

Excerpted from *National Educational Technology Standards—Preparing Teachers to Use Technology*.

This foundational book, published by the International Society for Technology in Education, is the product of writing teams bringing together best practices from all over the United States. It includes nearly 400 pages of peer-reviewed lessons, models, strategies, and demonstrations of technology integration across grade levels and content areas. Go to [www.iste.org/netst](http://www.iste.org/netst) for more information or call 1.800.336.5191.

## Using Model Strategies for Integrating Technology into Teaching

In an effort to implement the NETS for Teachers across the university, many methods and strategies have been identified. As with many teaching strategies, there are common methods in using technology that can be applied across various academic disciplines and grade levels. Having a set of generic models and strategies that are multipurpose in application assists teacher candidates in quickly developing technology-rich lessons for their fieldwork. This set can be continuously modified as experience in teaching increases through their student teaching.

This chapter provides an overview of proven effective models and strategies for the following:

- **Web-based lessons**
  - WebQuests
  - CyberGuides
  - Filamentality
- **Multimedia presentations**
- **Telecomputing projects**
- **Online discussions**

Most of the examples have online reference sites for further explanation and additional examples. Many of the activities in this book use versions of the models described in this section.

### Web-Based Lessons

#### WEBQUESTS

<http://edweb.sdsu.edu/webquest/webquest.html>

A WebQuest is an inquiry-oriented activity in which most or all of the information used by learners is drawn from the Web. WebQuests are designed to use learners' time well; to focus on using information rather than looking for it; and to support learners' thinking at the levels of analysis, synthesis, and evaluation. Developed by Bernie Dodge with Tom March at San Diego State University, the WebQuest model has been effectively applied to all levels of education, from elementary to postgraduate study.

#### The Model

The Internet offers teachers a wealth of information and resources for use in supporting curriculum-based experiences. Teachers often search the Web for hours and become frustrated with the quantity of resources and the time needed to actually identify the best sites to use with students in a lesson for a particular unit. If turned loose on the Web, students (and teacher candidates) can often have the same experience. In an effort to focus student learning and limit the time needed for a specific search, the WebQuest model provides teachers an option of reviewing and selecting Web-based lessons structured in a lesson-type format.

**Note:** The following is from the WebQuest site,  
<http://edweb.sdsu.edu/people/bdodge/webquest/buildingblocks.html>

<b>INTRODUCTION</b>	The purpose of the Introduction section of a WebQuest is twofold. First, it should orient the learner as to what is coming. Second, it should raise some interest for the learner through a variety of means.
<b>TASK</b>	The Task block in a WebQuest is a description of what the learner should have done at the end of the exercise. It could be a product, like a HyperStudio stack or PowerPoint presentation, or it might be a verbal act, such as being able to explain a specific topic. For example, "MexQuake" ( <a href="http://students.itec.sfsu.edu/edt628/mexquake/earthquakers.html">http://students.itec.sfsu.edu/edt628/mexquake/earthquakers.html</a> ), by Edith Kelly and Ryen Partin, ends in a newspaper account and videotaped newscast in Spanish.
<b>PROCESS</b>	The Process block in a WebQuest is where the teacher suggests the steps that learners should go through in completing the task. It may include strategies for dividing the task into subtasks, descriptions of roles to be played, or perspectives to be taken by each learner. The instructor can also use this place to provide learning advice and interpersonal process advice, such as how to conduct a brainstorming session. The Process description should be relatively short and clear. For example, Week 1 of Cheryl Rondestvedt's "Ocean Pollution/Solution" unit ( <a href="http://edweb.sdsu.edu/triton/PollSol/Week1.html">http://edweb.sdsu.edu/triton/PollSol/Week1.html</a> ) involves students doing a lot of activities, but the steps are clearly specified. Note that in this case, the resources needed are embedded within the steps rather than separately listed.
<b>RESOURCES</b>	<p>The Resources block in a WebQuest is a list of Web pages the instructor has located that will help the learner accomplish the task. The resources are preselected so that learners can focus their attention on the topic rather than surfing aimlessly. It's important to note that resources for the students are not restricted to those found on the Web. For example, the "Investigating Archaeotype" WebQuest (<a href="http://edweb.sdsu.edu/Courses/EDTEC596/WebQuest1.html">http://edweb.sdsu.edu/Courses/EDTEC596/WebQuest1.html</a>), involved a wide range of resources, including an audioconference with a distant expert, a videoconference with a not-so-distant teacher, a videotape, the hard copy of an evaluation report, and a number of Web pages. There's no reason that a WebQuest might not include textbooks, audiotapes, and face-to-face interaction with other people among the resources.</p> <p>Very often, it makes sense to divide the list of resources so that some are examined by everyone in the class, while others are read by subsets of learners who are playing a specific role or taking a particular perspective. For example, in "Avoid It Like the Plague" (<a href="http://students.itec.sfsu.edu/edt628/ascendedone/plaguell.html">http://students.itec.sfsu.edu/edt628/ascendedone/plaguell.html</a>), by Tommy Lee, all students look at three sites to give them a basic grounding in the Black Plague. Then, depending on the role they are playing, they make use of an additional two Web sites. By giving separate data sources to learners, you ensure the interdependence of the group and give the learners an incentive to teach each other what they've learned.</p>
<b>EVALUATION</b>	Since the Evaluation block has been only recently added to the model, there aren't many examples of this component to point to. In the "San Diego-Biarritz Comparison Unit" ( <a href="http://edweb.sdsu.edu/triton/SDBiarritz/SDBiarritzUnit.html">http://edweb.sdsu.edu/triton/SDBiarritz/SDBiarritzUnit.html</a> ), by Susanne Hirsch, Janice Thiel developed a rubric for evaluating the Web pages created in French by the students.

The rubric examines six different aspects of the student product and establishes four benchmarks for each aspect. It's intended to be printed out and given to the evaluators, who could be teachers, parents, or peers. Evaluation rubrics will take a different form depending on the kind of task given to the learner.

## CONCLUSION

The Conclusion section of a WebQuest provides an opportunity to summarize the experience, to encourage reflection about the process, to extend and generalize what was learned, or some combination of these. It's not a critically important piece, but it rounds out the document and provides readers with a sense of closure.

One good use for the Conclusion section is to suggest questions that a teacher might use in whole class discussion to debrief a lesson. In "The 1960s Museum" (<http://school.discovery.com/schrockguide/museum/webquest.html>), for example, Kathy Schrock asks learners to think about the sites they had visited and discern any biases represented at those sites. She also asks the learners to predict the reaction their own creations will receive once posted on the Web.

This model encourages teachers to create new activities and adapt already successful ones to take advantage of the power of the Web for their students. Because the model does not specify length of lesson, these lessons can be a short WebQuest (one to three days) or a long WebQuest (one week to one month).

## Example

The social studies curriculum for grades K–4 contains investigations into relationships in our world. Topics include weather, life cycle, and communities in both science and social science. One WebQuest, hosted on the Pacific Bell Knowledge Network site, asks students to look at these relationships and aspects of life on our planet. The "Big Wide World WebQuest" ([www.kn.pacbell.com/wired/bww/index.html](http://www.kn.pacbell.com/wired/bww/index.html)) uses a rubric appropriate for students at this age level. However, most students in K–1 grades would not be ready to explore all of the activities; teacher candidates or faculty may want to select a few activities that target their curriculum specifically. Some faculty and teachers in Grade 4 have chosen to include all the areas, reviewing foundation knowledge and adding more depth to student understanding of these relationships.

As an example, one activity relating to language arts in the "Big Wide World WebQuest" asks students in Grades K–1 to link to International Symbols or hear animal sounds while looking at a picture of the animal. Students in third or fourth grade explore heroes of the world under the section entitled "People."

## Online Samples

The WebQuest site offers the opportunity to search a database collection for specific topics. Everything is here, from world hunger to planning a trip to Canada, current issues, core literature, and even physical education topics. The WebQuest teaching strategy is an excellent framework for teacher candidates designing technology-rich experiences for students. As teachers, they can share their ideas with other educators by submitting their WebQuest lesson to the database.

This site also has the potential to engage candidates in critical analysis of WebQuests so they might develop Web-based lessons of their own with an eye toward learning outcomes. There is a WebQuest on a WebQuest. This site provides the experience of going through a WebQuest by exploring what a WebQuest is: <http://edweb.sdsu.edu/webquest/webquestwebquest.html>

By the end of the activity, learners know enough about the model to be able to answer the following questions: (1) Which two of the example WebQuests examined are considered to be examples of effective instruction? Why? (2) Which two examples need considerable revision? Why?

Other developers of Web-based lessons have offered similar models or versions of WebQuests. An example is MiniQuests from Illinois ([www.biopoint.com/wq2/Welcome.html](http://www.biopoint.com/wq2/Welcome.html)), sponsored by Internet Innovations, Inc. These Web-based activities include scenario, task, and product, simplifying the structure into these three steps.

## Resources

### WEB SITES

The WebQuest Page: <http://edweb.sdsu.edu/webquest/webquest.html>

WebQuest Collections: [http://edweb.sdsu.edu/webquest/webquest\\_collections.htm](http://edweb.sdsu.edu/webquest/webquest_collections.htm) (collections)

### MAGAZINE ARTICLES

Dodge, B. (2001). FOCUS—Five rules for writing a great WebQuest. *Learning & Leading with Technology*, 28(8), 6–9, 58.

Peterson, C., & Koeck, D. (2001). When students create their own WebQuests. *Learning & Leading with Technology*, 29(1), 6–9.

Yoder, M. (1999). The student WebQuest—A productive and thought-provoking use of the Internet. *Learning & Leading with Technology*, 26(7), 10–15, 52.

### CYBERGUIDES

[www.sdcoe.k12.ca.us/score/cyberguide.html](http://www.sdcoe.k12.ca.us/score/cyberguide.html)

A CyberGuide is a supplementary, standards-based, Web-delivered unit of instruction centered on core works of literature. CyberGuides provide a quick supplementary set of activities for students (and teacher candidates) as they explore specific pieces of literature.

## The Model

Each CyberGuide contains a student and teacher edition, identified targeted standards, a description of the task and a process by which it may be completed, teacher-selected Web sites, and an assessment rubric. The teacher's guide includes an overview of the activities, suggestions from the author, and a library of links provided to students in the activities. The student guides include activity directions written in a format appropriate for the age and reading ability of the students. The Cyberguide Web page contains a list of sites organized by grade level clusters, K–3, 4–6, 6–8, and 9–12.

## Example

An example of a CyberGuide for intermediate grades is "Dragonwings," by Laurence Yep ([www.sdcoe.k12.ca.us/score/drag/dragt.html](http://www.sdcoe.k12.ca.us/score/drag/dragt.html)). During this unit, students use the Internet to investigate and write a descriptive paragraph of San Francisco's Chinatown in 1903, read a firsthand account of the 1906 earthquake, and trace the route of a group of Chinese orphan girls from their home in Chinatown to safety in San Anselmo. Students may also research and prepare an earthquake safety checklist for their own homes and discuss how relationships with elders influence their own knowledge about their heritage. And because the definition of the dragon and the emergence of flight at the time can spark a discussion about the history of flight, students can investigate how a plane flies at the National Air and Space Museum, prepare a class demonstration of one of the principles of flight, and take a simulated flight on an early Wright brothers plane. Each of these activities is self-contained, and the classroom teacher may select any or all for a class to do.

### FILAMENTALITY

[www.kn.pacbell.com/wired/fil/index.html](http://www.kn.pacbell.com/wired/fil/index.html)

The Filamentality name is derived from the way the teacher can combine the "filaments" of the Web with a learner's "mentality." The Filamentality site provides templates and resources that allow educators to create their own Internet-based activity or search for one that has been created by others and adapt it. There are several formats and helpful hints. The entire tutorial is offered at the beginner level.

Teachers who create an activity are empowered by the personalized product and feel secure because it is password protected and immediately available on a server for their use with students. This experience motivates teachers to explore Web-based lessons for their students as an interactive learning experience.

Many teacher candidates find it easy to create experiences beyond the limitations of Filamentality. Adding graphics or creating a new format is not difficult. Changes can be easily saved and edited with any text editor, word processor, or Web-authoring tool (Adobe PageMill, Claris HomePage, Microsoft FrontPage, etc.). Teachers and teacher candidates can ask for their activity to be hosted on the university or district server or use it offline at their classroom computers. Opened from a saved file, the Internet links still work to access the sites referenced in the Web activities.

## The Model

[www.kn.pacbell.com/wired/fil/index.html](http://www.kn.pacbell.com/wired/fil/index.html)

The main Filamentality menu provides resources for creating or searching for an activity with the desired focus. Support is built-in through Mentality Tips, which guide the user along the way to creating a Web-based activity that can be shared with others without knowledge of HTML, Web servers, or the www-dot jargon.

Templates provide a step-by-step process in creating an Internet activity in one of the following formats:

**Note:** The following is from the Filamentality Web site.

### HOTLIST

This is a Web page with hot buttons linking to Web sites that the creator of the page has felt are most useful for the topic. This saves the user, or learner, the time searching endlessly for information and focuses the search. See "China on the Net," a collection of Web sites that focus on various aspects of China ([www.kn.pacbell.com/wired/China/hotlist.html](http://www.kn.pacbell.com/wired/China/hotlist.html)).

### SCRAPBOOK

If learners already have a general understanding of the subject they are studying (i.e., they've done some preliminary learning in class or with traditional resources), their first Web-based activity could be the exploration of a "Multimedia Scrapbook." Here learners dig through a collection of Internet sites organized around specific categories, such as, photographs, maps, stories, facts, quotations, sound clips, videos, virtual reality tours, and so on. Learners use the Multimedia Scrapbook to find aspects of the broader topic that they feel are important. For an example, see "Democracy Online in America" ([www.kn.pacbell.com/wired/democracy/scrapbook.html](http://www.kn.pacbell.com/wired/democracy/scrapbook.html))

### HUNT

When it's time to develop solid knowledge on a subject, teachers and students can create "Treasure Hunts." The basic strategy here is to find Web pages that hold information (text, graphics, sound, video, etc.) essential to understanding the given topic. First, gather 10–15 links. Remember, these are the exact pages students should go to for information, not the top page of a huge Web site. Don't expect students to find the needle in a cyberstack. After gathering these links, Filamentality prompts the teacher to pose one key question for each Web resource that has been linked to. If the teacher doesn't want to use all collected links, that's fine. Filamentality will take care of that.

A smartly designed Treasure Hunt can go far beyond finding unrelated nuggets of knowledge. By choosing questions that define the scope or parameters of the topic, when the students discover the answers they are tapping into a deeper vein of thought, one that now stakes out the dimensions or schema of the domain

being studied. Finally, by including a culminating "Big Question," students can synthesize what they have learned and shape it into a broader understanding of the big picture. For an example, see "Black History: Past to Present" ([www.kn.pacbell.com/wired/BHM/hunt.html](http://www.kn.pacbell.com/wired/BHM/hunt.html)).

#### SUBJECT SAMPLER

In a Subject Sampler, learners are presented with a smaller number (maybe half a dozen) of intriguing Web sites organized around a main topic. What makes this a particularly effective way to engage student buy-in is that the selected Web sites each offer something interesting to do, read, or see. Additionally, students are asked to respond to the Web-based activities from a personal perspective. Rather than uncover hard knowledge (as they do in a Treasure Hunt), students are asked for their perspectives on topics, comparisons to experiences they've had, interpretations of artworks or data, and so on. Thus, more important than the right answer is that students are invited to join the community of learners surrounding the topic to see that their views are valued in this context. Use a Subject Sampler when the goal is to make students feel connected to the topic and that the subject matter matters.

### Resources

#### WEB SITES

[www.kn.pacbell.com/wired/fil/index.html](http://www.kn.pacbell.com/wired/fil/index.html)

[www.kn.pacbell.com/wired/fil/beyond.html](http://www.kn.pacbell.com/wired/fil/beyond.html) (Access this site for an activity to post on your own server.)

<http://coefm.sdsu.edu/edfirst/filregister/> (Access this site to search the Filamentality Register.)

### Multimedia Presentations

Multimedia combines media objects such as text, graphics, video, animation, and sound to represent and convey information. In the course of designing, planning, and producing a multimedia product, students can acquire new knowledge and skills through a method of teaching and learning that often is project-based.

#### The Model

Many teachers have found that students are motivated to learn when they can use technology to present the results of a research project or activity. The multimedia presentation contains content but the messages are conveyed by the student's selection of the media. The teacher candidate can look at examples of projects and lessons at Internet sites housing collections of student samples.

Exemplary project-based learning with multimedia is

- anchored in core curriculum,
- multidisciplinary,
- demonstrates sustained effort over time,
- promotes student decision making,
- supports collaborative groupwork,
- exhibits a real-world connection,
- utilizes systematic assessment, both along the way and for the end product, and
- employs multimedia as a communication tool.

As new forms of multimedia are explored and bandwidth increases, the types of projects become more complex. HyperStudio and other multimedia-authoring tools are used to link and branch screens, making



them interactive and layered with information, with photos, scanned images, movies, and text. Students and candidates can easily narrate their project using a microphone. PowerPoint and other slideshow programs add tools for developing sequenced screens including all the elements of multimedia. Publishing multimedia products over the Internet provides that added dimension of having student works viewed by a distant audience. It is well recognized that the quality of student work increases markedly when they realize their work will be viewed by others outside of school.

Models of multimedia presentations include:

- Creating a Web page or site
- Developing a branching hypermedia stack
- Using PowerPoint or other multimedia tool to create a computer presentation
- Editing digital video to create a computer-generated movie

## CyberFair

Publishing a Web site is a rewarding experience for classrooms. The Global Schoolhouse (now part of Lightspan.com) organized several contests for students that provided rich multimedia experiences for project-based learning using the Web.

CyberFair is an annual contest that involves students with the community through collaborations with local leaders, businesses, special populations, environmental awareness, local music and art collections, and historical landmarks. These projects

- engage students,
- support standards-based coursework,
- connect students to their local communities,
- increase real-world, transferable skills,
- involve students in peer evaluation, and
- teach students education technology skills.

"Historical Landmarks of Escondido" (<http://cyberfair.gsn.org/berhman/Page1.html>) is a CyberFair example involving third-grade students as historians reporting local history documented through interviews and research with the community.

Students at Southampton Middle School in Virginia (<http://cyberfair.gsn.org/smsflood/index.html>) document a disaster and a community's efforts to rebuild and survive. The project title, Hurricane Floyd—Disaster in Motion in Southeast Virginia, demonstrates that students can focus on real situations that center the learning in a real-world context.

## ThinkQuest

The ThinkQuest model ([www.thinkquest.org/](http://www.thinkquest.org/)) provides opportunities for students (Grades 4 through 12), to collaborate on Web projects. Projects are hosted in a searchable library at the ThinkQuest Web site. Teachers and learners can explore a multitude of topics. Students in Hong Kong created a project called Genetic Engineering of Agriculture (<http://library.thinkquest.org/C005206/>). This site includes music, animation, and text covering topics from defining genetic engineering to exploring pros and cons of this area of science. Students in Australia created another ThinkQuest project called The Contemporary Art Experience (<http://library.thinkquest.org/26183/>). The project gives students the opportunity to analyze artworks and to learn from the interpretations of others.

## Multimedia and Copyright

For educational use, many copyright issues fall under the Fair Use clause. Teachers can use the fair use criteria to decide when use of materials in multimedia is appropriate. Criteria for judgment include that the use is for nonprofit; that the amount copied is minimal and not significant; and that no intent is made to replace the original—only to make it more accessible. Fair use is restricted to educational institutions. If the project is to be released outside the classroom in any way—published on the Web or in a school newsletter, broadcast outside the classroom, and so on—then fair use no longer applies. The teacher or student must have written permission for any copyrighted material, indeed for any material not created by the teacher or student. You can't go wrong by always getting permission.

## Resources

### WEB SITES FOR MORE INFORMATION

Copyright and Fair Use, Stanford University Libraries: <http://fairuse.stanford.edu/>

U.S. Copyright Office Study on Distance Education: [www.loc.gov/copyright/disted/](http://www.loc.gov/copyright/disted/)

Fair Use Guidelines for Educational Multimedia: [www.libraries.psu.edu/mtss/fairuse/guidelinedoc.html](http://www.libraries.psu.edu/mtss/fairuse/guidelinedoc.html)

University of Iowa Copyright Considerations: <http://twist.lib.uiowa.edu/resources/fairuse/index.html>

### WEB SITE FOR SAMPLE PERMISSION FORMS

Midlink magazine: [www.ncsu.edu/midlink/permission.html](http://www.ncsu.edu/midlink/permission.html)

### WEB SITE FOR CITING REFERENCES

Online Writing Lab, Purdue University:

[http://owl.english.purdue.edu/handouts/research/r\\_mla.html#Works-Cited](http://owl.english.purdue.edu/handouts/research/r_mla.html#Works-Cited)

## Telecomputing Projects

Telecomputing projects are Internet-enriched learning activities that often involve students in one location collaborating with students or adults in one or more other locations. They may share, among other things,

- experiences,
- beliefs,
- data,
- information,
- problem-solving strategies, and
- products they have developed or the joint development of products.

Telecomputing tools include e-mail, electronic mailing lists, electronic bulletin boards, discussion groups, Web browsers, real-time chatting, and audio- and videoconferencing. Online resources include Web sites and interactive environments, and remotely operated robotic devices.

## The Model

Judi Harris at the University of Texas at Austin has been doing telecomputing with students since 1981 and has researched and studied telecomputing projects since 1987. She has identified two types of Internet-enriched learning activities: telecollaboration and telereasearch. Both types are often present in the same project. Each of these areas focuses on particular learning processes, which she further divides into activity structures and purposes that facilitate curriculum development.

Telecollaboration projects focus on at least one of three primary learning processes: interpersonal exchange, information collection and analysis, and problem solving. Here is a list of the activity structures for each process of telecollaboration (Harris, 1998):



- |   |  |
|---|--|
| <ul style="list-style-type: none"> <li>• <b>Interpersonal Exchange</b> <ul style="list-style-type: none"> <li>Keypals</li> <li>Global Classrooms</li> <li>Electronic Appearances</li> <li>Telementoring</li> <li>Question-and-Answer Activities</li> <li>Impersonations</li> </ul> </li> <li>• <b>Information Collection and Analysis</b> <ul style="list-style-type: none"> <li>Information Exchanges</li> <li>Database Creation</li> <li>Electronic Publishing</li> <li>Telefieldtrips</li> <li>Pooled Data Analysis</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>• <b>Problem Solving</b> <ul style="list-style-type: none"> <li>Information Searches</li> <li>Peer Feedback Activities</li> <li>Parallel Problem-Solving</li> <li>Sequential Creations</li> <li>Telepresent Problem-Solving</li> <li>Simulations</li> <li>Social Action Projects</li> </ul> </li> </ul> |
|---|--|

Most telecollaborative projects incorporate some elements of teleresearch. Teleresearch is distinguished by a variety of activity purposes rather than structures. These purposes are to

- practice information-seeking skills,
- become informed about a topic of inquiry and/or answer a question,
- review multiple perspectives on an issue,
- generate data needed to explore a topic,
- solve authentic problems, and
- publish synthesized and/or critiqued information overviews for other students to use (Harris, 1998).

Harris has also developed a curriculum design process for curriculum-based telecollaboration. Here are her steps to design and carry out telecollaborative projects (Harris, 1998):

- Choose the curriculum-related goals
- Choose the activity's structure
- Explore examples of other online projects
- Determine the details of your project
- Invite telecollaborators
- Form the telecollaborative group
- Communicate!
- Create closure

To help make the curriculum design decisions while considering content knowledge and processes, Harris suggests that teachers think about what they want students to do to build understanding while engaged in the learning activities. She has identified the following student action sequences evident in telecomputing projects that teachers have created and used successfully in their classrooms (Harris, 1999):

- **Correspond:** Prepare a communication locally and send it to others. They respond, and the process continues.

- **Compete:** Register to participate, then do an activity locally. Submit completed work by a deadline and receive feedback.
- **Comprehend:** Locate online resources, then make primarily local use of them.
- **Collect, Share, and Compare:** Create something locally and add it to a group of similarly created works, combined to form a centrally located collection.
- **Chain:** Do an activity locally, create records of that activity, and send something on so that the next group can do something similar.
- **Come Along:** Shadow others as they travel either physically or cognitively, perhaps communicating briefly in the process.
- **Collaborate:** Work with remotely located others to realize a common goal.

In any telecollaborative or teleresearch project, therefore, there are one or more activity structures, teleresearch purposes, and action sequences working together that describe the plan and its implementation in the classroom (Harris, 1999).

Harris has developed these ideas over the years through her Mining the Internet column in *The Computing Teacher*, now renamed *Learning & Leading with Technology*, published by ISTE. In 1998, she wrote *Virtual Architecture—Designing and Directing Curriculum-Based Telecomputing*. (The second edition of *Virtual Architecture* is due out in 2002.) She continues to develop her ideas in Mining the Internet and through the Guest Expert column in the *Classroom Connect* newsletter.

## Resources

Virtual Architecture's Web Home: <http://ccwf.cc.utexas.edu/~jbharris/Virtual-Architecture/index.html>

Harris, J. (1997). Content and intent shape function—Designs for Web-based educational telecomputing activities (10 ways that Web sites can function to support curriculum-based educational projects). *Learning & Leading with Technology*, 24(5), 17–20.

Sample Curriculum-Based K–12 Educational Telecomputing Project Pages, Classified by Page Functions: <http://ccwf.cc.utexas.edu/~jbharris/form-follows-function/>

The Electronic Emissary Project's WebCenter: <http://emissary.ots.utexas.edu/emissary/index.html>

Teachers can search an index of more than 800 projects at the Internet Projects Registry (<http://gsh.lightspan.com/pr/index.cfm>). Listings include grade level, date, curriculum area, technology used, and complexity of project. This "one stop shop" database of projects contains descriptions of projects from reputable organizations such as I\*EARN, IECC, NASA, GLOBE, Academy One, TIES, and TENET.

## References

Harris, J. (1998). *Virtual architecture—Designing and directing curriculum-based telecomputing*. Eugene, Oregon: ISTE.

Harris, J. (1999). "I know what we're doing but how do we do it?"—Action sequences for curriculum-based telecomputing. *Learning & Leading with Technology*, 26(6), 42–44.

## Online Discussions

With the growth of infrastructure around the world comes the ability to access others through remote connections. Students and teacher candidates can connect to experts and peers through a variety of formats such as chat rooms, electronic bulletin boards, and e-mail. What makes communicating online unique is that it offers participants freedom to send and receive information efficiently during varying time frames from diverse geographic locations. Communication can occur asynchronously, that is, not at the same time, which allows periods of time for reflection or to compensate for varying time zones. In real-time online communication, as in chat groups, the communication is synchronous and provides immediate feedback for reinforcement and understanding.

## The Model

The model for online environments has been explored by several organizations. The structure includes environments for sharing information using e-mail, chat, and threaded discussions. It is important to set up protocols for communication and management. For example, when students post in a threaded discussion, they should consider how they can contribute to, enhance, or expand on knowledge with each posting. These environments can easily become nonproductive and disorganized without careful planning and consideration.

Experience tells us that group organization and working procedures take longer to develop online. It is critical to establish procedures early for contributing, posting, monitoring, and assessing. Online discussions can be moderated or unmoderated. In a moderated discussion, the instructor facilitates the discussion by initiating the discussion topic; organizing the forum around calendar or class requirements; matching discussion topics to class activities and curriculum; establishing expectations for participation; and categorizing, clustering, and summarizing student postings.

It is helpful to post topics in advance and agree on rules for the conduct of the chat. For example, pose a series of questions for students to think about before posting responses online. Or have them respond to something they have experienced or read about and compare that with readings that occur in class. Not all students respond well to the same approaches to discussion. To address diversity within an online group, be aware of cultural patterns as well as personal learning styles. How questions are framed can make a big difference to learner success. It may help to require a minimum number of postings.

## Examples

One online environment for professional development, Tapped In, is the online workplace of an international community of education professionals. The educators involved include K–12 teachers and librarians, professional development staff, teacher education faculty and students, and researchers. They participate in professional development programs and informal collaborative activities with colleagues.

An example of a project that uses online communications models is NASA Quest: Farming in Space, <http://quest.arc.nasa.gov/lrc/farming/farming.html>. Students and teachers participating in the Farming in Space investigation observe, share information, and develop research questions for experiments. Students and teachers are encouraged to share their questions and results with others by



participating in online chats, by e-mailing the ISS Challenge team, and by publishing findings on school Web sites. NASA researchers and International Space Station payload specialists answer questions and share project results.

There are commercial programs targeted at supporting online environments in higher education and the classroom setting. Blackboard.com is a Web site resource that powers e-Learning in the academic marketplace of schools, colleges, universities, and many organizations on the Internet today. This Web resource allows the posting of class materials, chat and threaded discussions with password protection. Another example of these models is found in WebCT software used by some educational institutions.

### Resources

Tapped In: [www.tappedin.org/](http://www.tappedin.org/)

Blackboard: [www.blackboard.com](http://www.blackboard.com)

WebCT: [www.webct.com/](http://www.webct.com/)

Beaudin, B. (1999, November). Keeping online asynchronous discussion on topic. *The Journal of Asynchronous Learning Networks* [Online serial], 3(2). Available: [www.aln.org/alnweb/journal/Vol3\\_issue2/beaudin.htm](http://www.aln.org/alnweb/journal/Vol3_issue2/beaudin.htm)

Winiecki, D. (1999, March). Keeping the thread: Adapting conversational practice to help distance students and instructors manage discussions in an asynchronous learning network. *Deosnews* [Online serial], 9(2). Available: [www.ed.psu.edu/acsde/deos/deosnews/deosnews9\\_2asp](http://www.ed.psu.edu/acsde/deos/deosnews/deosnews9_2asp)

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# Phone Phunctions

**Program/Grade Range:** Middle Level

**Subject:** Mathematics

**Topic:** Functions

**Profile:** Professional Preparation

**Abstract:** Experiencing the activity as middle school students, teacher candidates reflect on a cooperative learning activity during which they apply the concept of functions to answer the question "What is the best cellular phone plan for our client (a middle school student)?" Candidates use Web-based research to collect information about cellular phone plans and the phone habits of middle school students, spreadsheets to organize their findings, and technology to present their findings to the class. Candidates must justify their answer using the concept of function from the graphical, numerical, and algebraic perspectives. As a class, candidates reflect on the lesson, giving particular attention to the importance of the mathematics taught, the part technology played in conceptual development, and the appropriateness of the methodology.

## STANDARDS

### NETS FOR TEACHERS

**II. PLANNING AND DESIGNING LEARNING ENVIRONMENTS AND EXPERIENCES**—*Teachers plan and design effective learning environments and experiences supported by technology. Teachers:*

- A. design developmentally appropriate learning opportunities that apply technology-enhanced instructional strategies to support the diverse needs of learners.
- C. identify and locate technology resources and evaluate them for accuracy and suitability.
- D. plan for the management of technology resources within the context of learning activities.
- E. plan strategies to manage student learning in a technology-enhanced environment.

**III. TEACHING, LEARNING, AND THE CURRICULUM**—*Teachers implement curriculum plans that include methods and strategies for applying technology to maximize student learning. Teachers:*

- A. facilitate technology-enhanced experiences that address content standards and student technology standards.
- B. use technology to support learner-centered strategies that address the diverse needs of students.
- C. apply technology to develop students' higher-order skills and creativity.

### MATHEMATICS

#### Standard 1: Number and Operations

Instructional programs from PK–12 should enable all students to—

- compute fluently and make reasonable estimates.

#### Standard 2: Algebra

Instructional programs from PK–12 should enable all students to—

- understand patterns, relations, and functions.
- represent and analyze mathematical situations and structures using algebraic symbols.
- use mathematical models to represent and understand quantitative relationships.

#### Standard 5: Data Analysis and Probability

Instructional programs from PK–12 should enable all students to—

- formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.
- select and use appropriate statistical methods to analyze data.

#### Standard 6: Problem Solving

Instructional programs from PK–12 should enable all students to—

- build new mathematical knowledge through problem solving.
- solve problems that arise in mathematics and in other contexts.
- apply and adapt a variety of appropriate strategies to solve, problems.
- monitor and reflect on the process of mathematical problem solving.

## Lesson Description

	TEACHER PREP FACULTY	TEACHER CANDIDATES	FACULTY NOTES
<b>PREPARATION</b>	<p>Have teacher candidates review NCTM principles for math, NCTM standards for Grades 6–8, and NETS for Students for Grades 6–8.</p> <p>In preparation for the activity, divide the class into groups to locate specific information and have them be prepared to share their findings as well as the source of the data. One group should locate each of the following:</p> <ul style="list-style-type: none"> <li>• Rates of local cellular phone plans with options (assign one plan per group)</li> <li>• Demographic data on adolescent cell phone users</li> <li>• Use data on adolescent cell phone users including how many minutes they typically use in a month, what price they are willing to pay for the service, and when they typically use their cell phones—days, nights, or weekends</li> <li>• Cell phone companies who have special plans for individuals with handicapping conditions—define the services and the prices</li> </ul>	<p>Review the NCTM principles for school mathematics, the NCTM standards for Grades 6–8, and the NETS for Students profile for Grades 6–8.</p> <p>Locate the Web-based information for the work topic assigned to your group. Be prepared to bring the source of the information as well as to answer questions from classmates.</p>	<p>Candidates may hold one or more of the following attitudes that are barriers to using this lesson:</p> <ul style="list-style-type: none"> <li>• Activity-based learning takes too much time.</li> <li>• This lesson will not prepare students for the state exam.</li> <li>• My cooperating teacher said this lesson would not work.</li> <li>• This technology is not in my school.</li> </ul> <p>Finding the demographic and research data may be time-consuming. Examine the resources available in your area before making the assignment. If cell phone usage data are not available, make this assignment during the study of data collection, probability, and statistics prior to this lesson.</p>
<b>INTRODUCTION</b>	<p>Have groups share their data. Limit the discussion of the data to quickly observable conclusions.</p> <p>Have candidates relay what they learned about cell phone plans for people with handicapping conditions.</p> <p>Review the mathematics behind the notion of a function, variables, and so on.</p> <p>Introduce the activity by stating "Today you will experience a problem-based lesson designed for middle school students. I will be modeling strategies that illustrate the standards. Your job is to complete the activity by role-playing a middle school student. After the activity you will be asked to reflect on the lesson as you are, a teacher candidate, and to create a lesson that shows your mastery of the objectives."</p> <p>Inform the candidates that they are to find the best cellular phone plan as if they were a group of middle school students. (Distribute the presentation scoring rubric for a brief discussion before proceeding.)</p> <p>Assign collaborative groups of three to five candidates. These groups may be different than those used for the introductory research. Have them assign roles and create a time line.</p>	<p>Participate in having your group share the data brought to class. Listen for any commonalities and unusual information.</p> <p>What did you learn about cellular phone plans for persons with handicapping conditions?</p> <p>Review functions and variables.</p> <p>Become part of a collaborative work group. Assign roles and responsibilities for completion of the task. Make a time line for completing the tasks.</p>	<p>The activity may take too long for your time period. Consider where to break or alter the activity.</p> <p>Candidates may become enamored with the technology and neglect the mathematics of the activity. Keeping them focused can be quite a task. If this is the case, be prepared to debrief the activity heavily on classroom management techniques needed to control the use of technology in the classroom.</p> <p>Take time to look over the proposed scoring rubric below. Alter the rubric to fit your needs. When distributing the rubric to candidates, be open to the addition of other criteria and modification of performance indicators.</p>



	TEACHER PREP FACULTY	TEACHER CANDIDATES	FACULTY NOTES
IMPLEMENTATION	<p>Have candidates conduct their research. Have them assign roles and create a time line. The group's presentation must compare at least three cellular plans, determine costs for one year of all the plans, consider fixed and variable costs, address what happens if the client goes over the allotted number of minutes allowed by the plan, and so on. Groups should</p> <ul style="list-style-type: none"> <li>• research the topic using Web-based resources;</li> <li>• use the concept of function to solve a problem;</li> <li>• justify a solution from the graphical, numerical, and algebraic perspectives;</li> <li>• organize and analyze data using a spreadsheet; and</li> <li>• use technology such as presentation software to report to the class.</li> </ul> <p>Have candidates present their findings.</p> <p>Assign candidates to write a reflection on what they learned from the lesson, how different a problem-based lesson is than others they have experienced, and any concerns they have.</p>	<p>Conduct research about cell phone plans and organize findings in a spreadsheet.</p> <p>To complete your project:</p> <ul style="list-style-type: none"> <li>• Create a detailed description of your client (a middle school student).</li> <li>• Plan how you are going to use technology to describe the client in the presentation.</li> <li>• Identify the independent and dependent variables, create symbolic expressions for cost functions, create a spreadsheet of numerical data, and graph the functions using an appropriate viewing rectangle.</li> </ul> <p>Present your findings to the class.</p> <p>Complete an individual reflection on your experience in the lesson. Include in your reflective writing what you learned, how the problem-based lesson was a different learning experience for you than others you have experienced, and any concerns or other thoughts about this model of teaching.</p>	<p>Use observation to determine the following:</p> <ul style="list-style-type: none"> <li>• Did candidates identify reliable and appropriate Web sites?</li> <li>• Did candidates use the concept of function to solve the problem?</li> <li>• Are justifications correct, complete, and clearly stated?</li> <li>• Does the spreadsheet show that data have been organized and analyzed logically?</li> <li>• Do the electronic product and the presentation show sufficient expertise with the software?</li> </ul> <p>Getting candidates to focus on the mathematics may be difficult at first. Keep prodding with questions about the variables, depicting what they find in graphical form, and so on.</p>
CULMINATION	<p>Facilitate a discussion of candidate reflections, emphasizing important ideas that they might have missed.</p> <p>Assign collaborative groups to develop the skeleton or outline of a lesson that uses problem-based learning. The outline must include:</p> <ul style="list-style-type: none"> <li>• The standard being addressed with meaningful mathematics using the appropriate conceptual development</li> <li>• A topic of interest to middle school students</li> <li>• A problem requiring Web-based research and technology to complete and/or display</li> </ul> <p>Have the class peer-assess the outlines on the Web. Use the lessons as a topic for threaded discussion by the class.</p>	<p>Participate in the discussion of the lesson. Include information written in your reflection.</p> <p>In working groups, outline a problem-based lesson you would use with middle school students. This outlined lesson must require students to use Web-based resources for current information. The mathematical topic is of the group's choosing.</p> <p>Submit the lesson to the class Web site.</p> <p>As other lessons are submitted, participate in an evaluation of the lesson based on the posed questions.</p>	<p>The lesson outline assignment is designed to extend the experience into one that causes the candidates to think about their own practice and how they would use the techniques in their own classroom. The outline is used instead of a fully written lesson plan to save time. From a lesson outline, the readers should be able to answer the peer evaluation questions. Issues of classroom procedures, management, and other considerations used in creating a full lesson plan are left unaddressed in this exercise. However, if time allows, a full lesson plan is always preferable.</p> <p>The use of the outlines as a topic in threaded discussions can extend the learning of the candidates. Additionally, the posting of the outlines on the class Web site forces the groups to write for a larger audience. Knowing that their work will be responded to increases the level of concern for quality performance.</p>

## Assessment

The assessment rubric below is one in which a generic scoring scale is applied to the specific criteria for the lesson. In this model of assessment, candidates are familiar with the scoring statements as they are applied to multiple assignments and settings. The criteria for the specific project are developed to guide candidates in the development of their project and specify the important elements of the project.

### Rubric: Phone Plan

CRITERIA	PERFORMANCE INDICATORS
Presentation	The presentation is well-organized, engaging, uses technology, and presents the information in a comprehensible format.
Phone Plan	A rationale is provided for the plan presented that identifies the independent and dependent variables, creates symbolic expressions for cost functions, displays a spreadsheet of numerical data, and graphs the functions using an appropriate viewing rectangle.
Research	Credible Web-based resources are used in the decision making and the presentation.

### Scoring Scale

5	The work exceeds all expectations. It shows an exceptionally high level of creativity and sophisticated application of knowledge and skills. It contains elements that were not considered or discussed in class, thus setting it in a category all of its own. (Very rarely given score.)
4	The work exceeds the standard and shows very strong applications of the knowledge and skills.
3	The work meets the standard and demonstrates the appropriate application of knowledge and skills. It contains minor errors that do not diminish the quality.
2	The work does not quite meet the standard. It shows inconsistent application of knowledge and skills. The minor errors are significant enough to detract from the overall quality. Additional work is required.
1	The work does not meet the standard and shows limited understanding of the knowledge and skills. The work lacks depth or is incomplete with significant errors and/or omissions.
0	No work is presented.

### Peer Evaluation of Lesson Outlines

- Was the lesson based on the interests of middle school students?
- What concepts and processes were addressed?
- Will students learn meaningful mathematics?
- Is Web-based research essential?
- What part did technology play? Was it essential? Did it detract from the mathematics?
- How can the lesson be improved?
- Would you use this lesson in your classroom? Why or why not?

### Tools and Resources

#### SOFTWARE

Presentation, spreadsheet, class Web site, and threaded discussion forum

#### WEB SITES

Phone plan comparisons:  
[www.letstalk.com](http://www.letstalk.com)

ComSearch: [www.comsearch.net/](http://www.comsearch.net/)

#### Credits

Lucy Carpenter Snead, Columbia College, Columbia, South Carolina, [lsnead@gandalf.colacoll.edu](mailto:lsnead@gandalf.colacoll.edu)

James Wiebe, California State University, Los Angeles, [jwiebe@calstatela.edu](mailto:jwiebe@calstatela.edu)

### Comments/Stories

Teacher candidates could not believe the variety of information available on cellular phone plans. Because many of the candidates carry cellular phones, the research itself was a valuable exercise. Candidates were surprised how many middle school students were using cellular phones to keep in touch with parents. However, the research was expanded to look at cellular phone use over time. The older the students, the higher the cellular phone use. Again, the data spawned mathematically rich conversations about the function that resulted from the information.

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