

Teaching with Technology

Finding a Workable Strategy

by Donn Ritchie and Amy Baylor

As do many states, California requires teacher candidates to demonstrate their knowledge and skills in educational technologies before obtaining a long-term teaching credential. The technology competencies required for the credential include teacher and student productivity, instructional media, technology integration, and knowledge of copyright, ethical practices, and social and educational ramifications of technology use.

Although candidates have the option to demonstrate their abilities through either a comprehensive test or extensive documentation, most choose to complete a university course in educational technology. At San Diego State University, approximately 350 students complete this course each year.

As in many technology programs, the strategies we use to help preservice educators grasp technology-related competencies have changed over the years. These changes reflect not only improvements in hardware and software, but also in our understanding of how people learn. Although we long ago abandoned lectures as the predominant teaching strategy, we continually strive to find the correct mix of teaching strategies. This article describes some of our failures and successes, along with their pedagogical underpinnings, in hopes that our in-

sights may benefit other teacher trainers in similar situations.

Jumping into Constructivism

Over the years, we have incorporated a variety of pedagogies in our "Technologies for Teachers" course, some purposively and others accidentally. A nationwide trend that shaped some of what we have done during the past decade has centered on new ideas on how people learn, specifically the concept of constructivism. Although there are various definitions of constructivism, Duffy and Cunningham (1997) identified two common characteristics of constructivist environments:

1. Students learn by actively constructing, rather than acquiring, knowledge; and,
2. The purpose of instruction is to support this construction, rather than the communication of information.

Our most focused attempt at incorporating constructivist principles occurred last year when we implemented what might be considered a radical constructivist approach with one class of student teachers. In the first week of a 16-week semester, all students were taught to use e-mail. This completed our direct instruction for the course. We then asked each student to complete a comprehensive self-evaluation regarding his or her knowledge and use of educational technologies. Students were asked to mark their questionnaires twice. The first time they rated themselves on current ability. The second time they rated the skill level they wished to reach by the end of the semester.

Each student e-mailed a message to the instructor the second week, detailing the educational technology topics and level of competence he or she wished to master. The instructor and students used e-mail to collaboratively negotiate specific topics, assignments, and levels of knowledge needed to attain specific grades. A subsequent, whole-group discussion helped students think about how they could work through problems they might encoun-

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ter. The instructor loaded all computers with help programs, placed additional manuals around the room, established a newsgroup for student help, and encouraged students to assist one another. For the next 14 weeks, students worked on assignments negotiated with the instructor. Topics and levels of competence were renegotiated as individual strengths and weaknesses became more pronounced.

In this learning environment, educational components based on the constructivist theory of learning included self evaluation, negotiation of assignments, self-directed learning, peer assistance, and teacher facilitation. We expected this environment to facilitate self-directed learning, which in turn would help learners gain skills and knowledge applicable to their interests and needs. The program results, however, as measured by student evaluations and teacher assessment of knowledge and skills gained, did not meet our expectations.

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The major problems we identified included students' feelings of discontent in their roles as self-directed learners, a general lack of knowledge about educational technologies, students' feelings that some people had to do more to reach a specific grade, and the lack of the instructor's direct classroom teaching. Overall, the course structure was unfamiliar to the students, most of whom were extremely focused on their final grade in their last semester before entering the job market. Even with instructor assistance through e-mail and individual guidance, the level of dissatisfaction was higher than in previous semesters. Although this experiment lasted only one semester, the basic course structure may offer a worthwhile alternative for future classes. However, course refinements and better preparation of students to assume a greater responsibility for their learning will be required.

Anchoring the Class

Although we believe that learning environments based on constructivist theories hold great promise for teacher training, we found that our course needed more structure than initially provided. When we implemented a less radical approach, which combined learning strategies based on behaviorist, cognitivist, and constructivist learning theories within a situated learning environment relevant to the student teacher's future needs, it proved to be more successful. Some of the highlights from this course are described below.

In Week 1, each student receives a personal letter from a school superintendent (we mail merge the letter with the university's listing of enrolled students in the course). The letter encourages each student to apply for a position in the superintendent's school district. The superintendent states that because these student teachers are just learning how to use technologies, the application process will be staggered over the next 15 weeks. Additionally, the superintendent details how the recipients of the positions will receive \$15,000 toward new classroom technologies as long as they support a worthwhile "semester event" at their school. To fulfill the requests of the superintendent over the course of the semester, students master many of the educational technology competencies required to obtain their teaching credential.

In the superintendent's letter, students are asked to submit an e-mail message during Week 2 to indicate the student's interest in a position. Our university allows faculty to establish alias e-mail account names, so it is easy to establish an account for the fictitious superintendent. Students are told by the instructor to send all assignments and communication to this account. Questions pertaining to the course itself are sent to the instructor's account. Throughout the semester, the superintendent is referred to as a real person, although students realize that this person only exists in electronic form.

By Week 4, each student identifies a school event that they will organize and implement at their school. Students are asked to create a flyer announcing the event, then attach the flyer to an e-mail message and send it to the superintendent. Because of the ease in producing this initial document, students are immediately reinforced and feel a sense of accomplishment — especially important for the many novice computer users enrolled in the course. This step also requires students to formulate a semester theme for future assignments and to become competent in attaching and sending files through e-mail.

In Week 6, each student prepares and submits

a résumé detailing work and educational experiences. Although this course is often taken during the final semester before students enter the job market, many students have yet to create a professional looking résumé. This assignment not only helps students formulate this document, it also provides them with an incentive to use intermediate features of a word processing program.

The activity we include in Week 8 is used to help students become familiar with the use of spreadsheets. The initial letter from the superintendent stated that if selected for the teaching position, the recipient would receive a \$15,000 technology grant. In Week 8, students are to submit a detailed budget detailing how this money will be spent. To help students complete this activity, we obtain computer discount catalogs from a local mail order supply house. Additionally, we discuss hardware technologies and classroom computer configurations to provide students with the background knowledge needed for this activity. Students not only are required to become more aware of the cost of hardware, peripherals, and software, but also are provided with a practical reason for creating a spreadsheet.

In Week 10, students submit a newsletter with mail-merged names and addresses to send to parents detailing their event. The purpose of this assignment is to help students with the skills and knowledge of a database and mail merge, as well as desktop publishing.

During Week 11, students engage in an activity called a WebQuest (Dodge, 1997) which leads them through an Internet exploration of social, ethical, and technical issues related to the implementation of technology in education. At the end of the class, each student is required to compose and send a one-page reflection paper to the superintendent about his or her feelings regarding one of these issues.

Two final assignments are completed between Week 12 and Week 16. These technology integration projects require students to infuse a technology into their instruction to supplement their school's event. Rather than requiring specific infusion methods, students are exposed to a variety of topics and applications each week, then choose the topics most applicable to their needs and interests. Technology integration options include the creation of an instructional video, multimedia lesson, WebQuest, instructional database or spreadsheet project, collaborative telecommunications project, or other topic negotiated with the instructor. Due to the involved nature of these projects, students are allowed to work individually or with a team to complete these two final assignments.

Additional theoretical competencies required by the state are discussed throughout the semester by requiring students to conduct two classroom presentations on assigned articles from the anthology *Computers in Education* (Hirschbuhl & Bishop, 1996). This assignment not only provides direct experience using a desktop presentation tool, but also provides a forum for discussions on topics ranging from copyright legalities to virtual reality.

Throughout the semester, all communication and attachments are sent to the superintendent's e-mail address. Feedback on assignments is received through the same medium. Grading is based on how well assignments match project rubrics which provide undesirable, adequate, and exemplary descriptions of each assignment.

During Week 15 and 16, students present their technology integration projects to the class. This not only provides a wealth of ideas on how to infuse technology into instruction, but also allows students the chance to showcase their outstanding achievements. The structure of our course now ensures that students are exposed to, and reach a level of competence on, the skills and knowledge as requested by our state department of education. In addition, the course's format provides an engaging structure which maintains students' motivation as they work on relevant activities for classroom teachers.

Rationale for Choices

Why didn't our teaching strategies based on a strictly constructivist theory of learning work for our students? Why do we feel a blending of instructional strategies works better? How do multiple strategies combine in our daily classes? This section will try to answer these questions as we describe a typical class session.

Rather than having each student navigate his or her way through the course as we attempted in the initially described course, we now structure our classes to incorporate strategies based on a variety of learning theories. A typical class begins with an overview of the day's topics, followed by an indication of what students will be able to accomplish by the end of the class, a description and correlation to what they already know pertaining to the topic, exposure to a technology component needed to fulfill their next assignment, and student work time in which the instructor facilitates the learning.

When new software applications are presented, we use a three-step approach to reinforce comprehension. First, the instructor provides a five- to ten-minute demonstration. During this time students watch without taking notes or following along on their computer. The demonstration serves as an

advance organizer and helps students develop a mental model of the activity without having to memorize each step or fall behind if they try to duplicate the instructor's moves.

Job aids, which detail the steps used by the instructor, are then given to the students. Although each student has a computer available, every second monitor is turned off and student dyads work together to duplicate the steps. This procedure builds community and provides opportunities for peer tutoring.

Next, each team takes the skills provided in the lesson and applies them to better reflect the team's interests. For example, if the demonstration provided a quick preview of how to create a database of students in a class, students might decide to make a database of their favorite TV shows, music groups, or eating establishments.

During student work time, the instructor roams the room providing feedback, encouragement, remediation, and enrichment. Because students are teamed, individual questions are often answered before the teacher is needed to assist.

These steps are tied closely to a mix of teaching strategies influenced by behavioral, cognitivist, and constructivist theories. Behaviorism provides the pedagogical basis for the direct instruction, assistance with a step-by-step job aid, and immediate feedback. From a cognitive perspective, we assist students in understanding the instructor's mental model by requiring students to watch the instructor demonstrate and articulate the logic behind each procedure before students try to duplicate the steps independently. Additionally, we implement cognitivist principles by helping students recall prior experiences before new material is presented and by providing an evaluation rubric which identifies critical components and levels of attainment for their assignments.

We incorporate constructivist principles as we facilitate students' construction of personalized knowledge throughout the class. These principles are employed not only by formulating answers to real-life problems, but also through social interaction and negotiation with peers during initial software explorations. Additionally, the teacher coaches and questions students as they refine their skills and knowledge.

Summary

There will always be proponents who feel that learning strategies influenced by behaviorism, by cognitivism, or by constructivism, will be best to facilitate learning. Our experiences lead us to a different conclusion: that beliefs about learning are best translated into practice using a combined array of different teaching strategies, with an eye toward what works for a given situation. Because educational technologies are new to most students, we have found that even with instructor facilitation, the freedom of a strictly constructivist classroom lends to too little being achieved, especially with the demands of state certification.

Also undesirable would be a classroom influenced solely by behaviorist strategies. Classroom teachers are faced with a myriad of complex variables as they gain skills and knowledge in educational technologies. Trying to anticipate the variety of stimuli and reinforcements is not feasible in such a complex situation.

Finally, pedagogies based on a strictly cognitivist learning theory may not facilitate the personal knowledge gained in a constructivist system, or the ability for rapid association and discrimination to learn simple facts, concepts, or procedures that can be efficiently acquired through a behaviorist approach.

Through our experiences, we have found that by combining the strengths of different learning theories, we have created a workable mix of effective teaching and learning strategies. We have been able to tailor a course that provides the breadth, depth, and sustained interest to help both novice and intermediate learners integrate educational technologies in the classroom. ■

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