A Socratic Approach to Using Computers with At-Risk Students

Did your district purchase computers to help at-risk students learn better? Did the computers help? If you answered yes to the first question and no to the second, it’s time to take an approach that blends ancient and modern wisdom.

Suppose you’re in New York, and you want to go to Beijing. You could try to get there by boring straight through the earth, but you’d almost certainly get to China a lot quicker by using a roundabout approach. Similarly, if you want to enhance the learning of at-risk children, you could try to do it directly by using ordinary computer-assisted instruction (CAI), but you’d probably have better luck with a Socratic approach.

Right Solution, Wrong Problem
Alarmingly, conventional computer-assisted instruction (CAI) with at-risk students beyond the 3rd grade is producing little overall effect; CAI may, in fact, widen the gap between good and poor achievers. Indeed, over the past decade, educators have spent millions of dollars on technology, yet the at-risk problem has substantially worsened.

In conventional CAI, the explicit goal of the software is to teach toward a curricular goal, to provide instruction and practice toward the achievement of an immediate learning objective. Software to teach the calculation of averages, for example, would be expected to increase students’ knowledge about averages and to provide practice in calculating averages.

Moreover, new computer tools such as word processing and simulations, while frequently distinguished from CAI, are applied in much the same way. Word processing is expected to improve writing ability, for instance, and a simulation of chemical titration is designed to enhance knowledge of specific chemical reactions. Thus, both packages explicitly intend to produce topical learning, and both end up being used essentially as drill and practice CAI.

Since the inception of computers, educators have placed great faith in the use of explicit-goal software. After all, linking learning objectives with practice satisfies common sense. And the belief that software by itself can instruct—and thus produce substantial amounts of learning—has so dominated the use of computers that there are few reports of alternative curricular approaches.

This faith, if borne out, would certainly be a beacon. Then our only concern would be the coordination of software materials with learning objectives. There would be no need to rework the curriculum, change instructional strategies, or develop more sophisticated approaches—computer drill would solve the problems.

But we can no longer maintain that naive belief. Beyond the primary grades, CAI (whether in the form of expensive...
In learning dramas, the software is selected for motivation, not for its explicit goals.
averages. As students read the clues and talk about strategies, they are also discovering and practicing reading comprehension and metacognition skills. In short, students are learning content and thinking skills simultaneously. This helps explain a surprising finding: covering a fairly limited number of objectives in this manner enhances the learning of all content objectives in the regular classroom (Pogrow 1988b).

**Dramatic Techniques**

Why should dramatic techniques be used with technology? Because drama intrigues. It heightens curiosity and motivation, involves people in problems and tasks, and promotes the emotional engagement that deepens learning.

In learning dramas, teachers often wear costumes, tell jokes, and so forth, but the curriculum is much more than funny hats. Just as a good stage drama engages an audience with the characters and their problems by employing techniques like identification and suspense, teachers construct classroom scenarios to engage students emotionally in their learning tasks.

Each piece of software used in learning dramas can be used to choreograph a situation that generates passion. For example, HOTS twists the way “Word Master” (a popular vocabulary drill and practice program) is used in order to teach a lesson on the importance of rules and the clues that determine what the rules are. In the process, students feel excitement, frustration, anger, and pride.

At the beginning of this learning drama, the teacher points out the word *antonym* at the bottom of the screen. Players have to turn a pointer to match antonyms on the screen. If they don’t match words quickly, they lose. On the first day, the students get good scores. The next day, the students come in confident that they are going to get very high scores. The teacher does not mention that the computers have been switched to require *synonym* matches.

The students go to their computers. As their certainty about their ability to master the environment quickly evaporates, excitement turns to frustration. They start to complain that the computers are broken, that their poor scores are all the computer’s fault.

The teacher calmly explains that the computers are working perfectly and that if they would just think carefully, the information they need is available. When students finally become convinced that their former strategies are not going to work, they start to look closely at the screen. Eventually, someone will notice that the word on the bottom is now *synonym*. Students then adjust their strategies and get good scores.

The next day, the teacher engages the students in a conversation about the importance of words in understanding what the rules are. She goes on to discuss how you cannot develop strategies until you have first read the available information carefully or, in the case of the classroom, listened to the information she provides.

After that, the students do not forget about the importance of rules, and they are attentive during subsequent discussions about rules. Their behavior change bears out Vygotsky’s (1978) finding that interaction about ideas in socially meaningful situations is critical to the internalization of those ideas. In other words, when students experience and discover important thinking concepts on their own in socially meaningful situations, they learn more than they would from the most stirring adult lecture on the same concepts.

**Socratic Conversations**

The sophistication of the learning produced by technology depends on the sophistication of the conversation surrounding its use, not the sophistication of the technology. That was true of television, it is true of calculators and lab experiments (McPartland and Wu 1988), it is true of computers, and it will be true of the next generation of shiny boxes, no matter how many impressive dials, switches, and flashing lights they have.

Therefore, conversation is the heart of learning—conversation between teachers and students and among students. The dialogues must be more than just talk for the sake of talking, though. To produce substantial amounts of learning, teachers must react to students’ questions and answers in ways that maintain the ambiguity, probes, and clues that guide students to construct meaning on their own. If, instead, teachers respond didactically, the learning drama will quickly deteriorate into rote learning, and its power to help students understand how to understand will be lost.

Learning to engage students in Socratic dialogue is not easy. Teachers have to learn how to (1) understand students’ answers, rather than classify them as right or wrong; (2) probe responses so that students construct understanding on their own; and (3) guide students to a discovery of information, rather than act as a dispenser of information. Even good teachers need a week of practice to start becoming Socratic. Then, they report, it takes a year of self-monitoring before the techniques become automatic.

In the HOTS Project we identified the key types of student-teacher interactions that occur in the development of understanding (Pogrow 1990). Then we developed a system of Socratic techniques that teachers can use to deal with each key situation. Teachers learn to use these techniques by teaching each other lessons from the HOTS curriculum in workshop sessions.

During the training, each teacher encounters each of the key dialogue scenarios described in the HOTS curriculum. Each scenario is presented by the teacher who is training the others in the workshop, and the training teacher is then given the opportunity to respond to students’ questions in a Socratic way.

Drama heightens curiosity and motivation and promotes the emotional engagement that deepens learning.
Learning dramas are more effective for at-risk students than either the literal use of software or nontechnology-based interventions.

In this fashion teachers can build their thinking skills curriculum around many pieces of software, concentrating on four important skills from information-processing theory: (1) metacognition, or the conscious application of strategies while solving problems; (2) inference from context, or the use of known clues to figure out unknown information; (3) decontextualization, or the extraction of a generalization from one setting and the application of it in another setting; (4) information synthesis, or the identification, combination, and use of relevant information from two or more sources. Here are a few more examples of effective techniques.

**Metacognition**
To improve metacognitive skills, teachers can continuously ask students what strategy they used for solving a problem. How did they know the strategy is a good one? How could students tell if a strategy did not work? What might be a better strategy? If they tried it, what would happen?

**Decontextualization**
To develop decontextualization, teachers can use two simple techniques. In the first, students must use clues to negotiate their way through a computerized twist-a-plot story. Every time students make a choice as to what twist the story should take, they are asked to predict what will happen. They must base their prediction on clues in the combined text and graphics of the program.

The second technique is the purposeful inclusion of key words that students will not understand. (It does not matter what the words are or whether they are part of the curriculum.) Students are told that every time they come to a word they do not understand, they should (1) write down the sentence in which the word appears, (2) circle the confusing word, and (3) call the teacher over and make a guess about what the word means.

The next day, conversations begin and student answers are probed. The teacher lists the sentences on the board and asks students to determine what the circled words mean and why they think so. Students are also asked to compare their predictions with what actually happened.

**Decontextualization**
The ability to decontextualize can be advanced in two ways. First, when familiar words appear in the software, students are asked to make predictions about what the words mean in the computer context. For example, in the menu of the graphics

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**Fig. 1. Sample Learning Drama Questions for the Oregon Trail Program**

<table>
<thead>
<tr>
<th>THINKING SKILL</th>
<th>BASE OF QUESTION</th>
<th>METACOGNITION</th>
<th>DECONTEXTUALIZATION</th>
<th>INFERENCE FROM CONTEXT</th>
<th>INFORMATION SYNTHESIS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>At end of game, system indicates whether the player made it to Oregon and how much money was left.</strong></td>
<td><strong>Before you play the game again, you must tell me the following:</strong> What strategy did you use to get to Oregon, and why was it more successful than the previous attempt? Or: What strategy did you just use, and why was it unsuccessful?</td>
<td><strong>The system shows a picture of the wagon as it moves across the country.</strong></td>
<td><strong>From what perspective were you viewing the wagon, and how did that differ from the perspective you had when you were flying the balloon in the &quot;Ride the Wind&quot; program?</strong></td>
<td><strong>The instructions tell the student to budget for an ox and a yoke.</strong></td>
<td><strong>Is anyone who traveled the Oregon trail still alive today? How could you figure this out?</strong></td>
</tr>
<tr>
<td><strong>The instructions indicate that the trail closed in 1897 and that it took five to six months to reach Oregon if you didn’t get stopped along the way or killed.</strong></td>
<td><strong>Why not? What does this mean?</strong></td>
<td><strong>Is the Oregon trail still alive today? How could you figure this out?</strong></td>
<td><strong>What do you think it would be important?</strong></td>
<td><strong>Each time before you play, call me over and predict what month you will reach Oregon if you are successful.</strong></td>
<td></td>
</tr>
</tbody>
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program "DAZZLE DRAW," there is a choice called flood fill. The teacher asks students to predict what that choice means, based on what they know about the word flood. They then go to the computers to test their predictions.

The second technique stems from the recurrence of concepts. Ideas presented in one piece of software will also be found in others that are very different. For example, students discuss the differences and similarities of perspective as it was used when flying a hot-air balloon, in writing a story from the perspective of an object, and when discussing how a character in a story views a given situation.

Information synthesis. Teachers encourage information synthesis by creating situations that require students to use information from a variety of sources or to use several different types of information. For example, in tracking down the arch criminal Carmen San Diego, students have to use information from the screen, an almanac, and a dictionary to decide where to go to find the quarry.

These curriculum development techniques, described in detail elsewhere (Pogrow 1990), can be adapted to any collection of software.

Computers Don't Teach, Teachers Do

At this point you may be skeptical. I have implied that districts should spend money to buy computers, spend more money to buy software, and then use both in ways they weren't intended to be used. Why go to all that expense and trouble?

There's a simple justification. Learning dramas are more effective for at-risk students than either the literal use of software or nontechnology-based interventions. After seven years' work with teachers and students (there are now nearly 10,000 students in the HOTS program), I have concluded that learning drama stimulate complex thinking processes in much the same way that adult speech prompts children to learn to talk: by social imitation.

Learning dramas stimulate complex thinking processes in much the same way that adult speech prompts children to learn to talk: by social imitation.

1Research reviews such as Bangert-Drowns, Kulik, and Kulik (1985), and Niemiec and Walberg (1987) find that the major effects from CAI decline rapidly at upper elementary grade levels. In comparison to other interventions, Haller, Child, and Walberg (1988) found that instruction in metacognition (without technology) had twice the effect of CAI. Hativa (1988) found that when high- and low-performing students used CAI, learning gaps between the two groups widened. No evidence was found to indicate that word processing improved the writing of at-risk students.

2The new version of Oregon Trial uses color graphics and provides many more decision-making situations but takes an hour to reach Oregon, as compared to 10 minutes in the old version. This delay interferes with the development of metacognition, which requires students to determine whether a strategy did or did not work.

3The report to the National Diffusion Network cited research results showing that HOTS students gained almost twice as
much in reading and math as the national average for Chapter 1 students. Since that study was conducted, a newer version of the HOTS techniques has been developed, and sites are reporting gains greater than in the original study.

References


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Papers should be written in direct, conversational style and be as brief as possible (five to ten double-spaced pages).

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