Effective Integration

Research-Based Decision Making for Technology Planning and Integration

By John Cradler and Ruthmary Cradler

Subject: Technology integration, planning, professional development, action research

Audience: Teachers, administrators, teacher educators, technology coordinators

Grade Level: K–12 (Ages 5–18)

Standards: *NETS•T* II, III, V; *NETS•A* I–IV (www.iste.org/standards)

This is the fifth in a series of articles addressing critical questions about educational uses of technology from the Center for Applied Research in Educational Technology (CARET). This article discusses how to directly engage teachers in effective strategies for planning and integrating technology into instruction. For additional research findings, visit CARET at http://caret.iste.org/.

The No Child Left Behind (NCLB) Act requires that technology be integrated into curriculum and instruction in ways that will result in the highest probability of improving student learning. This requirement brings up many questions. In this month's Research Windows column, we look at studies reviewed by CARET and our own information to answer the following questions:

1. What effective technology integration strategies are suggested by available research?
2. Are there existing and tested models to facilitate integration of technology and telecommunications into the classroom?
3. What are the important steps for designing classroom-level technology integration action plans?
4. Do research-based guidelines exist for effectively planning the use of technology as a learning resource?
5. How can teachers and administrators be supported to most effectively use technology?

What Effective Technology Integration Strategies Are Suggested by Available Research? Research supports the common assumption that when teachers are engaged in planning and evaluating classroom instruction, they will learn more and sustain the use of new instructional and curricular approaches. Teacher creativity and imagination are evidenced most often when teachers develop and implement classroom projects that incorporate electronic learning resources that were part of their professional development. This model is often called *action research:* "Action research is continual professional development—a direct route to improving teaching and learning" (Calhoun, 2002, p. 18). Additionally, research on the Middle School Mathematics through Applications Program (MMAP), reported by the U.S. Department of Education (ED) (2001), reveals that teachers need opportunities to experiment and conduct action research using technology within the context of specific content to be taught. ED concluded that trying out the technology (or most other practices or resources) is what enables the learning to occur.

School leaders should commit to enabling teachers to design classroom-based action research plans that incorporate the use of technology as described in the first section of this article.

Kelley and Ringstaff (2002) report in their review of research:

> Researchers investigating the impact of a program found that when teachers are learning to integrate technology into their classrooms, the most important staff-development features include opportunities to explore, reflect, collaborate with peers, work on authentic learning tasks, and engage in hands-on, active learning. In essence, the principles for creating successful learning environments for children apply to teachers as well (Sandholtz, Ringstaff, & Dwyer, 1997; Sandholtz, 2001). (p. 15)

A study by Becker and Riel (2000), showed that teachers who engaged in collaborative planning and sharing of instructional strategies with other teachers most frequently demonstrated effective use of computers in classrooms. Zhao, Pugh, Sheldon, and Byers (2002) conclude that the most successful and innovative technology-based projects used electronic learning resources with content and instructional approaches compatible with the local school curriculum and pedagogy.

In their research on the Apple Classrooms of Tomorrow (ACOT), Sandholtz et al. (1997) concluded that rather than receive one-shot training with computer integration, teachers need to understand how to most effectively use potential applications of technology in a variety of settings. ACOT also found that teachers who were involved in planning for technology better integrated and sustained the use of technology in instruction. In 1987, the Monterey Model Technology Schools (MMTS) successfully applied the action research approach to professional development in classroom-level planning and technology use (Cradler & Montgomery, 1993). The focus of MMTS was to develop and test a model process to engage teachers in planning and implementing technology that will help address district and state content standards. MMTS also enabled teachers to collect and use student performance assessment data to inform modifications of instruction. To implement this approach, Cradler and Montgomery (1989) developed a process with accompanying forms and templates. They subsequently revised it based on extensive formative evaluation.

Are There Existing and Tested Models to Facilitate Integration of Technology and Telecommunications into the Classroom? A variety of projects, including the Cupertino Model Technology Schools Project (Stearns, 1988), the California Telemation Project, the Department of Defense (DoD) Schools' Presidential Technology Initiative (PTI) (Klein, Glaubke, & O'Neil, 2000), and

the Technology Innovation Challenge Grant (TICG) Just in Time, have adapted this project-based or action research approach to professional development. An evaluation of the DoD PTI conducted by the University of California, Los Angeles National Center for Research on Evaluation, Standards, and Student Testing (CRESST) (Klein et al.) found that when teachers faithfully developed and implemented personalized plans for the integration of technology into the curriculum, known as Curriculum and Technology Integration Plans (CTIP), there were greater increases in student learning and sustained infusion of technology into instruction (Cradler, 2002a). This is consistent with evaluation findings for the MMTS (Cradler & Montgomery, 1989) and Just in Time (Cradler, 2002b) projects. Evaluations of all of the projects mentioned show that this action research approach resulted in participants applying new knowledge and skills in the use and integration of technology into instruction with greater consistency and effectiveness. Our analysis shows that the planning process helped ensure that most of the prerequisite conditions for the effective use of technology were addressed. (*Editor's note:* Find project Web sites and other URLs under Resources on p. 56.)

Recent evaluations of projects that involve teacher development of Web-delivered units and curriculum projects have used surveys and interviews to document significant teacher interest and engagement in applying the Internet as an instructional tool. In most cases, teachers develop projects according to a template or set of guidelines and share them online with colleagues. Researchers find that when a moderator is involved, the Internet can help teachers form online communities to develop, test, and share instructional strategies (Cradler & Cooley, 1996; Wetzel, Zambo, Buss, & Padgett, 2001). An early example of this in California was the Telemation Project, in which teachers developed and shared text-based curriculum projects on the Internet. Since that time, other project-oriented staff development opportunities have evolved in both the public and private sectors, such as Connected University, Apple Learning Interchange, and MarcoPolo.

Evaluations from some projects such as Hawaii E-School and Just in Time, funded under the Technology Innovation Challenge Grants (TICG) program, also support other findings on the effectiveness of a project-based approach to staff development. Though most of the PT^3 evaluations of Light Bridge and TeachTech are still in the formative stage, early findings from these grant-funded projects are suggesting similar findings for faculty development. Evaluations of these projects have found that when teachers are given this type of professional development they in turn apply project-based teaching principles to their own teaching.

In most of these projects, teacher development of online lessons is reported to serve as a form of professional development. Additional research is needed to statistically document the cost benefits and instructional changes resulting from these types of programs.

What Are the Important Steps for Designing Classroom-Level Technology Integration Action Plans? Several conditions must be met before attempting to develop and implement a classroom technology integration plan (Cradler, 1998; Zhao et al., 2002):

A. Teachers must have access to information resources related to the use of technology. These resources would include publications, conferences, and regional professional development opportunities.
B. Teachers need an awareness of the wide variety of technology applications they may consider for classroom use and professional development and training on how to use the technology.
C. Teachers should become familiar with standards and guidelines for the instructional use of technology, such as ISTE's National Educational Technology Standards for Teachers (NETS) and the related publication of sample lessons and units, self-assessments, and other resources (ISTE, 2002).

Identifying colleagues or partners to work with on the plan, scheduling time for professional development on planning, and ensuring that the administration will actively support the design and implementation of the classroom integration plan are all important tasks.

Technology Action Planning Steps. Based on a review of the various programs discussed above and on our experience, the steps illustrated in Figure 1 (p. 49) for the design and implementation of a classroom technology integration plan are necessary. Sometimes this model is referred to as a *causal map* or *logical model* for planning.

Do Research-Based Guidelines Exist for Effectivly Planning the Use of Technology as a Learning Resource? The Design for Learning framework for professional development (Kent & Lingman, n.d.) offers a research-based set of guidelines for local instructional planning with a professional development emphasis. The framework provides the following design elements, which we have adapted to reference technology use:

A. Use student performance and achievement data when planning instruction and related applications of technology.

Teachers need opportunities to collaborate online and/or face-to-face on the development and implementation of classroom instructional projects.

B. Establish a coherent long-term plan for professional development that incorporates instructional applications of technology and is connected to existing school and classroom plans.
C. Provide sufficient time for professional development related to the infusion of instruction.
D. Ensure that school leadership encourages and supports professional development opportunities as well as classroom application of the practices and instructional and related technology resources introduced.
E. Plan to expand teacher capacity to integrate new instructional strategies, related technology applications, and resources into curriculum content.
F. Encourage teachers to inquire and reflect on the effectiveness of new resources, relevant technology applications, and knowledge introduced by the professional development.
G. Provide opportunities for collaboration and collegial work as well as for individualized learning.
H. Apply the established principles of effective teaching to professional development of teachers.
I. Establish broad-based organizational and community support for the professional development program and related classroom implementation of the new practices and resources.
J. Incorporate accountability and evaluation strategies for the practices and use of instructional resources and relevant technology applications and steps for using the results of evaluation to inform classroom and school-level planning.

Each of these guidelines should be carefully considered when planning, developing, implementing, and evaluating the level of use and effects of any new or emerging instructional practice or resource to be introduced through preservice or inservice professional development.

How Can Teachers and Administrators Be Supported to Most Effectively Use Technology? CARET staff reviewed more than 30 studies (cf. Abbott & Faris, 2000; Becker & Riel, 2000; CEO Forum, 1999; Cuban, Kirkpatrick, & Peck, 2001; Zhao et al., 2002) and, based on the findings, came to these major conclusions:

A. Teachers must have access to the Internet and know how to use the network to locate information needed to support their own classroom-level action research.
B. Teachers need opportunities to collaborate online and/or face-to-face on the development and implementation of classroom instructional projects.
C. School administrators should develop their own awareness and capacity to make informed planning decisions about technology.
D. School leaders should commit to enabling teachers to design classroom-based action research plans that incorporate the use of technology as described in the first section of this article.
E. School, district, and community leaders must be aware of the level of effort needed to support the planning and integration of technology into instruction.
F. Leadership action might include committing to a revision of the local school plan or other school instructional plans to infuse technology as a resource in support of the instructional plan.
G. Teachers and administrators should consider data-driven decision making, whereby student performance data informs changes in the school plan.
H. Teachers need sufficient time and support to analyze the data resulting from their plan, as well as time to plan, implement, and share the formative and summative results of their action research plans with colleagues, for example, during staff meetings and at professional conferences.

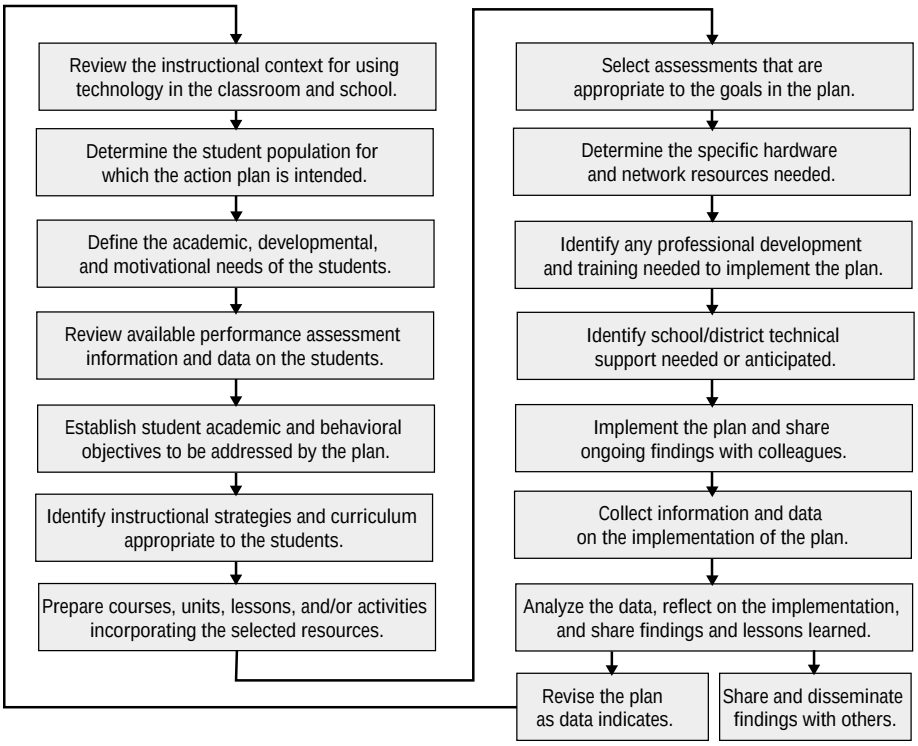

Figure 1. Causal map for technology integration planning.

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Research continued from page 49.

I. School administrators should publicize the results of teacher-developed classroom action plans to the district-level administration, the school board, and the community as appropriate.

Resources

Apple Learning Interchange: http://ali.apple.com/ali_sites/ali/nav5.shtml

Association for Supervision and Curriculum Development: www.ascd.org/

California Learning Resource Network: http://clrn.org

California Telemation Project: http://etc.sccoe.k12.ca.us/caltip/Pages/telemat/telemat.htm

Center for Applied Research in Educational Technology: http://caret.iste.org

Connected University: http://cu.classroom.com/logon.asp

Distance Learning Resource Network: www.DLRN.org/

ISTE National Educational Technology Standards: http://cnets.iste.org/

Lab National Network: www.nwrel.org/national/

LightBridge: www.sonaoma.edu/lightbridge/main/

LightBridge reports: available by e-mail from cradler@earthlink.net

MarcoPolo: www.marcopolo-education.org

National Staff Development and Training Association: www.buffalostate.edu/orgs/nsdta/

No Child Left Behind: www.NoChildLeftBehind.gov

Regional Technology Centers: www.rtec.org/index.shtml

State of the State Standards 2000: www.edexcellence.net/library/soss2000/2000soss.html

TeachTech reports: available by e-mail from cradler@earthlink.net

Technology Innovation Challenge Grants: www.ed.gov/Technology/challenge/grants1.html—search here for information and reports from all Challenge Grants, including Hawaii E-School and Just in Time.

Telemation Project: www.wested.org/techpolicy/telemation.html

U.S. Department of Education: www.ed.gov/index.jsp

U.S. Department of Education, Labs, Centers, Clearinghouses: www.ed.gov/offices/OESE/labs.html

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