Feature

When Students Create Their Own WebQuests

Although these students developed WebQuests for science topics, the activities discussed can be adapted for any content area.

By Cynthia L. Peterson and Deborah C. Koeck

Subject: Science, WebQuests

Audience: Teachers, technology coordinators, teacher educators

Grade Level: 9–12 (Ages 14–18)

Technology: Internet/Web, e-mail

Standards: *NETS•S* 1–6; *NETS•T* I–III (www.iste.org/standards)

Supplement: www.iste.org/L&L

A growing number of educators, inspired by the work of Bernie Dodge and Tom March, maintain Web sites of WebQuests, Web-based inquiry projects, created by teachers. To learn how teachers can create WebQuests for their students, read articles in *L&L* by Yoder (1999) and Dodge (2001). Teachers typically say the experience helps them discover new resources, hone technology skills, and gain new teaching ideas by collaborating with colleagues.

But what happens when *students* create WebQuests? Here, we share what we learned from the work of an adventurous teacher and her high school chemistry students.

Support for WebQuests

Support for the tasks of both creating and doing WebQuests can be found in the national curriculum standards across disciplines. For example, the National Science Education Standards require students in Grades 9–12 to understand the interdisciplinary nature of science, ask questions, and synthesize information from multiple sources of information. (See Resources at the end of this article.) The Web can provide students with the extensive resources necessary for this type of inquiry learning. The standards also require students to know how scientists draw on their creativity and imagination and work in teams. Students can do the WebQuests as creative, collaborative projects.

The tasks of developing a WebQuest differ from the tasks of doing a WebQuest (Table 1). WebQuest developers must compose explanations, pose questions, integrate graphics, and link to Web sites to reveal a real-world problem. They must understand the problem well enough to communicate it to

an audience. In other words, they become teachers. Students need opportunities to learn within complex environments (Spiro, Coulson, Feltovich, & Anderson, 1994), of which Web-based information networks are examples. To be actively engaged in that learning, students should be challenged without being frustrated (Csikszentmihalyi, 1990). We knew that the project's success depended on a well-planned WebQuest assignment that challenged students without frustrating them.

The Assignment

The 48 students who participated in this project were enrolled in two "advanced placement" classes of Chemistry I, an introductory, sophomore-level course that combines math and science content for college-bound students. Typically, many are unprepared for the challenges of the course, such as abstract thinking, organization, writing, and the reading of technical material.

Balancing structure and flexibility. Students were asked to identify a problem within the broad topic of "Nuclear Issues in the 21st Century," which the teacher found to be well supported on the Web. The teacher led students in a guided brainstorming session about what they knew about nuclear issues. She organized their responses into the categories that met her instructional objectives: history, science, public opinion, engineering, and future technology. These categories became major sections of the WebQuest assignment. Students worked in groups of five or six. Each group had a "Webmaster," a student who was either experienced with Web page construction or was willing to learn it outside of class time. Other tasks were developed, delegated, and monitored by the group.

With few computers in the classroom, students used class time for meetings and worked in the school computer lab. In addition to the lab, nearly a third of the students in this medium-sized, rural high school had access to the Internet outside of school, either at home, at the public library, or through a friend.

Evaluating the project. The project was worth 30% of the grade for the six-week grading period, during which students also completed unit-related textbook and laboratory work. Every two weeks, each group submitted a written progress report. The classes constructed a grading rubric for their WebQuests (Table 2). Most important, students knew they would present their project to an audience of university preservice teachers and that high-quality projects would be posted to the public forum of the Web.

Table 1. WebQuest Task Comparison: Developing versus Doing

Tasks for Developing a WebQuest	*Tasks for Doing a WebQuest*
Define a problem	Respond to a problem
Develop questions	Respond to questions
Search for and evaluate resources	Evaluate information within pre-selected resources
Design a site with an audience in mind	Navigate within a site
Work on a team for project creation	Work on a team for problem solution
Synthesize information	Synthesize information
Apply logical thinking	Apply logical thinking
Consider and accept multiple possible solutions	Arrive at a possible solution to the problem

The stages of GAP are:

- **G**athering information,
- **A**rranging information into meaningful formats, and
- Using technology tools to **P**resent that new knowledge to others.

Table 2. Student-Created Rubric for WebQuests

	Weak	*OK*	*Cool*	*Awesome*
Information (20%)	Little data or irrelevant data.	Some data missing.	Adequate data, mostly relevant.	Lots of good data, all relevant.
Overall Task/Focus Point (20%)	Focus/topic not clear.	Centered on several topics.	Centered on one topic but sometimes others.	Defined focus toward topic. Centered on one topic.
Organization (15%)	Messy. No organization.	Parts are neat. Organization sometimes confusing.	Mostly neat. Mostly easy to follow and understand.	Neatly put together. Always easy to follow and understand.
Activity of the User (15%)	No enjoyment for user. No creativity. Users not involved. No questions.	A few parts are enjoyable. One or two questions. Text makes the decisions.	Mostly enjoyable for user. Some creativity. Users sometimes get to make decisions.	Enjoyable for user. Shows creativity. Gets users involved. Users make decisions and share their opinions.
Graphics/Special Effects (10%) (audio, video, animation)	No pictures or special effects.	A few pictures or special effects.	Some pictures and special effects.	Many pictures and special effects.
Appearance (10%)	Splash page is boring. Boring fonts and colors.	Splash page is somewhat interesting. Fonts and colors all the same or too busy.	Splash page is interesting only for the serious user.	Splash page makes any user want to go on. Good design for fonts and colors.
Links (10%)	No links.	Few links to good sites. Internal links do not help user move around.	Most external links are to good sites. Most internal links help user move around.	At least four external links to relevant and interesting sites. Internal links take users to all pages.

Students excitedly mined real-world sites, comfortably and successfully finding information and graphics, yet they found this stage difficult and more time-consuming than they had anticipated.

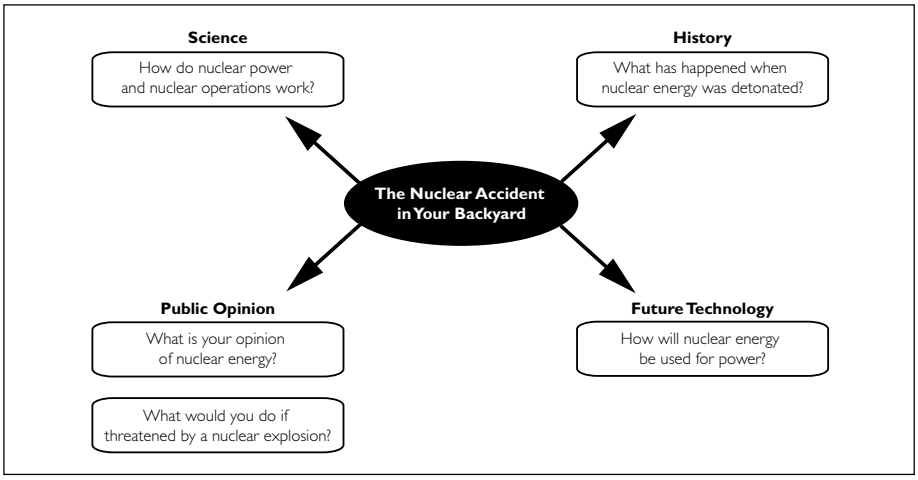

Figure 1. Map of "The Nuclear Accident in Your Backyard" WebQuest.

We documented the process of WebQuest creation through:

- written responses of students to open-ended questions before and after the project,
- notes of the classroom teacher and of two university professors who visited the classes, and
- the audience evaluations of the students' final presentations.

Creating the WebQuests

To prepare for the project, students completed a group activity in which they analyzed existing WebQuests to come up with their own answers to the question, "What is a WebQuest?" Their pretest definitions of WebQuests suggested a class assignment that ranged from the simple, "answering questions on the Web" to the more complex "taking a role" and "using the Web to complete a task." To develop their own WebQuests, we introduced students to a framework for constructing technology projects called GAP (Caverly, 2000). The stages of GAP are:

- **G**athering information,
- **A**rranging information into meaningful formats, and
- using technology tools to **P**resent that new knowledge to others.

Gathering. WebQuest creation began with students negotiating their group's focus as they gathered information from Web sites as well as print materials. All students were responsible for searching the Web for information. Chemistry-based mini-lessons (on searching, assessing Web site quality, copyright issues, and evaluating online information for relevance and credibility) prepared them for the tasks of gathering. The skills of searching for and critically analyzing information across the curriculum are particularly important for science teachers as a way to develop inductive thinking processes for drawing generalizations from data.

(***Editor's note***: For a sample mini-lesson on evaluating Web sites, visit www.iste.org/L&L, select the September 2001 issue and look for the online supplement for this article).

Students excitedly mined real-world sites, comfortably and successfully finding information and graphics, yet they found this stage difficult and more time-consuming than they had anticipated. The teacher attributed it to their lack of experience working without a set of prescribed steps. Most groups struggled to reach a consensus on a topic. The quantity of different ideas was cited by students as what they liked most—and also what they liked least—at this stage. Group members deferred to those students who not only had done the work of finding the information but also who could defend what they had found. They reached consensus by group vote. Expediency of access drove most students to the Web for content and to their own textbooks for definitions and succinct explanations of processes. Students without home Internet access were more likely to search for print sources.

Arranging. The process of arranging information to make sense of it included developing questions and tasks for visitors to their WebQuest. At this point, each group created a map (using Inspiration) to show the main sections of the project (Figure 1).

Individually or in pairs, students researched and wrote the description for a section of the project and submitted it to the group Webmaster as a word-processing file. The file included selected links and graphics as well as notes regarding how the page should be designed. Each group also assigned several members to create one or two PowerPoint slide shows on a particular topic. These were saved as HTML files and linked to the Web page. After the Webmaster added the work to the Web page, the group reviewed the work and made suggestions for editing. (See the WebQuest Task Form on p. 14.)

Presenting. For the culminating activity, students took a field trip to a nearby university, where preservice teachers and college of education faculty listened as each group formally presented their WebQuest using a digital projector. Because the high school did not then have its own server, we posted the projects on a university server. A few groups posted their projects on a free commercial server.

In presenting, the students took on the role of teachers who were passionate about their subjects. One group engaged the audience in a game that had been constructed on their site. On the evaluation forms completed by the audience a common response was "I'd better learn more technology if this is what high school kids are doing!" To prepare for the presentation, the groups

WebQuest Task Form

Date: _____ Task (Web page title) _____

_____

Group: _____ Partner Name(s) _____

_____

All graphics are in one folder labeled Graphics? ☐ Yes ☐ No

Graphics folder and all text files are in one folder? ☐ Yes ☐ No

Comments from Webmaster:

_____

_____

_____

Comments from Teacher:

_____

_____

_____

List graphics you propose to include:

File name:	*Type of file:*	*Description:*	*Source to credit:*

List the Web sites you propose to include:

Site title:	*URL:*	*Description:*	*Source or Sponsor:*

had practiced in their classes, where peer evaluations were more critical. "Don't be so long winded!" wrote one student.

Knowing their work would be shared had given students a meaningful deadline and a purpose, not unlike what they will be asked to do in their lives beyond high school.

Benefits for Students

These high school students clearly benefited from creating WebQuests. In the process we also learned what they find interesting and motivating in online learning environments. The evidence is found in the students' work, such as "The Nuclear Accident in Your Back Yard" (www.ci.swt.edu/faculty/peterson/nuclearaccident/nuclearaccident.html).

These students chose an engaging title that suggested emotional consequences of nuclear issues. They chose to communicate through dramatic photographs, vivid analogies ("How is a bomb like popcorn?"), and the press of a moral imperative, "Everyone must decide." They believed they had important questions and provided a way for the WebQuest visitors to respond to them by e-mail. We were surprised that test-like questions pepper the Web pages. One WebQuest included a pre- and posttest for visitors. We wondered whether students were mimicking the instruction they were so used to receiving. When asked, the students claimed they wanted to be sure their WebQuest users understood their message! Just like teachers, we thought. In this project, students shifted their role to that of teacher, and like teachers, they remained learners in the process.

Intellectual struggle. Students' intellectual struggle was driven by the desire to create a project their peers would find interesting and motivating. They were challenged but not frustrated because nuclear issues is a topic about which most high school students probably have some prior knowledge. Rather than building basic concept knowledge, they were able to devote time to synthesizing, evaluating, and communicating. The teacher observed that some of the strongest students seemed the most reluctant to make educated guesses from what they understood, afraid of not having the right answer.

Interdisciplinary connections. Although students were not told specifically to make interdisciplinary connections, their chemistry projects incorporated information ranging from the effects of the Holocaust from poetry written by children during World War II to stories from the lives of chemists. The interdisciplinary connections happened naturally, the result of investigating a real-world issue.

When asked to describe educational uses of the Web, students' preassessment answers heavily favored science and "looking something up on the Internet." Post-assessment responses reflected their deeper experience with the Web: "activity on the Web that gives info in an interesting way and helps you form an opinion," "a fun yet educational Web site that encourages you to think." When asked what subjects could be used for WebQuests, many students said almost any subject could and should be studied in this way.

"History, because it wouldn't be so dull."
"Humanities, because you could actually see art, places, and things."
"English, how events affect the story."

Fun. One of the most striking characteristics of the student-created WebQuests was the emphasis on learning as "fun." Fun was most often cited in both pre- and post-assessments as an important aspect of effective learning in a Web environment. Toward that end, some of the groups incorporated "choose your own adventure" options or an interactive game into their site.

Technology as a tool. Most students reported that they gained technology expertise through the project. Those who did not contribute to Web page construction still had to search the Web and communicate their work to the group Webmaster. On the preassessment, some students' misconceptions, such as not distinguishing between a CD-ROM and a Web site, were understood by project's end. Despite this growth, the project would be strengthened if all students contributed to the Web site construction.

More important, though, students used technology as a tool to communicate meaning. Their presentations forced them to balance creativity with clarity. Peer reviews were taken seriously. Most of the final projects included a way for visitors to provide feedback to the group.

Practice in collaborating and presenting. Some groups struggled to reach a consensus on project direction and design. Instruction and practice in cooperative learning skills, such as negotiating goals, tasks, and timetables might have helped. Most students also needed instruction in technology presentation skills, such as not reading from the screen. After the kudos from the final presentation, several students wrote that they wished they had worked harder with their group.

One of the most striking characteristics of the student-created WebQuests was the emphasis on learning as "fun."

In conclusion, this project spurs us to continue to support students in creating their own WebQuests. We are excited to explore its effectiveness in other grades and subjects.

References

Caverly, D. C. (2000). Technology and the "Knowledge Age." In D. B. Lundell & J. L. Higbee (Eds.), *Proceedings of the First Intentional Meeting on Future Directions in Developmental Education* [Online] (pp. 34–36). Minneapolis: University of Minnesota, General College and The Center for Research on Developmental Education and Urban Literacy. Available: www.gen.umn.edu/research/crdeul.

Csikszentmihalyi, M. (1990). *Flow: The psychology of optimal experience*. New York: Harper & Row.

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

Spiro, R. J., Coulson, R. L., Feltovich, P. J., & Anderson, D. K. (1994). Cognitive flexibility theory: Complex knowledge acquisition in ill-structured domains. In R. B. Ruddell, M. R. Ruddell, & H. Singer (Eds.), *Theoretical models and processes of reading* (4th ed., pp. 602–615). Newark, DE: International Reading Association.

Yoder, M. B. (1999). The student WebQuest. *Learning & Leading with Technology, 26*(7), 6–9, 52–53.

Resources

The WebQuest Page (Bernie Dodge and Tom March): http://edweb.sdsu.edu/webquest/webquest.html

Mid-continent Research for Education and Learning's K–12 standards database: www.mcrel.org/compendium/standard.asp?subjectID=2

Southwest Texas State University WebQuest Page (Cynthia Peterson): www.ci.swt.edu/faculty/peterson/webquests.html

Cynthia L. Peterson, PhD, is an associate professor of secondary education at Southwest Texas State University. She received her doctorate from The University of Texas at Austin after teaching public school in New Orleans, Louisiana. She may be reached at 512.245.3839 or cpeterson@swt.edu. Visit her Web site at www.ci.swt.edu/Faculty/Peterson/Petersonhome.html.

Now an assistant professor in the Department of Chemistry at Southwest Texas State University, Deborah Koeck taught chemistry at Wimberley High School, Wimberley, Texas. She received her doctorate in chemistry at Texas Tech University. For 10 years she was a systems analyst with Sandia National Laboratories. She may be reached at 512.245.9716 or dk10@swt.edu

Feature

Mini-Lesson on Evaluating Web Resource (with a focus on nuclear issues)

By Cynthia L. Peterson & Deborah Koeck

Editor's Note: This is a supplement to the author's article "When students create their own WebQuests".

This supplement is appended to the PDF of the original article. ISTE Members: Download the PDF.

Materials: data projector, Web access, or Web sites that have been previously downloaded to show offline.

Objectives

Students will:

- differentiate the top-level domain names in a URL and use that information to evaluate Web sites about nuclear issues.
- use navigation strategies to determine the source of a Web site on nuclear issues.
- evaluate Web sites on nuclear issues for credibility and reliability of information.

Instructional Model: Direct Instruction

Opening Activity: (about 6 minutes) Show transparency of chart below. Ask students to contribute possible insights and biases for each source of information about one nuclear issue, nuclear power plants.

Source, Insights, & Possible Biases

1. A Fact Sheet from an organization of citizens concerned with social justice issues.
2. An interview with an ex-employee who was fired from a nuclear power plant for "blowing the whistle" on safety violations.
3. A pamphlet from a company that sells building materials to nuclear power plants.
4. A fact sheet from the Department of Energy about levels of radiation in nuclear power

plants.
5. A published report from a university school of nuclear engineering.

Transition: (about 3 minutes) Each of those different views can be found on the Web. Ask students why it is important for us to know who produces the Web pages we are citing.

Instructional Modeling: (about 12 minutes) A Web site address provides clues to its source (see The Anatomy of a URL at Widener University's Wolfgram Memorial Library: www2.widener.edu/Wolfgram-Memorial-Library/pyramid/wwwanato.htm) Ask students which of the views on the transparency would likely have the domain name of .edu, .org, .gov, and .com. Using a popular search engine, such as Google (www.google.com), show the results of a search on the term "nuclear issues." Before teaching the lesson, bookmark selected "hits" to show as examples for each of the different types of Web sites. Think aloud as you model how you evaluate each of the sites. As you think aloud, show how you use navigational clues to determine the source. Show how you use content clues in graphics and language to help you understand potential bias. Sources we used were:

EDU
MIT Nuclear Engineering Links: http://Web.mit.edu/ned/www/links.html

- Navigational clues: Scroll to the bottom of the page to learn its source. The links are selected and maintained by an individual (possibly a graduate student or professor) listed by e-mail address.
- Content clues: The links seem to represent varied points of view.

GOV
California Energy Commission: www.energy.ca.gov/nuclear

- Content clues: Most government agencies have a Web page. The fact sheets and news releases present a positive image of nuclear energy.

Supervising Scientist Division, Department of the Environment, Australia, Radiation and Nuclear Issues: www.environment.gov.au/ssg/radnuc/rad_nuc.html

- Navigational clues: This site shows how you need to scroll to the bottom to find out where you are. Sometimes a hit will take you to the middle of a larger site. In looking at the URL, note that each forward slash (/) represents a "folder" on that site. When you backspace or delete folders in the address bar, you can get back to the main site, http://www.environment.gov.au/ 3.

ORG
American Nuclear Society: www.ans.org

- Navigational clues: A link that says "About Us" or "About" can provide information about the source of the site. Here, we learn that this is a "not-for-profit, international, scientific and educational" organization.
- Content clues: The list of members, professional papers, and meetings suggests these are

people who have studied and dedicated their careers to work in this field. Probably they have a bias in favor of nuclear energy.

GreenPeace Nuclear Campaign: www.greenpeace.org/~nuclear

- Content clues: The language (such as "nuclear pathways to destruction") and graphics tell me this is a site that has a bias against nuclear energy. It seems to be open to any citizen who wants to join.

COM
Mother's Alert: www.geocities.com/mothersalert/index.html

- Content clues: The language (the term "Nukes") and graphics tell me this site has a bias against nuclear energy, as does the selection of "political action reports" ("Why Nuclear Power is Not the Solution to Global Warming," "Infant Mortality Drops As Nukes Close"). Geocities is a .com because it offers space to anyone who would like to post a Web page there in exchange for allowing commercials to run in a banner across the top of the page. What other ".com" sites would you expect to find about nuclear issues on the Web?

Student Guided Practice: (about 15 minutes) Bookmark the MIT site of links. Have students work in groups of two or three per computer. Assign each group to explore the links under one of the headings (General Information, National Laboratories, Government Agencies, Nuclear Organizations, Fusion Information, Fission Technology, Radiation Science and Technology, Nuclear Policy Groups, University Nuclear Engineering Departments). Another site may work as well if this one is not available.

Students answer the following questions for two or three links.

1. Give the domain name of the site's host computer.
2. What do the graphics tell you about the site?
3. What does the language tell you?
4. Who (person, organization, or agency, or institution) put this on the WWW?
5. Why is it on the WWW? Who is the audience?

Transition (about 2 minutes for each group): Let each group share one site they found and how they analyzed it. Student Independent Practice/Evaluation: Students select and describe Web sites in preparing their WebQuest projects.