evaluate and modify search based on results
Bookmarks web sites	• Create system for organizing bookmarks
Hyperlinks to related resources	• Examine information prior to and after using hyperlinks
Provides interactive feedback	Engage in decision-making

Classroom Ideas: WEB BROWSERS

Below are examples of how students can use web browsers as a tool to better learn subject area content. Also included is space for you to add additional ideas for your students to use web browsers.

Student Web Browser Activities	My Ideas for Student Use of Web Browsers
Historical Documents	•
• Books – e.g., Complete Works of Shakespeare	•
• Documents – e.g., U.S. Constitution	•
• Video – e.g., Martin Luther King – " I Have a Dream"	•
• Audio - e.g., Robert Frost reading poetry	•
Current Events	•
• News	•
• Human Interest stories	•
• Sports	•
• Science and Technology	•
• Foreign Relations	•
Reference and Resources Tools	•
• Dictionaries	•
• Thesaurus	•
• Encyclopedias	•
• Calculators - e.g., graphing, interest calculations	•
• Statistics - e.g., census, employment	•
Interactive Learning	•
• Basic skills drill and practice	•
• Problem-solving	•
• Virtual reality	•

Example Ideas: WEB BROWSERS

Directions: Use this form to expand and personalize two of the Classroom Ideas for Web Browsers. Select two ideas that are similar to topics you teach. List the key learning objectives that would be achieved if students completed these tasks. Create a problem that would result in student attainment of the objectives by reaching a solution. Then,generate a list of key words that could be used to search for the information or web sites that contain the information, and briefly describe the information that would be collected.

Lesson Idea: Cost of Living

Learning Objective(s): Understand cost of living in different geographic locations

Problem(s) that could be solved with this data: What would it cost to build your dream house in Florida, Connecticut, Texas, Seattle, and California?

Keyword Search Terms	Search Results
building costs	Building costs per square foot
square footage in Texas	Create your own estimate
cost of living	
building estimate	

Lesson Idea: Interactive Learning: Virtual Reality

Learning Objective(s): Science – demonstrate the structure of chemical bonds

Problem(s) that could be solved with this data: We plot chemical bonds withpencil and paper – what do you think they look like in reality or when represented in a 3D format

Keyword Search Terms	Search Results
chemical bonding	Virtual reality environment that allows students to create and examine a variety of chemical bonds.
3-D models	

My Integration Ideas: WEB BROWSERS

Directions: Use this form to expand and personalize two of the Classroom Ideas for Web Browsers. Select two ideas that are similar to topics you teach. List the key learning objectives that would be achieved if students completed these tasks. Create a problem that would result in student attainment of the objectives by reaching a solution. Then,generate a list of key words that could be used to search for the information or web sites that contain the information, and briefly describe the information that would be collected.

Lesson Idea: _____

_____

Learning Objective(s): _____

_____

_____

Problem(s) that could be solved with this data: _____

_____

Keyword Search Terms	Search Results

My Integration Ideas: WEB BROWSERS *continued*

Directions: Use this form to expand and personalize two of the Classroom Ideas for Web Browsers. Select two ideas that are similar to topics you teach. List the key learning objectives that would be achieved if students completed these tasks. Create a problem that would result in student attainment of the objectives by reaching a solution. Then,generate a list of key words that could be used to search for the information or web sites that contain the information, and briefly describe the information that would be collected.

Lesson Idea: _____

_____

Learning Objective(s): _____

_____

_____

Problem(s) that could be solved with this data: _____

_____

Keyword Search Terms	Search Results

Practice Lesson: WEB BROWSERS

Here is a Web Browser lesson idea that can be used as hands-on practice for classroom teachers and as a technology lesson that can be implemented in the classroom.

Weather: Web vs. TV

The Internet is becoming a very popular source of information – but is it always the best source? For example, if you were going to plan a weekend camping trip, should you use information from a web-based weather service or the weather reports given by your TV station? Your group is to design and conduct a study that compares data collected from the web and from the TV to determine which one has the most accurate and consistent weather predictions.

Weather Recording Sheet

Fill in the column and row names of the type of data that will be collected from the Web and from the TV Stations.

How to...

Use Communication Tools as Learning Tools

With the use of Internet-based communication tools, the educational opportunities for students have become limitless. Under strict security and close supervision, students can now instantaneously exchange ideas, school projects, and photos with other children across the globe. Students can ask a writer why they added particular components to a story, a scientist how to set-up an experiment, an engineer which mathematics skills they use while working, and a grandmother how she created her quilt pattern. These experiences and gained knowledge add a "real-world" component to the classroom environment.

When to use Communication Tools

Use when interactivity with others will enhance learning

Using Communication Tools for Higher-Order Thinking

The following chart contains the basic functions of communication software and example activities for which students could use these functions to engage in higher-order thinking.

Communication Tools: Basic Functions	Examples of Higher-Order Thinking Activities
Allows synchronous/ asynchronous communications	• Select conversation topics and questions.
Sends/Receives Text	• Evaluate received text to establish alignment with purpose.
Sends/Receives Video/Audio	• Determine appropriate content and format to allow easy retrieval.
Sends/Receives Attachments	• Determine content to ensure it supports purpose.
Archives Messages	• Establish meaningful structure to ensure retrieval of information.

Classroom Ideas: COMMUNICATION TOOLS

Below are examples of whom students can contact using communication tools, such as email, listservs, bulletin boards, chats and instant messaging, as a tool to better learn subject area content. Also included is space for you to add additional ideas for your students to use communication tools.

Student Communication Tools Suggested Participants	More Ideas for Student Use of Communication Tools
Other Students	•
Same class	•
Same school	•
Same city	•
Same state	•
Throughout the United States	•
International (e.g., keypals)	•
Experts	•
Researchers (e.g., professors, scientists)	•
Government (e.g., local, state, national, international)	•
Medical (e.g., doctors, nurses, pharmacists, technicians)	•
Writers (e.g., newspaper, books, poets)	•
Artists (e.g., musicians, painters, sculptors)	•

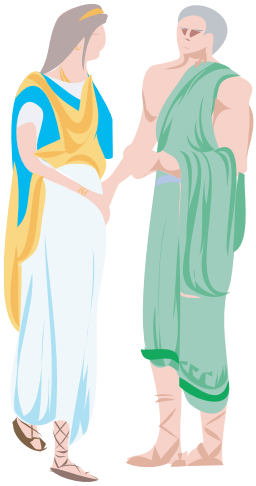
My Integration Ideas: COMMUNICATION TOOLS

Directions: Use this form to expand and personalize two of the Classroom Ideas for Communication Tools. Select two ideas that are similar to topics you teach. List the key learning objectives that would be achieved if students completed these tasks. Create a problem that would result in student attainment of the objectives by reaching a solution. Then, list who will participate (specific names may not be needed, e.g., high school students in Alaska) and briefly describe the exchange of information that would occur.

Lesson Idea: Other students - International
Learning Objective(s): Compare cultural characteristics of the world
Problem(s) that could be solved with this data: Do Greeks believe in Greek mythology?

Sample Email:

From:	Group A
To:	13 year old in Greece
Subject:	Greek mythology
Message:	We are studying Greek mythology and wanted to know if students in Greek schools also study Greek mythology. If you do, which of these myths is your favorite and why?



Lesson Idea: Expert - Business
Learning Objective(s): Connect math procedures to real-world situation
Problem(s) that could be solved with this data: Is the math that we have to learn in high school really used in the real world?

Sample Email:

From:	Mrs. Smith's class
To:	Architects
Subject:	Mathematics
Message:	I am a high school freshman considering becoming an architect and would like to know what type of mathematics you use while doing your work.

My Integration Ideas: COMMUNICATION TOOLS

Directions: Use this form to expand and personalize two of the Classroom Ideas for Communication Tools. Select two ideas that are similar to topics you teach. List the key learning objectives that would be achieved if students completed these tasks. Create a problem that would result in student attainment of the objectives by reaching a solution. Then, list who will participate (specific names may not be needed, e.g., high school students in Alaska) and briefly describe the exchange of information that would occur.

Lesson Idea: _____

Learning Objective(s): _____

_____

Problem(s) that could be solved with this data: _____

_____

Sample Email:

From: _____
To: _____
Subject: _____
Message: _____
_____
_____

Lesson Idea: _____

Learning Objective(s): _____

_____

Problem(s) that could be solved with this data: _____

_____

_____

Sample Email:

From: _____
To: _____
Subject: _____
Message: _____
_____
_____

Practice Lesson:
COMMUNICATION TOOLS

Ask the Experts

The Memphis Zoo has an "Ask the Zookeeper" project as part of their educational programs. A link on the zoo's website provides an opportunity for students to email one of the curators for each exhibit. So, students can email a zookeeper to ask specific questions about specific species.

The Problem:

Different kinds of animals have different social structures. Even among the same kinds of animals, such as monkeys, they can act differently toward one another. First, determine what information the zookeeper can add to your own knowledge by completing the table below. Then in the space provided below, write an email to the zookeeper at the Memphis Zoo to ask about the social structures of the primates they have.

What do you already know about primates' social structures?	What do you want to know about the primates' social structures?	What kinds of information can the zookeeper add to what you already know?

From: _____

To: _____

Subject: _____

Message: _____

_____

_____

SECTION 5

Planning Professional Development

How to Understand your Role as a Coach

What Is Mentoring

How to Share Expertise

How to Motivate Teachers

How to Meet the Needs of Adult Learners

How to Provide Constructive Feedback

How to Use Self-reflection

How to Plan and Provide Professional Development

How to...

Understand Your Role as a Coach

The previous section of this handbook dealt with understanding technology integration and what it looks like in the classroom. Emphasis was placed on recognizing national and state standards, the implications of research-based practices and the use of technology to improve student learning.

This section, however, focuses on the technology coach's role as a coach. In order for a coach to be successful in partnering with other teachers and administrators to effect change, he or she must fully understand his or her role as a coach and mentor. The following pages explore:

- what it means to be a mentor;
- motivating teachers;
- teaching adult learners;
- how to use constructive feedback;
- using reflection; and
- planning professional development.

Be sure to review the tables, handouts and tip sheets. You can use these blackline masters as needed for the professional development opportunities you will design for teachers.

What is...

Mentoring

Think back to when you began teaching. Can you think of someone you regularly visited—someone you shared your frustrations with and valued her advice? If so, you are familiar with the type of relationship is at the heart of a mentoring partnership. Your role as a technology coach follows this type of relationship. You will actively listen, observe, teach, evaluate and guide novice technology integrators. You will pilot these colleagues as they journey through using computers and electronic resources effectively in their curricula.

Mentors are generally considered experienced individuals who assist novices in acquiring knowledge, skills and values. While this may appear to suggest mentors are merely teachers, the role of a mentor is much more complex. Peterson (1996) explains that the most effective mentors:

- Want to share their knowledge, materials, skills and experience with those they mentor;
- Offer support, challenge, patience and enthusiasm while they guide others to new levels of competence;
- Point the way and represent tangible evidence of what one can become;
- Expose the recipients of their mentoring to new ideas, perspectives and standards, and to the values and norms of the profession; and
- Are experts in terms of knowledge, and view themselves as equal to those they mentor.

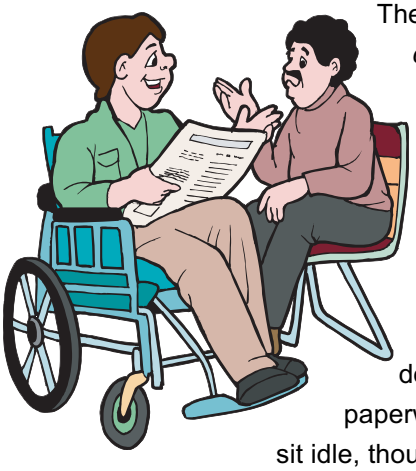
Stratton, Wootten and Mitstifer (2000) agree that mentors' roles are complex. They add that mentor relationships:

- Advise, give moral support and build confidence; and
- Furnish a relatively objective assessment of strengths and weaknesses.

Mentoring appears to be a multifaceted activity replete with challenges and personal satisfaction for both the mentee and the mentor.

Good Mentors

The task of mentoring others may seem daunting. Obviously, it requires significant time and energy. Using a list adapted from Rowley (1999), these tasks have been distilled into six essential qualities of a good mentor appropriate to a technology coach. While the number of qualities may make it easier to grasp the breadth of a mentor's responsibilities, these essential qualities belie their complexities.



The first essential quality of a good mentor is *to be committed to the role* (Rowley, 1999). Good mentors are persistent and rely on the underlying belief that mentors are capable of making significant change in classroom instruction and student learning. Rowley also encourages mentors to maintain simple documentation of teacher conferences and professional development seminars or workshops. This documentation should be simple and keep paperwork to a minimum. Don't let this documentation sit idle, though. Use this documentation in evaluation reports and impact reports for parents, teachers and administrators as evidence of efforts to effect change.

Good mentors:

- are committed;
- accept beginners;
- are skilled at instruction;
- are effective interpersonally;
- model continuous learning;
- communicate hope and optimism.

The second essential quality appropriate for technology coaches is that a good mentor is *accepting of a beginner* (Rowley, 1999). Mentors must set aside their personal beliefs and judgments about beginners in order to be supportive and provide worthwhile feedback. It may be helpful to reflect on your own journey through technology use and curriculum integration.

Can you recall a lesson involving technology that didn't go as you planned? What happened? How did you resolve it? How can you use this experience to help other beginning teachers grapple with integrating technology in their classrooms?

The third essential quality of a good mentor is to be *skilled at providing instructional support* (Rowley, 1999). Beginning technology integrators vary according to their technology and teaching skills. Good technology coaches move teachers along their journeys of novice to expert on a technology integration continuum and adjust for skills in both areas. Additionally, they find ways to collaborate on planning, instruction, management and evaluation. Such collaboration can occur as team teaching or team planning, mentors observing mentee, mentees observing mentors, or both mentors and mentees observing another teacher.

Fourth in the essential qualities of a good mentor is that they are *effective in interpersonal contexts* (Rowley, 1999). Each mentoring relationship is unique. A technology coach as mentor must vary his or her approach to each interpersonal relationship. Just as a teacher adjusts instruction and behavior plans to accommodate different learners, so does the technology coach.

A good mentor is also *a model of a continuous learner.* This is the fifth essential quality for technology coaches (Rowley, 1999). An effective technique for a novice learner is to observe an expert as they model problem solving and learning (Collins,

Brown, & Newman, 1990). Mentors can make their own process for problem solving and searching for solutions overt to novices. For example, a technology coach may model how she renovates an existing lesson plan to incorporate technology in a meaningful manner.

Lastly, a good mentor *communicates hope and optimism* (Rowley, 1999). It is important to support affect and feelings of novices. Communicating that it is possible to move beyond the current challenges is vital for mentors. As mentioned above, it is valuable for the mentee to observe mentors' frustrations and challenges and the methods used to overcome them.

A toxic mentor can be:
- an avoider;
- a dumper;
- a blocker;
- a criticizer.

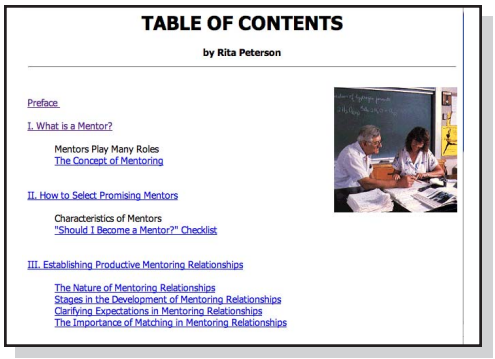
How can you avoid being a toxic mentor?

Toxic Mentors

While it is important for technology coaches to develop habits that promote the essential qualities of a good mentor, it is equally critical that coaches avoid becoming toxic mentors. Stratton, Wootten and Mitstifer (2000) identify four types of individuals who can effect negative consequences on mentoring relationships. An *avoider* is a mentor who is never accessible and evades the responsibilities of mentoring relationship. This type of individual is not committed to the role of a good mentor (c.f. Rowley, 1999). Second, a *dumper* dodges providing necessary guidance when mentees enter new situations or roles. This individual fails to advise and support, letting novices "sink or swim." Next, a *blocker* fails to meet the mentees needs by withholding necessary information or impedes professional development by supervising too closely. Finally, a *criticizer* neglects the provision of emotional support. This type of mentor publicly criticizes a mentee or persistently criticizes. Striking a balance between support and independence while providing constructive feedback to individuals is a difficult task for mentors to achieve.

How to...

Share Your Expertise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by Rita Peterson

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I. What is a Mentor?

Mentors Play Many Roles
The Concept of Mentoring

II. How to Select Promising Mentors

Characteristics of Mentors
"Should I Become a Mentor?" Checklist

III. Establishing Productive Mentoring Relationships

The Nature of Mentoring Relationships
Stages in the Development of Mentoring Relationships
Clarifying Expectations in Mentoring Relationships
The Importance of Matching in Mentoring Relationships

As a technology coach and mentor, you have a body of professional knowledge and skills that you can share with other teachers who are novices at technology integration. For some technology coaches, this may include insight on Language Arts, Math, Science and Social Studies, along with word processors, spreadsheets, databases and Internet search engines. But from your experiences of integrating technology, you may also be able to share expertise in planning, instructional management, and evaluation (Peterson, 1996) related to teaching and learning with technology.

Below are some ideas that are appropriate for technology coaches to use when sharing expertise with others. These were collected from Rita Peterson at the University of California Irvine (Mentor Teachers Handbook: http://www.gse.uci.edu/doehome/EdResource/Publications/MentorTeacher/Contents.html). Be sure to include your own ideas concerning your expertise in the spaces provided.

Sharing Expertise Handout

Directions: Read through the suggestions for sharing your expertise with others in each of the elements of classroom teaching. These were provided by Rita Peterson at the University of California Irvine (Mentor Teachers Handbook: http://www.gse.uci.edu/doehome/EdResource/Publications/MentorTeacher/Contents.html). Then write your own ideas in the spaces provided.

Sharing Expertise on Planning

1. Team up during the orientation week before school begins, and schedule regular times to meet for discussion and planning sessions.
2. Discuss goals for the year or semester and objectives for units or lessons.
3. Show how you organize your planning for the year, the semester, the week, and the day.
4. Share your ideas about planning for contingencies.
5. Collaborate on a special unit of instruction or a project.
6. Work together to design a new lab or learning center.Write in your own ideas here:
7. _____
8. _____
9. _____
10. _____

Sharing Expertise on Instruction

1. Structure times at noon or the end of the day to share reaction to the day's teaching.
2. Be willing to share information about your own teaching successes and failures, if appropriate.
3. Offer to demonstrate lesson or labs—live, on videotape, or on CD.
4. Describe strategies you use to increase student attention, motivation or participation.
5. Offer to prepare videotape lessons or classes, and offer to give feedback for those with questions.Write in your own ideas here:
6. _____
7. _____
8. _____
9. _____
10. _____

Sharing Expertise on Management

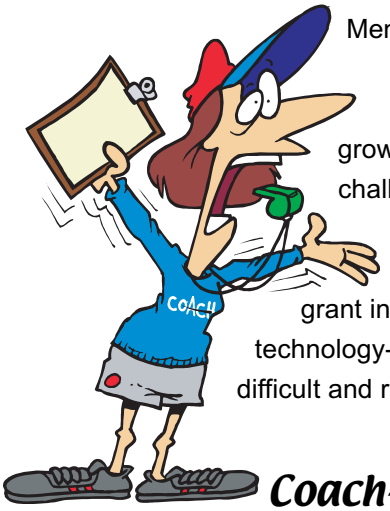
1. Talk about the most difficult management problems you have encountered and various ways to address them.
2. Share examples of ways to enhance students' self-concepts.
3. Talk about standards of schoolwide conduct.
4. Offer to analyze (as a colleague and peer) the videotape of a teacher's lesson and be willing to share your ideas about classroom management.Write in your own ideas here:
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

Sharing Expertise on Evaluation

1. Talk about the variety of ways (formal and informal, verbal and nonverbal) that one can use to evaluate student learning and attitudes.
2. Share your own system of grading and record keeping, and describe other models that you know.
3. Offer to share a collection of evaluation measures you have developed.
4. Offer to give feedback on a mentee's evaluation measures.
5. Review the standardized test program used by the school, and talk about its role in relation to curriculum planning and evaluation of student learning in the classroom.
6. Discuss and compare various techniques for evaluation of one's own teaching effectiveness.
7. _____
8. _____
9. _____
10. _____

How to...

Mentor and Motivate Teachers



Mentoring and motivation go hand in hand; these are the skills that enable teachers to succeed at technology integration. It's imperative to build support for growth while identifying weaknesses and overcoming challenges. Below are some tips from technology coaches in Tennessee. These coaches were part of a Technology Literacy Challenge Fund (TLCF) grant in 2002. As you can see from these teachers-turned-technology-coaches, the role of a technology coach is varied, difficult and rewarding.

Coach-to-Coach Tips

- Be a peer, not a boss.
- Recognize that you have a lot to learn from experienced teachers.
- Consider matching your beginning users with more experienced mentors.
- Consider meeting with grade-level teams as well as one-on-one.
- Consider "ability grouping" your teachers for small-group mentoring.
- Consider working with one teacher on a grade-level team, who will teach new skills to the rest of the team.
- Encourage teachers to look at student work generated in other classrooms.
- Recruit teacher or student helpers to ensure that a teacher's classroom application of a new skill is a success.
- Create opportunities for beginning users to watch seasoned users find solutions to computer problems.
- Start simple: "For some teachers this meant helping to devise a schedule to get children on the computers on a daily basis."
- If possible, assess the teacher's competency level before first meeting to work at the teacher's level.
- Ask, "How can I help you?"
- Probe when a teacher asks for a specific equipment or program. Find out how the teacher wants to use it.

When you're working with others, recognize that you have a lot to learn from these experienced teachers.

More Coach-to-Coach Tips

- Focus on a skill that the teacher can use immediately in the classroom.
- Clearly define the goals for the training time: "Put individual goals in writing. These plans formalize teachers' commitment to using technology in the classroom."
- Tie the skill to the teacher's subject area.

- Identify web resources useful to the teacher: "Research their topic by in-depth searches, then email them the link and how you found it (this identifies and teaches them technique)."
- Offer the teacher a sample of a finished product: "I have found that presenting the teacher with a finished product is often very motivating. It whets the appetite and makes them want to learn how to reproduce the same type of lesson or activity."
- Offer step-by-step instructions in multiple formats (oral, note taking, hands-on, Internet): "Explain what you are going to do and why."
- Show the steps... not more that 3-4 steps at a time. Undo the steps, and then let them do it.
- Allow plenty of time for the teacher to practice.
- Ask for feedback checks to make sure you are meeting the teacher's needs.
- Work alongside the teacher to use the built-in Help menus.
- When working on lesson plans, provide a structure if needed: "I asked teachers to bring their favorite non-technology math or reading lesson with them. We worked on ways to integrate a technology component into this lesson. This helped eliminate the problem of where do I begin?"
- When using standardized test data to identify areas of weakness within the classroom, provide examples from your own classroom.
- Plan the next mentoring session in conjunction with the teacher.
- At the beginning of the next mentoring session, review the previous skill.
- Be flexible.
- Set up "on call" hours if possible.
- Set up a calendar for additional before-school or after-school support.
- Schedule the conference appointment time during the teacher's planning time.

Even More Coach-to-Coach Tips

- Consider hiring a roving sub: “The substitute relieves the teacher for 1-1/2 hours so the teacher can meet with me for 1:1.”
- Choose a time of day when the teacher is fresh.
- Stop when the brain is full and continue on another day.
- Use the teacher’s time wisely. If a teacher does not understand the concept, then slow down. If the teacher is gaining an understanding quickly, move on to the next skill.
- Make arrangements to assist the teacher in the classroom when the new skill is introduced.
- Choose a location in which the teacher will have access to a computer.
- Make the teacher feel as comfortable as possible.
- Take the teacher a snack or candy!
- Smile.
- Be patient.
- ENCOURAGE! ENCOURAGE! ENCOURAGE!
- Get the teacher excited about the prospect of using computers.
- Help to develop and nurture the teacher’s teaching passion.
- Let the teacher know that you think every question is worthy of discussing.

How to...

Meet the Needs of Adult Learners

One of the primary responsibilities of a technology coach is to help teachers improve their ability to integrate computers into classroom instruction. To do this, each teacher needs to be engaged in learning opportunities that recognize his or her individual differences and unique characteristics as an adult learner.

Below are some guidelines to assist with the facilitation of adult learning.

Adult Learners:

- Learn what they consider important.
- Need to be involved in establishing learning goals and expectations.
- Need to integrate what they are learning with what they know and practice.
- Tend to be more persistent when working in small groups of peers with similar ability levels.
- May avoid trying new things in front of peers because errors may be taken personally and can negatively impact self-esteem and the willingness to continue learning.
- May need a slower approach, and one that addresses beliefs and values when new ideas conflict with prior knowledge.

Adult Learning Environments should:

- Acknowledge adult learners as mutual partners and draw upon their professional and life experiences as relevant enhancements to the learning situations.
- Meet the diversity of learning styles by providing a variety of instructional techniques, learning options and resources that relate to the learners' experiences.
- Use a straightforward approach that goes from training to classroom application.
- Have an open and comfortable atmosphere in which the adult learners are respected and treated on an adult-to-adult level, feel safe but challenged, and are responsible for their learning.

How to...

Provide Constructive Feedback

Technology coaches are concerned with helping teachers implement the skills and knowledge learned from technology-related professional development. After training sessions are over and teachers return to their classrooms, technology coaches, whether explicitly stated or not, must ensure that teachers are properly using what they were trained to implement. This task, on top of other duties, may appear as a daunting, if not frightening task – especially if it is an area in which a coach does not have previous experience.

How can technology coaches encourage teachers to implement the content of a recent training session? Or, how can they positively guide teachers in the development of technology-enriched lesson plans, without stepping on toes? After all, not all teachers are as excited or knowledgeable as a coach about technology integration, but they may be extremely competent in another facet of education. Regardless, some teachers understand technology integration concepts and will easily implement them, while others are less than interested — to say the least. Nevertheless, providing teachers with constructive feedback is one of the most important responsibilities that a technology coach can provide. Research shows that "teachers who receive the most classroom feedback are also most satisfied with teaching" (Glickman, Gordon & Ross-Gordon, 1998, p. 297).

Therefore, technology coaches need to remember that their role is to help teachers. By providing teachers with feedback, coaches are helping them. Although the interaction in this role is an administrative function, it does not mean that a coach will be entering classrooms to formally evaluate teachers. Coaches are not there to scrutinize the value of the teacher to the school. They are not there to renew or not renew a contract. Rather, coaches are there to help teachers by providing them with direct assistance. For example, coaches help teachers understand how the content of a recent training session can be used in the classroom.

These points are mentioned as it is important to realize that some teachers may, nevertheless, feel threatened by the presence of a coach in their classroom. That is, they may feel uncomfortable or intimidated unless a coach prefaces his or her work with some underlying principles.

The five steps below from Glickman, Gordon, and Ross-Gordon (1998) are designed to provide coaches with a step-by-step overview of how to provide teachers with constructive feedback. Each of the steps is written with a broad understanding in mind, assuming that coaches will more adequately adapt the steps to their particular needs.

Steps for Providing Constructive Feedback:

1. Preconference with teacher
2. Observation of identified need
3. Analysis & Interpretation
4. Postconference with teacher
5. Critique of previous steps

STEP 1: Preconference with teacher

The purpose of the preconference is to provide time for a coach to sit with a teacher to discuss the reason and purpose for wanting to work with a specified teacher. This is a good time for a coach to share with the teacher that his or her interest in working the teacher is not for evaluation purposes. Rather, the coach is there to provide support and direct assistance to the teacher regarding technology-related, classroom needs. In order to know how best to assist the teacher with classroom needs, the coach may occasionally want to observe a technology-enriched lesson in the teacher's classroom. However, it may be good to mention that such observations will be done out of good-natured collaboration with the teacher. Furthermore, the preconference is also a good time for the coach to discuss the specific focus of intended work with the teacher (e.g., how student learning can be enhanced with the use of spreadsheets). Often, it is a good idea for a coach to collaborate with the teacher to identify areas (and hopefully, a specific area) that are of greatest need to the teacher.

Additionally, the preconference is a good time for a coach to mention the ways in which he or she likes to communicate. That is, if a coach prefers email to phone calls or scheduled appointments to being randomly stopped in the hallway, these points should be mentioned at this time. Additionally, a coach should try to elicit the same type of information from the teacher. Does the teacher prefer scheduled bi-weekly meetings or appointments as specific needs arise? Of course, the more open a coach and teacher can be with each other about these types of issues, the more likely enhanced communication will occur throughout the extent of the collaboration.

STEP 2: Observation of identified need

Next, a coach needs to follow through with what was discussed in the preconference. Depending on the type of need that was identified, a coach may now need to observe the teacher in action to more clearly understand how he or she can assist the teacher. Additionally, a coach may want to request a copy of a lesson plan that the teacher is working on, so that he or she can provide guidance where it is needed. Regardless of the specific need, the role of a coach in this step is to take action to "observe" an area of need in action.

During the observation, regardless of the format, focus should be on describing what is seen. Reserve interpretations for after the observation. Ideally, it is a good idea for a coach to use an instrument or technique that will encourage this practice. Keeping tally marks on how students are actually using computers, for example, is more effective than immediately interpreting what is viewed in a non-factual manner.

STEP 3: Analysis and Interpretation

After a coach has observed a particular need, analysis and interpretation should occur. It is recommended that a coach retreat to his or her office or another quiet location to think about the information that is present. During this time a coach should examine any collected data to recognize patterns, count frequencies, or discover inconsistencies, for example. This is the time in which the coach should thoughtfully consider what is or isn't happening in a classroom. Of course, a coach's "observation" may not have been a face-to-face meeting in which a teacher was teaching or implementing lesson plan. In such instances, the observation of step two will likely be less distinct from the relevance of step three. Nevertheless, separating descriptions from interpretations is still important. The key point to this difference comes in ensuring that a coach's biases do not taint what is actually occurring in a specific situation. Making such a distinction also provides a way for a coach to logically support interpretations.

Now, regarding the manner in which a coach will share this information with the teacher, a few options are available. The following table has been provided to assist with choosing the most appropriate option. The choices in this table are interpersonal communication forms that, when wisely chosen, will encourage a more productive result with a given teacher. Of course, some teachers have more experience than others and teacher qualities differ. Therefore, the ways in which a coach communicates and relates to teachers should differ according to what will be most beneficial to the specific needs. Before continuing, please take a moment to review the interpersonal approaches identified in the following table.

Interpersonal Approaches to Communication

Use a directive control approach . . .	**by doing the following . . .**
• When teachers lack the desire or knowledge to change an issue. • When you alone are held accountable for the outcomes of the revision. • When you are more committed to solving the issue than the teacher.	• Let the teacher know that you believe a specific revision will change things. • Let the teacher know that you will take responsibility for the decision to make such a change. • Don' t be bossy for the sake of being bossy.
Use a directive informational approach . . .	**by doing the following . . .**
• When a teacher has less knowledge about an issue than you. • When a teacher views you as someone who knows more than they do about an issue. • When you are willing to support the teacher in the decision they decide to implement.	• Provide knowledge and information to the teacher. • Offer several alternatives to the teacher from which you allow him or her to choose the solution he or she would like to implement.
Use a collaborative approach . . .	**by doing the following . . .**
• When you share with the teacher similar amounts of expertise on an issue. • When you share with the teacher the accountability for the outcomes of the revision. • When you share with the teacher the same amount of commitment for finding a solution to the need.	• Encouraging the teacher to provide his or her input to the solution. • Providing your honest views and opinions of issues. • Viewing disagreements as opportunities to come to an improved solution. • Letting go of all titles and positions of power in order to work in a partnership.
Use a nondirective approach . . .	**by doing the following . . .**
• When a teacher has more knowledge about an issue than you. • When a teacher alone is held accountable for the outcomes of the revision. • When a teacher is more committed than you to solving the issue.	• Aiding the teacher in the thought process about what types of changes could be made to improve the need. • Do not influence the teachers intended solution; just encourage and direct their thoughts about the issue.

(Glickman, Gordon & Ross-Gordon, 1998)

STEP 4: Postconference with teacher

Now, with collected data, interpretations, and communication approach in hand, it is time for the coach to meet with the teacher for a postconference. The postconference is intended to provide time for a coach and the teacher to discuss the observation and interpretation. And perhaps most importantly, it is designed as a time for an instructional improvement plan to be produced.

In the actual meeting, it is a good idea for the coach to first share with the teacher what he or she observed. Then, depending on the type of interpersonal approach that was selected, a future plan can be devised. Of course, depending on the type of approach that was chosen, the development of the plan may be a coach's responsibility entirely, or it may be produced out of a collaborative or teacher-devised approach.

Regardless of the method of development, a plan that includes a specific focus should be created. Once a key area is recognized, indications of how that improvement will be made visible in future observations should be stated. Additionally, resources that will assist in such improvement should be documented.

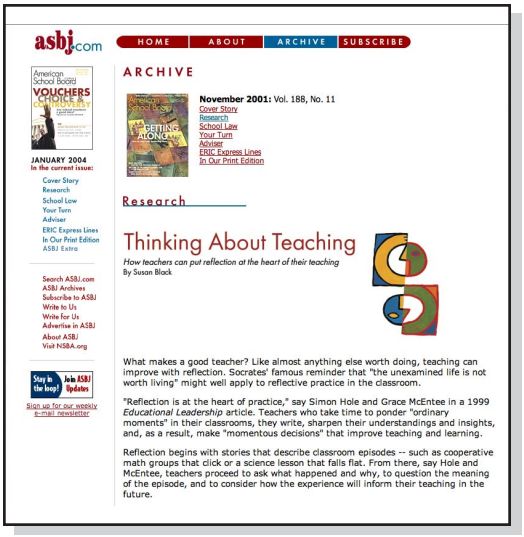
STEP 5: Critique of previous four steps

Finally, a brief discussion with the teacher about the above process should be conducted. The conversation can be brief and even occur at the end of the postconference. But regardless of when it is held, it should allow time for the coach and the teacher to discuss what was valuable during the four-step process, in addition to what could be changed during the process. In turn, this process will encourage a more productive collaboration between the coach and the teacher.

How to...

Use Self-Reflection to Improve Pedagogy

Susan Black in the November 2001 issue of the American School Board Journal explores how teachers can use reflection as a tool to improve teaching. Reflection, she says, is the opportunity to examine classroom episodes that may have gone unusually well or surprisingly poor. The examination of these episodes through questioning and multiple perspectives informs future pedagogy.



Reflection, Black writes, is being incorporated into preservice and graduate teacher preparation programs. Eastern Menonite University, VA, and Mankato State University, MN, are just two of the colleges of education integrating reflection into their teacher preparation programs. Structured reflection, she reports, appears to provide higher levels of understanding than open journaling.

The National Board for Professional Teaching Standards also requires deep reflection, Black reports. These standards support teachers' consistent review of their pedagogy in order to improve student learning. A case study of three National Board certified teachers found that teachers used both spontaneous and structured reflection. Spontaneous reflection occurred in class while they were teaching. When problems arose, situations were analyzed and contingencies made. Structured reflection occurred outside the classroom. Teachers analyzed, modified and wrote about their practices.

While reflection offers no guarantees to improved practice or improved student learning, it does offer an avenue for teachers to begin examining their practice. Technology coaches and teachers alike could benefit from reflection. These reflections may offer springboards during mentoring conferences, annual evaluations with administrators, or routine technology assessments. Use reflection as a tool—not a chore. Continually visit the question: Are all my students learning?

From Black, S. (2001, November). Thinking about teaching: How teacher can put reflection at the heart of their teaching. American School Board Journal, 188(11). Available at http://www.asbj.com/2001/11/1101research.html.

How to...

Plan and Provide Professional Development

Professional development is a journey for teachers in which technology coaches ideally mirror the practice our teachers follow with students. In other words, to assess where individuals are in relationship to knowledge, skills and attitudes, then provide varied instruction to support the individual's learning.

The workshops, one-on-one sessions and handouts technology coaches will provide to teachers should reflect this same philosophy. Coaches should provide professional development that is a) based on the needs of the individual teacher; b) based on standards to ensure high quality; and c) based in the context of the teacher's work.

Needs-based professional development: Meeting the needs of the individual

One of the first activities a coach will probably want to do is assess the technology literacy and technology integration skills of the teachers he or she will be supporting. By finding the levels of skills of the teachers with whom a coach will be working, he or she will be able to customize professional development opportunities for each teacher.

The CEO Forum's StaR chart provides a complete picture of classroom pedagogy and technology integration. However, other instruments can also be beneficial in identifying the strengths and weaknesses of teachers. Following is a list of possible tools to use in identifying individual's needs. Of course, instruments can be combined and modified sections of these to create customized assessment tools.

Observation Protocols

Type of Protocol	Self-Administered	Third-Party Observer
Quantitative (including checklists & inventories)	• LTPT (NCREL/NCRTEC) • ATRL (SCRTEC)	• RTOP (ACEPT) • Classroom Observation (Littleton) • SOM (University of Memphis) • TOI (WestEd) • TELAR (Penn State) • TIC (WestEd)
Qualitative (including narrative descriptions)		• Classroom Observation (Sun Assoc.) • SFO (SRI/MSU)
Combination (including rubrics)	• UTAP (Utah Education Network) • TN STaR (Tennessee DOE)	• COP (Horizon Research, Inc.) • COP (CETP/University of Minnesota) • TUOT (WestEd) • VCOT (Virginia Tech Institute of M/S)

From Dirr, P. J. *Classroom observation protocols: Potential tools for measuring the impact of technology in the classroom*. Available at http://www.the-atec.org.

Standards-based professional development: Matching national values

Successful interventions not only reflect the needs of the individual, but also reflect the current national standards for professional or staff development. The National Staff Development Council (NSDC, www.nsdc.org) has developed twelve professional development standards focused on improving learning for all students. These standards are divided into three categories: context standards, process standards and content standards.

How can a technology coach ensure the professional development he or she provides will meet national standards? Review the NSDC standards for staff development, and use the following checklist to appraise workshops, handouts and other plans. While not every professional development opportunity he or she presents will encompass each one of these standards, it is worthwhile to review this checklist for areas of improvement and enrichment for teachers. Coaches may come up with new ideas for staff development or improve upon current activities by reflecting on these standards and the checklist.

National Staff Development Council
Standards for Staff Development

(Revised, 2001)

Context Standards

Staff development that improves the learning of all students:

1. Organizes adults into learning communities whose goals are aligned with those of the school and district. (Learning Communities)
2. Requires skillful school and district leaders who guide continuous instructional improvement. (Leadership)
3. Requires resources to support adult learning and collaboration. (Resources)

Process Standards

Staff development that improves the learning of all students:

1. Uses disaggregated student data to determine adult learning priorities, monitor progress, and help sustain continuous improvement. (Data-Driven)
2. Uses multiple sources of information to guide improvement and demonstrate its impact. (Evaluation)
3. Prepares educators to apply research to decision making. (Research-Based)
4. Uses learning strategies appropriate to the intended goal. (Design)
5. Applies knowledge about human learning and change. (Learning)
6. Provides educators with the knowledge and skills to collaborate. (Collaboration)

Content Standards

Staff development that improves the learning of all students:

1. Prepares educators to understand and appreciate all students, create safe, orderly and supportive learning environments, and hold high expectations for their academic achievement. (Equity)
2. Deepens educators' content knowledge, provides them with research-based instructional strategies to assist students in meeting rigorous academic standards, and prepares them to use various types of classroom assessments appropriately. (Quality Teaching)
3. Provides educators with knowledge and skills to involve families and other stakeholders appropriately. (Family Involvement)

Professional Development Opportunity Checklist

Directions: Use the checklist below to evaluate the professional development you will be providing. Consider your professional development against the standards provided by the National Staff Development Council. Remember to align your workshops, seminars, handouts, etc. with your school district's goals and your individual school's goals, as well.

Context Standards:		
1. Does your professional development organize adults into learning communities?	☐ Yes	☐ No
2. Do your professional development opportunities and plan involve school and district leaders?	☐ Yes	☐ No
3. Does your professional development use various resources?	☐ Yes	☐ No
Process Standards:		
1. Are your professional development objectives based on student data?	☐ Yes	☐ No
2. Does your professional development rely on multiple sources of information to demonstrate its impact?	☐ Yes	☐ No
3. Is your professional development based on research practices?	☐ Yes	☐ No
4. Does your professional development encourage learning strategies that match intended outcomes?	☐ Yes	☐ No
5. Does your professional development incorporate theories of learning and change?	☐ Yes	☐ No
6. Does your professional development support collaboration among educators?	☐ Yes	☐ No
Content Standards:		
1. Does your professional development engender equity among students?	☐ Yes	☐ No
2. Is this professional development an opportunity to support quality teaching and pedagogy?	☐ Yes	☐ No
3. Does this professional development offer educators knowledge or skills to draw in families or the community?	☐ Yes	☐ No

Context-based professional development: Meeting professional development needs in the regular workday

While many professional development opportunities occur outside of the classroom (e.g. workshops, seminars), it is important to remember that “just-in-time training” is also a powerful tool for technology coaches. Providing job-embedded support for teachers may include team teaching a technology-enhanced lesson or teaching a model technology-enhanced lesson so the classroom teacher may observe the technology coach manage teams, groups and learning centers.

Job-embedded support for teachers occurs as part of the regular workday, thus allowing the coach to meet the immediate needs of teachers. For example, the technology coach and teacher can plan before the lesson what support and resources are needed.

It is important for the coach to document each intervention and record the teacher’s growth. The contact log at the end of this section can be used to record the activities. This documentation will be important for mid-year and year-end evaluations needed to report school-wide activities and growth for the school.

Technology Coach Contact Log

Teacher Name:		
Date	**Activity**	**Comments**

How to reach teachers *without* a 3-hour workshop

Sometimes when we think of professional development, we immediately think of half-day workshops off-site that require hiring a substitute to cover your class. This is only one type of professional development that reaches teachers. Hopefully the previous pages have given you a number of ideas for professional development.

Here are some additional ideas that don't require a half-day workshop format:

1. Peer mentoring
2. Technology minute in faculty meetings
3. 20-minute modules before or after school
4. Job-embedded support
5. Require a technology component for all lesson plans
6. Stall stories (idea sheets or job aids in the bathroom)
7. Newsletters
8. Supplemental websites
9. Visit grade level/content area meetings
10. Develop a technology support team (teacher groups, student groups, parent groups)

Can you think of other ideas to reach teachers without a 3-hour workshop? Write them in the spaces provided below.

11. _____

12. _____

13. _____

14. _____

15. _____

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SECTION 6

Technology Resources

How to Obtain and Maintain Technology Resources

Understanding Hardware

Basic Hardware Maintenance

Understanding Software

Basic Software Maintenance

Maintaining Technology Resources with a Tech Assistance Team

How to...

Obtain and Maintain Technology Resources

While supporting teachers, mentoring, and engendering technology integration in classrooms may receive the lion's share of a coach's time, he or she may also be asked by the principal, district technology coordinator or library media specialist to assist with obtaining and maintaining technology resources throughout his or her school. This may include suggesting specific models of computers or specific vendors to purchase from, recommending educational and productivity software, providing an updated list of useful links for content areas on the school's website, as well as proposing an upgrade schedule for replacing computers.

Included in this section are some resources for supporting hardware, software and online assets. Coaches may also need to keep track of vendors and sales representatives when getting quotes or making purchases. Coaches can use Vendor Contact List template at the end of the section to organize corporate representatives. The technology coach website will provide updated links and downloads.

Sample Base Computer System

	Windows	Macintosh
Operating System	Windows XP	Mac OS 10
Processor & Speed	Pentium 700+ MHz	PowerPC, G4
Memory (RAM)	256 Mb	256 Mb
Hard Drive	40Gb	40Gb
Monitor	15″	15″
Additional Requirements	3.5″ floppy, CD ROM	CD ROM, ZIP drive, 3.5″ floppy

Understanding Hardware

Hardware includes the hard drives, or CPUs, the monitors, computer memory (RAM), and peripherals, such as scanners, digital cameras, CD writers, printers, speakers, keyboards and mice. As part of a school-wide technology plan, a coach should define in writing the configuration for a base computer system. This should include:

- the operating system (e.g., Windows 2000, Windows XP, Mac OS 8.1, Mac OSX),
- the minimum processor and speed (e.g., Pentium III, 700+MHz; PowerPC, 466+MHz)
- the minimum amount of memory (e.g., 256 Megabytes RAM),
- the minimum hard drive size (e.g., 40 Gigabytes)
- the minimum monitor size (e.g., 15-inch monitor)

- other specifics associated with your school or district's preferences, such as a ZIP drive, 3.5″ floppy drive, wireless networking cards, CD writer, DVD drive, USB Flash drives, etc.

Coaches should keep or have access to a record of the serial numbers, warranty information and location of each computer to use during inventory and for service orders. These records will assist coaches with quickly referencing when a computer was purchased and if it is still under warranty. At the end of this section is a suggested template for keeping track of hardware specifications, or specs, as they are called. A coach can, of course, create a computer database in AppleWorks, Microsoft Excel, FileMaker Pro or Microsoft Access to keep track of this information as well.

Basic hardware maintenance

Many potential problems can be avoided by simple, periodic maintenance of the computer equipment in the classroom. Many teachers choose one day of the week for cleaning classroom computers. Student technology teams may also perform these duties.

The following list provides basic hardware maintenance tips:

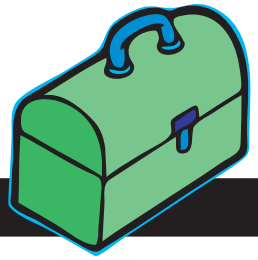
- Cover the printer when not in use.
- Do not place textbooks or heavy objects on the scanner.
- Remove diskettes from the computer when not in use.
- Do not allow food or drink near computers.
- Regularly vacuum the outside of the computer, including the fan and cooling vents
- Clean the computer and monitor cases with isopropyl alcohol and a lint free cloth.
- Clean the mouse by removing the mouse ball and spraying inside the mouse with compressed air. Clean the rollers with alcohol, and wash the mouse ball with mild detergent.
- Use a can of compressed air to clean the keyboard, and clean the keys with alcohol and lint free cloth.
- Use a floppy drive cleaning kit to clean floppy drives, and a similar kit to clean on CD-ROM drives.

Computer Diagrams

It is helpful to draw a diagram of the back of the computer and mark what connections go where. Or you can take a photograph of the rear of the computer and label the connections. This will help the classroom teacher resolve problems caused when connecting cables are removed from the computer.

Classroom Computer Maintenance Toolkit

A classroom computer maintenance toolkit can be distributed to classroom teachers to help them maintain their computer(s). The following table lists suggested supplies to include.

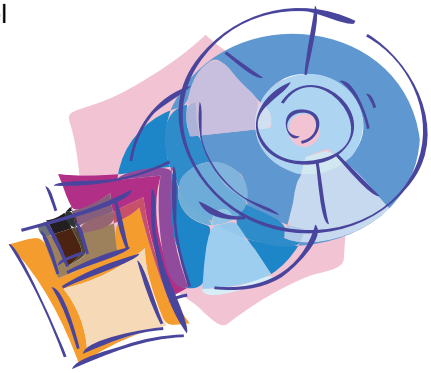


Sample Computer Maintenance Toolkit Items	
What?	**Why?**
Tool Box	To keep everything in
90% Isopropyl Alcohol	To clean floppy drive, drive connectors, mouse rollers, and limited use on screen, keyboard, and scanner table.
Cotton swabs	To clean mouse rollers and between keys on keyboard
CD ROM cleaning kit	To clean CD ROM
Floppy cleaning kit	To clean 3.5” floppy drive
Duster	Dust off keyboard, monitor, and desktop
Lint-free, static-free wipes	Use instead of tissue paper or paper towels to clean monitor, keyboard, and mouse, everything requiring cleaning
Screen cleaner	Clean monitor screens
Screwdriver set (flathead tip, Philips tip) NOT MAGNETIC!	Remove cables from rear of computer, tighten cables, general use
Small flashlight or pen light	See inside printers to clear jams, see behind computers for cable installation.
Velcro or nylon cable ties	Use to secure cables

Adapted from Tech Support For Teachers Training Guide available at http://www.area4.k12.il.us/techsupportteach.htm#_Toc479676098

Understanding Software

Coaches may also find it helpful to use a common software configuration on all computers. This can help save time and frustration when troubleshooting, creating job aids, and upgrading existing software. The following list of describes basic software applications:



- productivity titles (e.g., Microsoft Word, Corel WordPerfect, AppleWorks, Microsoft Excel, Microsoft PowerPoint),
- educational software (e.g., Accelerated Reader, Geometer's Sketchpad),
- operating systems (e.g., Microsoft Windows 98, Microsoft Windows XP, Mac OS 8.1, Mac OS X),
- web browsers (e.g., Microsoft Internet Explorer, Netscape Navigator),
- web browser plug-ins (e.g., Shockwave, RealAudio),
- internet filtering software (e.g., SurfWatch, NetNanny)
- system protection software (e.g., Fortres, Foolproof),
- virus protection software (e.g., Norton Antivirus, Fprotect),
- system utilities (e.g., Norton Disk Doctor) and
- network access software (e.g. Novell Netware).

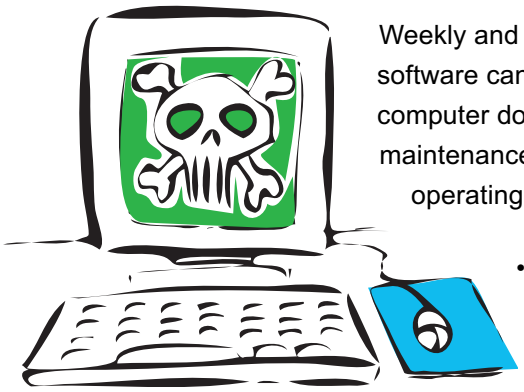
Like hardware, it is very useful to generate as part of your school wide technology plan a standard, or base, set of software for installation. This creates a common configuration for all the computers. Coaches may also find it useful to keep a record of the software titles in use at his or her school. Some schools have site licenses that cover an unlimited number of installations of software titles, while some software titles are purchased for a specific number of installations, such as one, five or ten. Keeping track of these locations, numbers of installations and serial numbers is reason enough to start a file.

At the end of this section is a sample template to keep track of software titles, serial numbers and where they are installed. As a security note, coaches should keep this list secure to avoid illegal use of the software.

Sample Software Database

	Windows	Macintosh
Operating System	Windows 2000	Mac OS 9.x
Productivity	Microsoft Office	AppleWorks
Educational Software	Accelerated Reader	Accelerated Reader
Web Browser	Internet Explorer	Netscape Communicator
Web Browser plug-ins	Shockwave, Real player	Shockwave, Real player
Internet filtering	CyberSitter	SurfWatch
System Protection	Foolproof	Fortres
Virus Protection	Norton Antivirus	Norton Antivirus
Utilities	None	None
Network Access	Novell Netware	Appleshare IP

Basic software maintenance



Weekly and monthly maintenance on systems software can help prevent hours of frustration and computer down time. Some basic software maintenance for both Windows and Macintosh operating systems should cover:

- Repair disk errors to catch physical disk problems before data loss and to recapture lost disk space. On a Windows machine, use ScanDisk. On a Macintosh, routinely rebuild the desktop and run Disk First Aid.
- Defragment your disk to "put pieces of files" back together to increase the speed of opening and saving operations. On a PC, run the Disk Fragmentation utility, located in System Tools. On a Macintosh, you will need to purchase a third party utility, such as Norton Disk Doctor.
- Backup common server files of teacher and student work. Also keep extra floppy, zip or CD copied of all files you cannot afford to lose.
- Regularly download updates and patches to fix known problems in your OS and application software. Many software titles provide updates or patches on their websites.
- Keep the anti-virus software up to date as new viruses are introduced daily

(adapted from San Francisco State University, 2002; Strevey et al., 2001)

Maintaining Technology Resources with a Tech Assistance Team

A Tech Assistance Team is a group of students, typically under the direction of a technology coach, that provide technology support for teachers and students. Members are trained to troubleshoot, maintain equipment, and help the classroom teacher use technology more effectively. Example activities include:

- Searching the Internet for instructional resources.
- Creating classroom materials such as PowerPoint presentations, instructional puzzles and games, handouts, flyers, and other printed materials.
- Assisting the teacher with the preparation of equipment by bookmarking Internet sites, booting up computers and designated software, getting printers ready to use, and setting up peripheral hardware.

It is helpful to provide a basic troubleshooting form for teachers to fill out when they need assistance. This form helps identify what the teacher needs or a problem that the teacher is having. Members of the Tech Assistance Team should be trained to perform basic hardware troubleshooting and maintenance of the following:

- Camcorders
- Cleaning—keyboards, screens, mouse tracking balls
- Computer to TV Monitor presenters
- Connections—checking power cords and network cords
- Digital Cameras
- Mouse—connection and tracking ball
- Printers—paper jams and ink/toner cartridges
- Projectors
- Scanners
- VCRs

Hardware Record

Computer Location	CPU Serial #	Monitor Serial #	Date Purchased	Warranty Length	Vendor

Software Record

Software Title(including Version)	Serial # (or installation key)	# of Licensesor Site License	Purchase Date	Installation Location	Vendor

Vendor Contact List

Vendor	Telephone Number	Sales Representative	Notes(e.g., Percent Discount)

References

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San Francisco State University. (2002, March 1). *Recommended computer maintenance for Apple Macintosh systems 7.x-9.x*. Retrieved February 6, 2003, from http://www.sfsu.edu/~helpdesk/maint/mac_maintenance.htm

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See what others are saying about the Technology Coach Handbook...

"Title 2-D of the No Child Left Behind Act of 2001 authorizes substantial funds for improving student academic achievement through the use of technology in elementary schools and secondary schools. The legislation specifically directs states and school districts to strengthen the capacity of schools to integrate technology effectively into curricula and instruction that are aligned with challenging State academic content and student academic achievement standards, through such means as high-quality professional development programs.

The Handbook developed by Dr. Deborah Lowther and her colleagues at the University of Memphis has benefitted from more than two years of independent research and evaluation reports. An experienced and well-trained educational technology "coach" is in a good position to facilitate the collaborative learning that needs to take place within each and every school building, that is, if we expect technology to support and extend opportunities for all students to learn and achieve higher academic standards."

— Dr. Gary Bitter, Professor, Arizona State University

"The notion that the computer is a learning tool is firmly planted in the language used to describe new technologies; yet integrating the tool into the daily repertoire of teachers remains the ultimate challenge. The designation of a teacher as a full-time technology coach to assist his or her colleagues appears to be one of the practical solutions that more school districts should consider."

— Dr. Larry Cuban, Professor Emeritus of Education, Standford University
Author of *Oversold and Underused: Computers in the Classroom*

"The research and careful analysis that preceded the development of this Handbook is impressive. Most of the experience and trial and error activities that Dr. Deborah Lowther and her colleagues devoted to this effort have taken place in the State ofTennessee. However, the product reflects the results of research and evaluation studies that have been underway in other states across the nation. It also draws upon years of research on the "conditions for learning," including the seminal work by the late educational psychologist Robert Gagné who discovered that the competence specifically learned should enable the learner to perform some acts of practical to him or her in connection with an occupation —what Gagné described as 'teaching for transfer.'

The lessons guided by this Handbook recognize that successful transfer depends heavily on previous learning, and on the experience of classroom practitioners. In addition to building this Handbook on the bases of sound psychological principles and solid research, its developers continue to improve the lessons and support services for 'coaches' by observing and listening to the teachers who are actually making a difference on the front line."

— Dr. Arthur D. Sheekey, Director, ATEC

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