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### ABSTRACT

This article describes how we have begun to integrate the Internet and World Wide Web (WWW) into preservice teacher education in hopes of expanding the instructional use of technology in special education classrooms. We have provided examples showing how faculty members can instruct both practicing and prospective teachers in ways to integrate the Internet and the WWW into their K-12 classroom instruction.

The growth in educational technology has been tremendous. The Office of Technology Assessment (OTA) estimates that the number of computers in K-12 schools increased by 300,000 to 400,000 a year from 1985 to 1995. The total number of computers in schools was estimated at nearly 6 million during 1995, or 1 for every 9 students. This represents a great advance from the 1984 average ratio of 1 computer to 125 students (OTA, 1995).

Despite this growth, the decade of the 1990s has witnessed a limited use of computers in K-12 classrooms (Hunt & Bohlin, 1995; OTA, 1995).

To develop technological competencies and understand how they can be integrated into classroom instruction, critiques of teacher education suggest focusing on three areas.

1. Teacher educators must model appropriate use of computers and related software applications for instructional purposes, either in courses or field experience (OTA, 1995; Sheingold, 1991).

2. Teacher education programs need to incorporate the use of technology across the curriculum. Walters (1992) argued that traditional technology courses designed to stand on their own and teach student-specific applications fail to teach prospective teachers how to integrate technology into their instruction.

3. The instruction provided to preservice teachers must focus on newer, more sophisticated tools (e.g., the Internet, integrated media, problem-solving applications) that support the development of students' higher-order thinking and problem-solving skills, leading to classroom integration (OTA, 1995).

U.S. teacher education programs should have as a major priority the infusion of technology into preservice teacher education--particularly in special education, where technology integration can be beneficial to student development (Schmidt, Weinstein, Niemic, & Walberg, 1986).

### INTERACTIVE CASE-BASED TEACHING

One way we model the use of technology in our own teaching links a teaching model--case-based teaching--with the Web (see box, "Case Method"). Cases created for the WWW offer students video and audio clips to illustrate the situation being considered.

### VIDEO

As preservice students read the case (see Figure 1), they select video segments, downloading

examples of an instructional strategy, a behavior modification plan, or a similar incident to help bring context to the case. The video helps students to engage in the problem-solving task by providing a visual example to a given situation. The video helps students enhance their practical, empirical, and theoretical knowledge. As the Cognition and Technology Group at Vanderbilt explains, "Video allows a more veridical representation of events than text; it is dynamic, visual, and spatial; and individuals can more easily form rich mental models of the problem situation" (Bransford, Sherwood, Hasselbring, Kinzer, & Williams, 1990, p. 3).

#### **AUDIO**

Audio clips on the Web can offer advice from experts, offering information regarding the educational theory or suggestions and additional information that might help the students as they make decisions and find alternate solutions.

#### **GRAPHICS**

Web-based cases also use photographs or graphic images to illustrate the text-based narrative. Users can examine the design of a classroom, picture a particular person with special needs, or generally enhance their understanding. Graphics, illustrations, and animation further provide detail to engage the preservice teacher in problem-solving behaviors. Images also illustrate specific forms, regulated processes, or information relevant to topics like transition of students with special needs.

#### **LINKS TO FURTHER RESOURCES**

The rich context of the WWW can further supplement case-based teaching through links to additional resources. For example, we have supplemented cases by creating links to resources relevant to the topic (e.g., transition services). As students examine the case, the links offer additional information, pertinent examples, related expertise, or further explanations.

#### **CLASS DISCUSSION**

By using cases, we encourage students to consider different points of view, basing their arguments on the theoretical, empirical, and practical issues surrounding the case. When we use the Internet for our interactive cases, discussions are not limited to classroom time. Through e-mail, listservs, newsgroups, and form submissions, students continue their discussions beyond the classroom setting. Indeed, these discussions can include preservice teachers from several different institutions, in other geographic locations. Because the case is accessible on the WWW, preservice special educators can gain multiple perspectives from an array of practicing and prospective teachers.

#### **FROM RESEARCH TO PRACTICE ON THE INTERNET**

The Internet also provides a way to help bridge the gap between teaching and research. Many teachers often justifiably complain that research is something done and read by professors in ivory towers. But the Internet is changing all that.

#### **INTEGRATING RESEARCH WITH BEST PRACTICE**

Effective teachers (i.e., those whose students have greater measured outcomes than other students) are researchers, whether or not they recognize themselves as such. Here's what effective teachers do:

- \* They analyze their students' levels of performance.

- \* They make instructional changes in response to those levels of performance.
- \* They evaluate the effects of those instructional changes.

Sometimes teachers accomplish this cycle through pretests and posttests--analogous to studies using statistical procedures--to evaluate the effects of interventions. At other times, teachers use repeated measures of baseline and intervention data--analogous to single-subject research methods.

One goal we have is to make it more evident to teachers that they can and should be researchers (i.e., prove that the techniques they choose to use are effective) by exercising more deliberate control over their data-collection procedures and instructional decision-making processes. At the same time, we must convince teachers that they don't need to "reinvent the wheel" or rely solely on other teachers' personal experiences and anecdotes to deal with every behavior and learning problem they encounter. There is existing research with direct classroom applications in libraries and, increasingly, in cyberspace, waiting to be found.

### **PROVIDING RESEARCH TO K-12 EDUCATORS**

Because more and more teachers have access to the Internet, they can now use the WWW as a resource for locating intervention techniques to use in their classrooms. Practicing and prospective teachers can use the WWW to locate teaching techniques in three ways:

1. Use the WWW to access electronic databases like ERIC (see <http://ericir.syr.edu/>). These databases are searchable, using keywords. Users can read abstracts of the articles included in the database. The teachers will still have to go to a library to locate the actual articles. A disadvantage of the typical abstract-form database is that the abstracts are generally written in the same technical language of the articles, making it difficult for teachers to tell if an article validates a specific teaching method to use with a specific behavioral or learning problem. Furthermore, even teachers who are keyword-savvy have to wade through tremendous numbers of descriptive studies, theoretical papers, and other research in their attempt to locate a few research-validated teaching techniques.

2. Locate sites on the Web for particular types of disabilities (e.g., ADHD, learning disabilities) that include information about effective interventions for people with those disabilities. The search engines used to browse the Internet (e.g., Yahoo, Magellan) can take a reader directly to many informative sites; however, these sites generally have few specific recommendations for classroom interventions and do not assure the reader that the interventions suggested have been shown to be effective (i.e., validated through research studies).

3. Use and contribute to sites that contain information about research-validated teaching techniques. We have a particular affinity to this suggestion because we are the developers of one such site. Our site, The University of Virginia: Office of Special Education (fondly called "little ose" to distinguish it from the federal government's "OSE"), contains many Web pages of special education resources, including a database of intervention techniques (<http://curry.edschool.virginia.edu/go/specialed/information/interventions.html>) (see Figure 2).

We have used the intervention-techniques database in several ways with preservice and inservice teachers. Students in colleges of education can search the database, which is organized by instructional topics (e.g., reading, social skills) to locate articles to use for class research papers. They can also contribute to the database by locating relevant research studies and writing special, user-friendly abstracts that clearly identify the skill being addressed, the participants in the study, the technique used to teach or improve the skill, the way the participants' progress was monitored, and the full citation for the study.

This database gives both prospective teachers and classroom teachers valuable practice in

locating and analyzing applied research studies. Most important, teachers in the field can use the database to read about teaching techniques that address learning and behavior problems in an easy-to-read format. This also eliminates the need to wade through abstracts of nonapplied research. As with other databases, teachers still have to obtain the full article from a library or use other sites on the Web, such as CARL UnCover. (Uncover is an online article-delivery service with a table of contents and keyword index to nearly 17,000 periodicals at <http://www.carl.org/index.html>).

### **PRESENTING COURSE MATERIAL: LECTURES, DISCUSSIONS, AND ASSIGNMENTS**

In our own teaching, we present class materials using Web resources, promote class discussions using the Internet, and give assignments that require students to interact with Web-based programs.

#### **CLASS PRESENTATIONS**

Many educators are familiar with presentation software. Astound, Persuasion, PowerPoint, Storyboard Live, and similar commercial programs permit teachers to create lecture slides that include text, graphics, and even animation. As the Web has developed, however, it now can provide comparable capabilities. Indeed, teacher educators can create a set of pages that present material, using not just text, graphics, and animation, but also illustrations that exist outside of the presentation itself--actual links to resources on the Web.

Going just a step further, you can create presentations and require that students peruse them prior to a class meeting; then, during the class meeting, the students have a shared basis for discussing the materials they found in the presentation. Such an activity not only acquaints students with available Web resources, but also helps them become critical consumers of those resources and prepares them to respond to parents who have found similar resources on the Web.

#### **DISCUSSION OUTSIDE CLASS TIME**

For our preservice students, we use Internet resources to promote discussion outside of class. We routinely establish e-mail discussions lists that include only the members of our classes and encourage the students to use them to inquire about assignments, argue the merits of a controversial position, report about experiences, and so forth. Local newsgroups can be used in similar ways.

It is sometimes difficult to get each member of class to respond using electronic media. We know of instructors who have made contribution to discussions a requirement for classes. Another strategy to promote discussion is to use the list yourself and make students' use of it beneficial: Provide proactive comments, distribute hints about assignments, post replies to inquiries promptly, and participate in the discussions.

#### **ASSIGNMENTS**

In addition to using the Internet in presentations and discussions, we have created assignments that incorporate several uses of technology. For example, we have used HTML forms. Web pages that have fill-in forms, buttons, and checklists are ubiquitous these days, but that should not stop us from using them in assignments. Using an HTML page with forms, an instructor can have students interact with a computer program that reads and responds to the students' input. Two examples:

\* HTML forms can permit instructors to present quizzes that students can take whenever they are ready to take them, rather than during class sessions; the script (computer program that

receives the data from a Web page with a form) can deliver immediate feedback to students about their answers. The script can go beyond just checking multiple-choice items; it can also search brief essays for key phrases and provide feedback on the basis of their presence or absence.

\* HTML forms, when integrated with other activities, can foster reflection and discussion. (See box, "Form-Based Web Activity, page 64," for a Web assignment in an introductory class on learning disabilities.)

### **FROM CLASS TO CLASSROOM**

More preservice teacher education students are learning to use advanced technologies for personal and instructional use. The challenges of technology integration, however, remain significant for teacher education instructors. We cannot continue to do as we have done in the past--leaving technology instruction for the computer class. Instead, we must work to integrate the use of technology across our curriculum. The Internet offers a valuable way to use technology in teacher education.

Added material

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Figure 1 Teacher Case: Transition Services and Legal Requirements

Figure 2 Effective Techniques Database: Reading Comprehension

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## **BOOKS NOW**

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## **CASE METHOD AND TEACHER EDUCATION**

Case-based teaching is an emerging curricular innovation that enhances the skills of novice teachers to analyze a situation, to formulate action plans, and to evaluate those actions with respect to specific context variables.

Recently, special education textbooks and related resources have incorporated the case method, which is based on cases--a descriptive research document--often presented in narrative form, related to real-life situations or events (Shulman, 1992). Generally, cases are created for discussion purposes and seek to include sufficient detail and information to elicit active analysis and interpretations by users (e.g., preservice teachers) with differing perspectives. Cases can provide opportunities for prospective teachers to grapple with the ambiguities and dilemmas of teaching individuals with special needs, such as behavior modification, appropriate instruction, and collaboration with the general education classroom.

By incorporating the Internet into case-based instruction, we gain the advantage of providing an extended example (a macro-case), allowing students to plunge into highly contextualized situations for practice. Students have the benefit of sharing a common experience, much like the anchor recommended by the Vanderbilt technology group (Bransford et al., 1990). We have found that cases and the Internet each present ways to bring the complex situations of teaching into university classrooms.

## **FORM-BASED WEB ACTIVITY FOR PRESERVICE TEACHERS**

I. During the first class session, students write statements about learning disabilities that they think are true and false (one each).

II. The instructor edits these statements and creates a Web page using some of them. For each statement, the instructor provides buttons indicating "true" or "false" and a text form (a box where users can type written responses).

III. Before the next class meetings, students read the introductory material in the textbook and then, working in pairs, they review the Web page. They must

A. Reach agreement about whether they think each answer is true and

B. Write a brief rationale for their decision, then

C. Submit the form over the Web (click the "Submit" button).

IV. The script (computer program)

A. Receives the answers from the students,

B. Sends copies of the students' answers to them and tells what ideas would have appeared in a good rationale,

C. Sends copies of the students' answers to the instructor,

D. Adds selected essay answers to a different Web page, and

E. Generates a new Web page that nearly immediately appears on the students' browsers indicating that their work has been recorded, that they should read their e-mail for feedback, and they should follow a given link to get a look at how other students responded to the questions.

V. In subsequent class session, the instructor can display the Web page with the compilation of student responses and lead a discussion of the strengths and weaknesses of various answers.