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AUTHOR	Pisapia, John
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ABSTRACT

Productivity tools allow students to do something that was not possible without technology and then to share their results with others. In contrast to traditional software that encourages linear procedural processes, tool software is open-ended. Productivity tools include word processing, spread sheets, graphics, and telecommunications software. When designing cooperative computer-based strategies, teachers must deal with issues such as the size of the group, equity of access to the computer, time pressures, and software that is designed for individual use. There is a definite "best practice" approach to using technology in a problem-solving application. The most successful teachers draw their students into the problem area without undue emphasis on computer aspects of the units. Best practice in these situations includes: (1) introductions to computers; (2) modeling of problem-solving steps and practices; (3) discussion; (4) written products; and (5) public sharing of results at the end of each unit. Some of the most valuable learning occurs when students and teachers manage computer projects together. (SLD)

Teaching With Technology: Productivity Tools.
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TEACHING WITH TECHNOLOGY: PRODUCTIVITY TOOLS

The introduction of computers does not automatically help incorporate them into classrooms.

Why should I use technology productivity tools?

Productivity tools allow students to do something that was not possible without technology and share it with others. Some have found that the most valuable learning takes place when the teacher and the students manage computer projects together.

In contrast to traditional software that encourages linear procedural processes, tool software is open-ended, promoting an education that includes the expressive forms of learning and provides greater opportunities for problem-solving.

What productivity tools are available to teachers?

Word processing, data bases, spreadsheets, graphics and telecommunications are productivity tools that, along with simulation and interactive video applications, empower teachers and students in the problem-solving activities.

What factors should be considered when using a problem-solving approach to teaching?

Three themes running through the literature transcend many different categories of the problem-solving model. These are small group work, prior student knowledge and time. They are considered as "overlay factors" impinging on the whole process of using computers as tools.

The **small group factor** is very positive. Using small, **noncompetitive groups** of students works well if there are interesting problems and strong guidance by teachers. Under these circumstances, students cooperate within and across groups, with teachers and with each other. Students learn important skills, and challenge one another to think. This instructional practice is an excellent teaching strategy to use with problem-solving and data base applications.

Students' inability to work in a **knowledge vacuum** has been underscored by several studies. Simply, many students lack sufficient knowledge about subjects they investigate. This factor detracts from unit objectives, student success as problem solvers, and plagues all teachers to some extent. Lack of student knowledge must be anticipated by incorporating specific ways of overcoming the problem in teaching.

Time pressure to finish the activity, lesson, or unit in order to get on to the next one is another factor felt by teachers and students alike. The use of computers increases this pressure. Teachers feel time pressure because to do a good job means extra preparation, instruction, and practice with such mechanics as database commands and printing sequences. Students complain that they need more time to collect more evidence or to write reports. Some teachers complain they need more time to do more debriefing or computer lab work. In short, a unit on problem-solving with computer databases tends to increase the press of time in the classroom.

What other factors should teachers be aware of?

When designing cooperative computer-based strategies, teachers must deal with issues such as the size of the groups, equity concerns, and software that is designed for individual use.

Off-task Behavior. Many educators are reluctant to implement cooperative learning systems because of potential increases in off-task behavior, despite proven benefits. Teachers often believe they lack the control necessary to focus learner attention on lesson content during cooperative learning exercises.

Off-task behavior is a definite waster of time, sometimes by students and sometimes by teachers. Students sometimes are off-task for extended periods of time and sometimes their teachers knowingly permit it to continue. Teachers sometimes backtrack unnecessarily because of ineffective planning, organization, or teaching in the classrooms.

Group size also has an effect on off-task behavior. For example, small groups in the computer laboratory setting were more attentive to the lessons and had fewer disruptions than large groups. A group size of two to four can be used as a general guideline.

Grouping/Pairing. There is considerable evidence that cooperative grouping and pairing makes a significant difference in technology-based learning. For example, Whyte et al. (1990-91) and Levin et al. (1987) found that pairing students for computer-assisted instruction is efficient and cost-effective. They concluded that the manner in which individuals were paired by individual cognitive style made a significant difference.

Other studies show that the use of paired/cooperative teaching methods results in both more effective and more efficient computer-assisted instruction. For instance, Dalton et al. (1987) found that learners working in pairs significantly outperformed learners working individually during a CAI lesson. Analytical and independent students did not seem to need an externally provided structure and functioned with very little environmental support. On the other hand, students who show a lack of initiative and readily submit to authority benefit significantly when paired with independent students. Additionally, independent students seem to do equally well regardless of their partner. Groups made up of either two independent learners or a mixed group of one dependent and one independent consistently outperformed groups made up of two dependent learners.

In addition, Johnson et al. (1985) reported that learners working cooperatively on a CAI lesson produced a greater quality and quantity of daily work and demonstrated greater problem-solving skills than learners working individually or competitively. Additionally, they found that cooperative group work with computers enhanced factual recall, application of factual knowledge, and problem-solving skills when compared to competitive group or individual group work on the same material.

Finally, Mevarch et al. (1991) reported that students who used CAI for drill and practice in pairs tended to perform better than those who used the same program individually.

Structure environment. Group work on computers does not insure cooperative learning has occurred. Rysay, (1990) says that providing structure helps. He further recommends that students summarize and explain what they are learning to their partner at various intervals. Rotating roles is suggested to insure equity. Groups should also agree on what is entered into the computer. Students should ask other group members for help when needed.

Is there a "best practice approach" to using a problem-solving approach to teaching?

There is a definite "best practice approach" to using technology in a problem-solving application. The most successful teachers draw their students into the problem area without undue emphasis on the computer aspects of the units. They also set forth clear expectations for student work and outcomes, including intermediate "milestones" in the process. Best practice includes introductions, modeling, discussion, written products, and public sharing.

Introductions. Introductions are critical. They are the point at which the teacher familiarizes students with the "big picture" of the unit. Introductions were a good time for the teacher to use a simple example of a "problem" and work on it through parts of the problem-solving process, so that the "big picture" was reinforced. It is clear that the strength of the units' introductions—the clarity of goals, whether the overall topic was introduced in an interesting way, the clarity of expectations for students—are very important in shaping the eventual problem-solving success of the students. These factors seem much more important than the nature and operation of the technology application.

Modeling. The teachers' use of examples, modeling of various problem-solving steps and processes, and providing for student practice, were very important to the success of units. Without them, students tend to drift and wander rather than carry on with purposeful activity.

Discussion. Discussion seems to be an important component to achievement. While using interactive video and computers can be motivating, it should not be used alone, but rather in conjunction with teacher-led discussions. Future studies should look at the effectiveness of interactive video with discussion time versus text with discussion time.

Written Products. In addition to the practice of regular debriefings, ask students for interim written products of their work, check these products, and give clear feedback and suggestions to students to assist them in the process. The students of teachers that use these tactics are much more successful than those whose teachers did not.

Public Sharing. It is important to include some public sharing by students at the end of each unit. It gives students and teachers a solid target to shoot for. It also emphasizes one key value of inquiry, the idea that results should be scrutinized by others.

John Pisapia
Phone: 804 828-1332
FAX: 804 828-0479
Internet: JPISAPIA@CABELL.VCU.EDU

Answers to questions found in this research brief have been synthesized from the MERC publications listed below. To obtain a copy, please contact the MERC office.

Pisapia, J. (1993, April). Learning technologies in the classroom: Case studies of technology intensive schools. 64 pp. ($8.50)

Pisapia, J., Schlesinger, J., & Parks, A. (1993, February). Learning technologies in the classroom: Review of the literature. 213 pp. ($10.00)

Pisapia, J. & Perlman, S. (1992, December). Learning technologies in the classroom: A study of results. 134 pp. ($8.50)