Rethinking Online

The key to a good telecollaborative project is not Internet access or a fancy e-mail program. It is good teacher training and curriculum planning.

By Bob Coulter, Alan Feldman, and Cliff Konold

Subject: Teacher planning for telecomputing projects in any subject

Audience: Teachers, teacher educators

Technology: Internet/Web, word processing software, e-mail

Standards: *NETS•T* II. (Read more about the NETS Project at www.iste.org—select Standards Projects.)

Supplement: www.iste.org/L&L

Adventures

No teacher can escape the calls to integrate the Internet into the classroom. Regardless of academic discipline or students' ages, educators and national leaders are touting the Internet as a sure path to improved learning. Visions of endless information and distant collaborations with peers and experts herald the dawn of a new era in education.

Yet those of us who have taken our students online know that the reality is far from what is promised. Useful information is often difficult to locate or inappropriate for the age of the students, and online collaborations tend to fizzle, if they ever take off in the first place. (See "More on Science and the Internet" on p. 52.)

In response to this gap between the promise and reality of the Internet in the classroom, we set out to learn from the experiences teachers faced as they participated in a variety of online curriculum projects (Feldman, Konold, & Coulter, 2000). The curricula we studied ranged from large, structured projects involving classrooms around the world to smaller and more informal research projects. Our research suggests the following about classroom use of online resources:

- The primary value of the Internet in schools is as a tool for providing depth and context to learning.
- If good teaching and learning practices are not established in the classroom, the Internet won't improve them, despite the fervent belief by some that Internet resources, by themselves, will improve education.
- When learning through inquiry is well established in class, there is the greatest likelihood that online resources will be used productively.
- Finally, in contrast to visions of Internet use promoting learning *online*, we see the greatest value of the Internet in the new resources that teachers and students can bring to their learning and teaching *in the classroom*.

In short, the Internet is no silver bullet for improving education.

To guide the planning process, we offer six questions to teachers who are ready to venture online for the first time or to rethink how they are currently using online resources in their classroom:

1. What is the educational purpose of the activity?
2. Where does the activity fit into the curriculum?
3. How will using the Internet enhance the activity?
4. How will students use the online resources?
5. What experience do my students have with data analysis and thoughtful discussion?
6. What will happen if the online resources I plan to use are unavailable?

By addressing these questions before your students venture online, you can greatly increase the chance that their experiences online will be worth the effort.

What Is the Educational Purpose of the Activity?

Too often, technology-enhanced activities are promoted as an important end in themselves—do this activity and your students will learn important technology skills. This admonition is usually preceded by solemn pronouncements about the high-level technology skills students need in the 21st-century workplace and how these skills will keep the United States globally competitive. We don't doubt that learning to use information technologies brings personal and societal benefits. However, we maintain that students acquire these skills best when they use these technologies to do something meaningful. Students do not need to make advertising campaigns for imaginary products to learn presentation software like PowerPoint, nor do they need to go online to find information they could more easily look up in a standard reference. (See the online supplement at www.iste.org/L&L for specific project outlines.)

Furthermore, we can find many useful applications of information technologies within high-quality curricula that aim to meet state and local standards. Students investigating water quality in the creek by the school can use presentation software to communicate their findings at a town meeting. Students studying local weather patterns can go online to find archival data as well as up-to-the-minute forecasts.

To paraphrase Dewey (1938), students shouldn't use technology to prepare them for some future needs but to address current ones. More recently, Jamie McKenzie (1999) has distinguished between "just-in-case" and "just-in-time" learning. Students today often learn a software tool *just in case* they need it someday. Students can

More on Science and the Internet

This article is the first of four that will be published this fall in *Learning & Leading with Technology*. These articles are based on our recently published book, *Network Science, A Decade Later: The Internet and Classroom Learning* (Erlbaum, 2000).

Our research focused on network science—science curricula that make use of online communities and shared data sets to support students' science learning. Funded under grants from the National Science Foundation, the research examined the goals of these curricula and the actual experiences of teachers and students as they participated. Rather than seeing the Internet as a certain road to educational reform, the authors found that the Internet's greatest effects are felt in classes where teachers and students are already engaged in inquiry-based methods of teaching and learning. The book offers guidance to educators—teachers, technology specialists, curriculum developers, and policy makers—as they seek to extend the best teaching and learning practices through the use of online resources.

For more information about the book, including the table of contents, sample chapters, comments from readers, and ordering information, see http://teaparty.terc.edu/book.

learn tools more effectively when they encounter them *just in time* as a means to some end. There is a real and compelling need for the Internet for students researching competing views of a controversial issue or trying to locate archival data to see if their water test results are typical.

If there is no apparent connection between an online activity and key curricular goals, then the online activity is probably not a good use of your students' learning time.

Where Does the Activity Fit into the Curriculum?

In general, online activities should fit into your current curriculum and build on your students' skills and experiences. Consider, for example, one of the best educational sources for online data about seasonal variation—Journey North (www.learner.org/jnorth). In this project, thousands of classes report signs of seasonal change in their local communities. Using student reports and other information, students create maps showing spring unfolding across North America. By carefully observing patterns of animal migration and plant growth, students deepen their understanding of how changing temperatures affect those patterns. Students who are more advanced use archival maps and data from the Journey North site to compare seasonal change from year to year, exploring questions such as how tulip blooming patterns differ in the current growing season from what is "normal."

As wonderful as this type of activity may sound, the students who are likely to learn the most from it are those who are doing the investigation as part of longer-term and curriculum-based study. The nature of the questions students can productively investigate depends on their prior knowledge and experiences as do their abilities to use data to answer these questions. Therefore, as you plan online experiences for your class, select resources that are closely related to the curriculum and support growth in content and skill areas. Resist the urge to use a curriculum only because it offers glitzy technology.

How Will Using the Internet Enhance the Activity?

Many uses of online technology extend the curriculum in powerful ways, enabling students to engage in significantly richer learning activities. Using online resources, students and teachers can access up-to-the-minute data, explore different points of view, and retrieve information and images not available locally. More broadly, the qualities that characterize good curriculum—being authentic, active, cooperative, constructive, and reflective and promoting higher-order thinking—are qualities that online resources can enhance (Jonassen, 2000; Jonassen, Peck, & Wilson, 1999).

In classroom planning, however, you need to consider more than the potential benefits of using information technologies. Using the Internet often involves tackling new problems of classroom management, especially if only a few students can go online at a time. There are also the issues of students accessing inappropriate materials and the inevitable network and computer failures.

Given these logistic challenges, it makes sense for you to use the Internet

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only if the benefits outweigh the costs and if Internet use significantly enhances the investigation you are planning. A good guideline is if you can achieve your educational objectives satisfactorily without online technology, then don't use it.

How Will Students Use the Online Resources?

Answers to this question will vary depending on your students' and your own experience with online resources, the task, and the infrastructure available to your students, but it is a question that needs reflection. The importance of students *locating* resources is often overvalued, and their *using* resources in their learning is often undervalued. If your students are exploring land cover through satellite images, it may be more productive for you to retrieve the relevant images and install them on a network server or print copies, thereby directing students' time to more cognitively challenging tasks. Similarly, if your students are studying the current presidential campaign, you might organize them in teams and point them to specific sites, so that the objective is not to learn to locate relevant information but to learn to compare and contrast perspectives on issues.

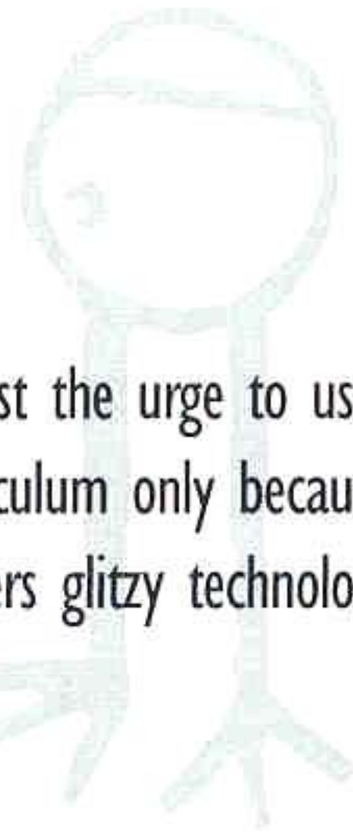
In both cases, these choices of resources are ones that you as the teacher are likely to make much better than your students, especially if they are new to a topic. For selecting satellite images, which images can the class explore productively? Which show the most important features? Which can my students interpret given their current skills? For designing the election study, which issues are most important for the students to consider? What skills do my students have in assessing competing points of view? What documentation of claims should students be looking for? These are important issues for you to address because they provide the framework for choosing the resources that allow students to go well beyond *locating* information to *using* information to compare, contrast, analyze, and synthesize.

What Experience Do My Students Have with Data Analysis and Thoughtful Discussion?

In our research, two areas posed challenges for nearly every teacher: classroom discussions and data analysis. Consider what experiences your students have with each of these areas. The Internet offers students access to massive amounts of quantitative data on a wide range of topics. Students can quickly obtain data about the temperature of most cities going back 50 years or more, the current or past populations of cities and countries, or the number of immigrants arriving in the United States for any given year. How much experience do your students have in making sense of that data?

If you and your students have limited experience with data analysis, it may be best to begin with topics to which students can bring considerable "real-world" experience in interpreting data, such as temperature trends and variations from "normal" readings. It is often easier for students to think about trends and variation when they are dealing with daily temperatures than when they are investigating the nitrate levels of a stream. In the latter case, the measurements are nearly meaningless to students who don't have a sophisticated understanding of stream ecology. Furthermore, they will have no background knowledge to use for spotting surprising results or in deciding what to look for.

Likewise, meaningful classroom discussion is often an elusive goal. Most students are used to a didactic, teacher-centered classroom in which the teacher initiates a question, solicits a response from a student, and evaluates that response. When a teacher tries to foster discussion among students, students must learn new norms:



Resist the urge to use a curriculum only because it offers glitzy technology.

- What is my responsibility as a listener when others are speaking?
- How do I challenge other students' viewpoints?
- How do I support my own claims with logic or evidence?

For example, students participating in a problem-solving project such as the Math Forum's "Problem of the Week" program (www.mathforum.com/pow) can investigate complex math problems and offer their solutions online. Ideally, these solutions are debated in class before they are submitted online, but this process can be difficult at first. If students view the teacher as the source of the right answer, they may not be used to offering their own thoughts. They almost certainly won't be used to listening to their peers' reasoning. It is just such work that provides the greatest value to the "Problem of the Week" program. The response from the online mentor is rarely more than an acknowledgement that a given solution is correct or incorrect. Growth in mathematical thinking comes from students debating which solutions are "best," which are most accurate, which show novel insight into the problem situation, and which raise additional possibilities. That type of work can happen best *in class*, in the give and take of a rich classroom discussion supported by a skilled teacher. As with data analysis, it is best to start with modest goals, discussing relatively straightforward topics.

Complexity in subject matter can grow with the students' increasing skills in actively participating in discussions and the teacher's skills in leading them.

Developing student skills in data analysis and classroom discussion—skills essential to inquiry—is a daunting task, best done over several years in a situation where a group of teachers (e.g., a middle school team or a high school department) work at developing these skills in their students. These skills are essential for students to engage successfully in meaningful inquiry. (Look for a more detailed discussion of classroom discussion and data analysis in parts two and three of this article series.)

What if the Online Resources I Plan to Use Are Unavailable?

Internet connections are not always completely reliable. You may come into the classroom ready to go online and find that the connection is not working or lose it in the middle of the activity. This lost connection need not be crippling. Among the strategies teachers use for dealing with temporary interruptions are putting archived sets of data on CD-ROM or downloading critical online resources well in advance so that they are available when needed.

An additional benefit of designing local investigations is that students will have plenty to keep them busy offline while they wait for the connection to be reestablished. A watershed monitoring project run by Bob Coulter was limited last winter when the EPA Web site (www.epa.gov), which has significant watershed study resources, was taken offline in response to concerns about its security with sensitive environmental data. The watershed project was able to proceed in the classroom, however, because the core of the activity involved students investigating local watersheds. Though the EPA resources and other online components were important to the project, they were not essential.

Investigations often run aground when they are totally dependent on distant resources. If the curriculum you select is structured entirely around timely retrieval of data and information supplied by partner classes, you are likely to be disappointed. Collaborative data projects such as these invariably have a significant dropout rate, even when schools pay to participate. A robust curriculum design can withstand a range of problems and continue to support productive learning.

Concluding Thoughts

In our research of online curriculum projects, we wanted to find out why some curricula are successful when so many others falter. Based on our observations in dozens of classrooms and our work with multiple curriculum projects, we found two qualities that characterize most successful online curriculum projects.

First, these curricula used online resources to supplement activities and in-

vestigations that were centered in the classroom. These inquiries had clear educational value that fit well with the teachers' existing curricula and students' skill levels. The Internet provided additional context and data to these local investigations.

Second, these curricula encouraged teachers to add complexity gradually as their technology comfort level and skills increased. In this way, the teachers were best able to orchestrate new technology, new sources of information, and new approaches to teaching and learning at their own rate.

Although some have argued that technology is diminishing the importance of the teacher, we found the opposite. The effective use of the Internet for learning depends on the skillful judgment of the teacher, who plays a critical role in bringing together an understanding of the students, the district's curriculum, and the state standards with the potential of technology.

Editor's note: In the October 2000 issue, the authors will describe the role of online resources in supporting classroom-based discussions.

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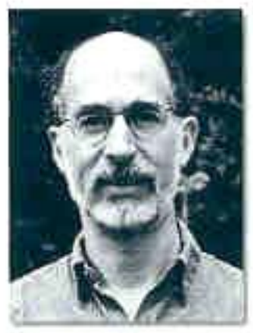

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Cliff Konold's (konold@srri.umass.edu) current research focuses on understanding and improving students' ability to reason about data. With funding from the National Science Foundation, he is heading a team building data-analysis software for middle school students. The tool, "Tinkerplots," is structured like a construction set, permitting students to create their own types of plots and analyses.