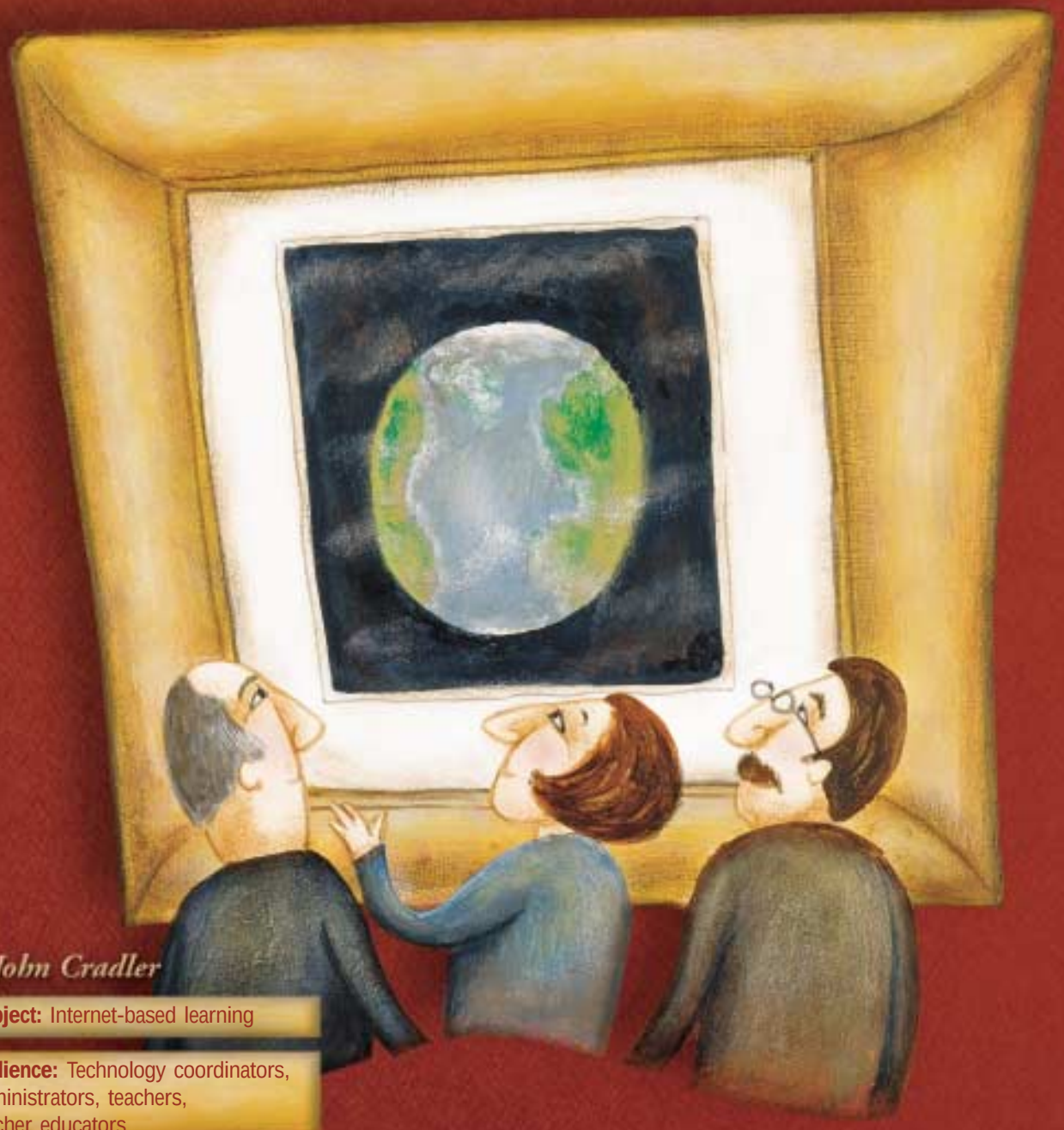
Research on E-learning



By John Cradler

Subject: Internet-based learning

Audience: Technology coordinators, administrators, teachers, teacher educators

Grade Level: K–16 (Ages 5 & up)

Standards: *NETS•T* II; *NETS•A* II (www.iste.org/standards)

Supplement: www.iste.org/L&L

This is the sixth in a series of articles addressing critical questions about educational uses of technology from the Center for Applied Research in Educational Technology (CARET). For additional research findings, visit CARET at http://caret.iste.org/.

On the surface, research and evaluation studies appear to produce mixed findings about the effects of the Internet on learning. Reported findings range from concluding that the investment in classroom Internet access has no effect on achievement to concluding that all curriculum should be accessible through the computer rather than books.

After reviewing a wide range of studies and project evaluations, the CARET staff concludes that Internet-based learning, or e-learning, can be an effective educational intervention and resource depending on:

- how it is used—that is, the specific application of the Internet, such as an online course or student project
- under what conditions or context it is used—for example, the extent to which teachers are prepared to use the technology combined with necessary administrative support

Establish Clear Focus

A recent study illustrates the lack of focus on technology use and context. Goolsbee and Guryan (2002) investigated the E-rate Internet subsidy for connectivity in California schools from 1996 to 2000. The study concluded that by the final year of the program, there were about 66% more Internet-connected classrooms than there would have been without the E-rate subsidy. The study concluded that the E-rate was successful in meeting its primary goal of getting classrooms connected to the Internet—especially in poorer schools with 80%–90% of students on free or reduced-price lunch.

However, Goolsbee and Guryan (2002) also attempted to determine whether the investment affected student academic performance. They found no evidence that the E-rate subsidies had any measurable effect on student achievement as measured by the Standard Achievement Test in math, reading, and science. They did not attempt to disaggregate data according to any of the many possible factors, such as curriculum content; teaching approaches; or frequency, level, and type of Internet use.

Goolsbee and Guryan (2002) suggest that it is "too early to evaluate long-term investments in information technology, or that the gains took place in areas other than test scores" (p. 17). Yet, the statement that "Internet connections had no measurable impact on any measure of student achievement" (Goolsbee & Guyran, p. 16) was widely published in major newspapers and is reported to have renewed the debate in the U.S. Congress about the educational benefits resulting from the federal investment in the Internet through the E-rate legislation. Lack of focus on technology use and context led to premature conclusions based on incomplete data that may influence policy makers to cut or delay support of Internet connections to schools.

Ask Appropriate Questions

CARET staff found that educational technology studies have been asking the wrong questions about the educational use of technology and telecommunications, causing much of the data relevant to the effects of technology not to be considered. Studies often make the mistake of considering the technology in and of itself as an educational intervention—regardless of how and when it is used. Technology uses may range from serving as an administrative tool for managing student information to the delivery of online advanced placement courses for college preparation. Evaluation and research questions must attempt to answer questions based on the specific applications of the Internet and/or how the technology and Internet use can enhance or extend learning opportunities not otherwise possible.

Also, the extent to which teachers know how to use technology and the necessary application must be considered. This point was mentioned by Goolsbee and Guryan (2002) when they cited Rowand (2000), who reports that only one-third of teachers felt well or very well prepared to use computers and the Internet.

The issue of teacher knowledge also applies to other areas in education. For example, after years of research on class size and achievement, it was concluded that class size doesn't matter. However, when the data and studies were reassessed, it was found that smaller classes can enable improved learning when teachers understand and apply instructional strategies and curriculum appropriate for small groups and individuals—that is, when teachers had the knowledge of how to teach smaller classes (Ehrenberg, Brewer, Gamoran, & Williams, 2001).

Becker's (2000) Teaching, Learning, and Computing survey of 4,000 teachers documents the conditions supportive of teachers' uses of the Internet. Becker reports that three major predictors of teachers' Internet use are variables related to connectivity, computer expertise, and constructivist pedagogy, with the teacher's level of classroom connectivity "by far the most important" (p. 105). None of these factors were considered by Goolsbee and Guryan (2002) and are absent from

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consideration in many other studies, especially those that conclude a lack of educational benefit from classroom access to the Internet. Many other factors need to be considered when studying the effects of the Internet, such as the level of teacher readiness to use the Internet and the availability of appropriate content. For example, a survey by NetDay (2001) of 600 public and private school teachers reported that "the vast majority of teachers (78%) cite lack of time as their greatest barrier to using the Internet within the classroom."

Design Evaluations Appropriately

Evaluation of the educational effects of the Internet must be designed to directly relate to the instructional setting, the training of the teacher, and how the teacher integrates the technology into instruction as well as the added contribution of the Internet and related technology. Figure 1 illustrates the process for evaluating or researching the contribution of technology with possible Internet uses each being documented and considered in the overall analysis of the summative evaluation findings. The effects of the Internet cannot be determined without a formative evaluation that considers the Internet uses or applications along with the conditions under which the Internet is used.

Provide Evidence of Internet's Contributions

Studies are providing evidence that the Internet helps improve learning. Following are some examples of CARET-reviewed studies that taken together provide evidence that the Internet can contribute to improved teaching and learning under the conditions described in each study. These provide a very small sample of the many studies and program evaluations selected by CARET as the current best evidence available to document the effects of the Internet.

- A recent study showed that use of the Internet has significant effects when video segments correlating to state standards were delivered on the Internet to support instruction. Results showed significantly greater gains in science and social studies skills for the students exposed to the video segments than for the control groups not receiving the videos (Boster, Meyer, Roberto, & Inge, 2002). In this study, science and social studies skills were assessed through academic measures directly related to the standards. A unique aspect of this study was the use of a large sample size with control groups and the use of statistical analyses that documented significant achievement gains for the video over the control groups.
- Performance-based rubrics assessing elementary, middle, and high school students yielded scores suggesting that online mentoring, or *cybermentoring,* in the use of literacy strategies had clear and impressive effects on student learning when preservice teachers were specifically prepared to be cybermentors and when the cybermentoring and literacy strategies were not add-ons but "were perceived by preservice teachers, classroom teachers, and students as integrated within it" (Boxie & Maring, 2001, p. 5).
- The development of professional rapport among preservice teachers was supported by an online course at three geographically remote university campuses. Students were required to work in small groups to read, analyze, and discuss research pertaining to equity, acceptable use, software evaluation, technology funding, and integrating technology. The online instructors provided examples of excellent work in which the student teachers "truly appeared to want to learn from each other beyond the confines of the project" (Slowinski, Anderson, & Reinhart, 2001, p. 5). The methods used in these courses promoted the patterns of professional collaboration reported by Becker & Riel (2001) to be characteristic of teachers who make exemplary use of technology in their classrooms.

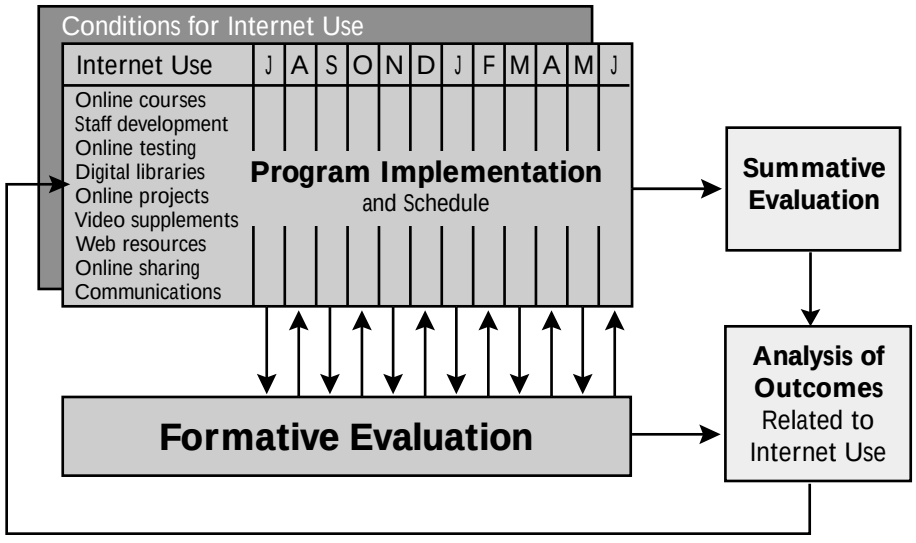

Figure 1. Formative and summative evaluation of Internet-based projects is essential.

Make Research-Based Guidelines Available

Researchers have developed guidelines and rubrics based on reviews of studies and evaluations of the use of the Internet to serve as an online resource for the delivery of instruction to both teachers and students. Such guidelines help ensure that the development of online learning resources is informed and benefits from lessons learned in prior efforts. One of several efforts was

that of Cradler and Cradler (2000) who developed and continue to use and update a rubric to evaluate Web-based courses. Use of this rubric to guide development of high school courses incorporating the Internet resulted in documented improvements in existing Web courses based on student reactions, performance, grades, and motivation to take online courses (Cradler & Cradler, 2002). The rubric is divided into eight review categories. Each category includes seven or eight specific review criteria, or indicators, and a rating scale to rate the extent to which each of the criteria are addressed in the online course or resource. (*Editor's note:* Find the rubric online at www.iste.org/L&L/.) The review criteria include:

- *Profile*—the appropriate student population for the which the course is designed
- *Pedagogical Model*—the instructional approach used for the course
- *Content Emphasis*—the use of content standards and accuracy and relevance of content
- *Engaged Learning*—making optimal use of the Internet to engage and sustain student interest
- *Technology Integration into Curriculum*—strategies for integrating the online resources into curriculum
- *Assessment Strategies*—incorporation of embedded assessments related to the resource objectives
- *Resources Needed for Students*—connectivity, related hardware, and any print or other resources needed
- *Course Structure*—details about the design of course units and provisions for individualization
- *Course Web Site Features*—inclusion of features known to optimize the use of the Internet site

Look at Whole Picture

The study of the effects of the Internet and technology on learning is a very complex undertaking. Often evaluators and researchers do not consider the wide range of variables that must be considered in the study of technology's impact. Technology must be studied as a tool or supplement to an existing instructional plan or strategy along with the conditions under which that plan or strategy is implemented. Educators and policy makers must be cautious about making decisions from any single study but must follow what CARET considers the "best evidence" approach whereby evidence of effectiveness is collected from a variety of different studies and reports and then analyzed in total. Here are some directions and suggestions for future research.

1. Revisit existing large-scale studies (e.g., Goolsbee & Guryan, 2002) and attempt to identify specific demographic, curriculum, instruction, teacher skill, and other variables and their possible contributions to the findings.
2. Monitor and review e-learning studies to inform the development of new e-learning endeavors and modifications of existing courses and resources.
3. Update, validate, and disseminate guidelines and rubrics for e-learning resource designs.
4. Conduct research to determine how to make optimal use of current technology and networking resources in ways that will add to and enhance existing curriculum and instruction.
5. Identify and review—both for curriculum standards alignment and learning effects—online or distance learning courses and resources for possible integration into No Child Left Behind programs and projects.

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Web-based Course-Development Indicators

By John Cradler and Ruthmary Cradler

Purpose: This survey is intended to provide an assessment rubric and instrument for use by ESS in collaboration with project staff, teachers, and administrators to determine: A) the level of development of online courses, and B) readiness for local, state and national expansion and dissemination. The indicators are based on a comprehensive review of research on web-based course design and delivery as well as existing lesson and course rubrics.. A complete web-course review includes assessment of website, examples of student work, supporting instructional activities, teacher interviews and other materials, as appropriate. These indicators can be used to guide the development of web-based courses and instructional units as well as to assess the content and quality of online instructional resources as they are used and revised. It is advised that the form be by one or more external reviewers as well as a self-assessment by the person(s) who developed and are implementing the online course or resource.

Instructor(s):	Course Title:
Reviewer:	Date of Review ___/___/___

Course Profile

A. Does the course profile provide the following course information?	Yes	No
1. Course title (and number if available)		
2. Name of instructor(s)		
3. The course units offered (if appropriate)		
4. The approximate student-time commitments needed for the course		
5. A course description that clearly indicates course expectations for students		
6. A statement of the prerequisite courses or background knowledge for this course		
7. A statement about the prerequisite skills needed to succeed in this course		
8. Other		

Course Review

Course Indicator Rating: For each Evaluation question, there are several indicators to help inform your judgement about the overall rating for the particular evaluation question. Use the scale to the right of each of the items and rate the indicators as follows:	0. Not applicable or relevant to this course 1. Feature has not been developed but is planned 2. Feature has been developed but still needs work or attention 3. Feature or element is developed and is being implemented 4. Feature is considered an exemplary model

B. Pedagogical Model:	0	1	2	3	4
1. Collaborative-group learning opportunities are evidenced online or face-to-face.					
2. Students have opportunities to explore new ideas.					
3. Students have increased opportunities to conduct independent research.					
4. Assessments help students re-direct learning opportunities.					
5. Students have opportunities to assess their own performance.					
6. Students have opportunities to construct their own projects.					
7. The course provides opportunities for real-life learning experiences.					

C. Content Emphasis	0	1	2	3	4
1. Course content is based on National and and/or State Education Standards.					
2. Standards are linked to course units, lessons, and assignments.					
3. Cross-curricular standards are cited for interdisciplinary courses.					
4. Content is accurate and up-to-date.					
5. Content is without cultural, gender, or racial bias and stereotyping.					
6. Depth and breadth of subject is appropriate for the course objectives.					
7. Content engages the learner.					

D. Engaged Learning	0	1	2	3	4
1. There is continuous dialogue between and among instructor(s) and learners.					
2. Tasks are generally challenging to students taking the course.					
3. The learning resources allow students to extend the content in a variety of ways.					
4. Students are encouraged to analyze problems and generate multiple solutions.					

E. Technology Integration into the Curriculum	0	1	2	3	4
1. The technology extends learning opportunities beyond the traditional classroom.					
2. Technology is utilized when assessing student performance.					
3. The course makes optimal use of technology to enhance instruction.					
4. Technology is a catalyst to engage students in meaningful learning opportunities.					
5. Students are encouraged to use technology as a problem-solving tool.					
6. Technology is used to promote student collaboration through telecommunications.					
7. Students learn how to use technology to present their work to others.					
8. A variety of technologies are used to augment the course units and lessons.					

F. Assessment Strategies	0	1	2	3	4
1. Pre-assessment or beginning of course tests are used to determine skills and knowledge.					
2. Multiple assessment measures and strategies are employed.					
3. Required assessments are identified for the students at the beginning of the course.					
4. Performance, or authentic, assessments are embedded into the learning experience.					
5. Students have the opportunity to evaluate the course and make recommendations.					

G. Resources Needed for Students	0	1	2	3	4
1. Hardware and software needed for the course are described.					
2. Print materials, including textbooks, and other materials such as video are available.					
3. Technical support is available when needed.					
4. Access to course (and resources) is reliable and available for students.					
5. On-site facilitators are available to support assignments, procure resources, etc.					
6. Instructor office hours are available electronically.					
7. Students are provided with the needed software, navigation tools, and plug-ins.					

H. Course Structure	0	1	2	3	4
1. Units begin with "teasers" or activities to engage and interest the student in proceeding.					
2. A "course road map" or index illustrates the scope and sequence of lessons & activities.					
3. Units include unit-objectives to guide the lessons and assignments.					
4. The approximate time needed to complete a unit is defined.					
5. Lessons & assignments provide clear instructions, models, guidance, & expectations.					
6. Assignments make optimal use of technology and the Internet as a resource.					
7. Lesson assessments help students know when they are ready for the next lesson.					

I. Course Website Features:	0	1	2	3	4
1. The links are active and show evidence of careful selection and/or evaluation.					
2. A description of the links is provided.					
3. A comprehensive index, site map and/or table of contents is available.					
4. Graphics, photos, or video/audio clips are used to contribute to understanding.					
5. The overall look and feel or visual design enhances readability and understanding					
6. The site is easy to navigate and locate information and links.					
7. Icons are simple, consistent, and easy to use.					
8. Text is well-written, concise, and free of grammatical and spelling errors.					
9. Reading level and writing style are appropriate for the intended students.					
10. Site content conserves bandwidth to facilitate more rapid access.					
11. Revisions are frequent enough to keep the site up-to-date, and noted.					
12. All graphics and resources are copyright-cleared.					

Comments and/or recommendations: