DOCUMENT RESUME

ED 433 996 SE 061 654

AUTHOR	Dockterman, David A.
TITLE	Cooperative Learning and Technology.
INSTITUTION	Tom Snyder Productions, Inc., Watertown, MA.
PUB DATE	1998-00-00
NOTE	60p.
AVAILABLE FROM	Tom Snyder Productions, 80 Coolidge Hill Road, Watertown, MA 02172-2817; Tel: 800-342-0236 (Toll Free); Fax: 617-926-6222; Web site: <http://www.teachtsp.com>.
PUB TYPE	Guides - Classroom - Teacher (052)
EDRS PRICE	MF01/PC03 Plus Postage.
DESCRIPTORS	Computer Software; *Cooperative Learning; *Educational Technology; Elementary Secondary Education; *Grouping (Instructional Purposes); Mathematics Instruction; Science Instruction; Teaching Methods

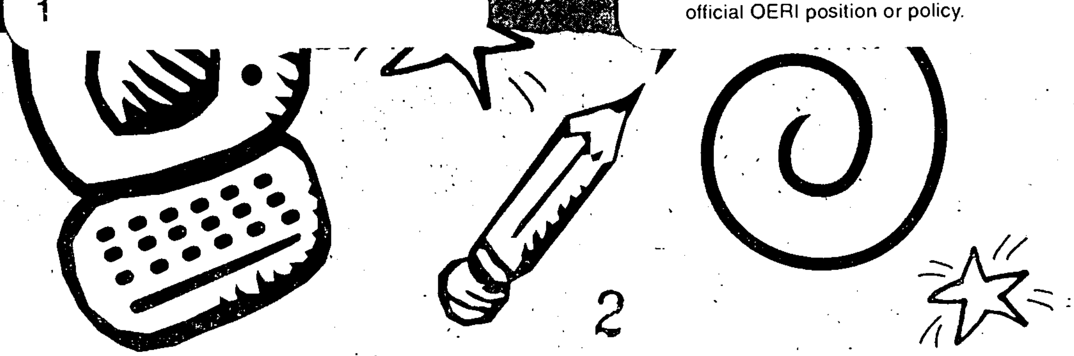
ABSTRACT

The process of learning cooperatively improves the acquisition and retention of content and skills throughout the curriculum. This booklet provides information and tips on the use of cooperative learning in the classroom and how technology can be helpful. Tips for groupmaking, self-allocating roles, complementary information, conflicting information, shared responsibility, and software for cooperative learning are discussed. (ASK)

Tom Snyder Productions®

Cooperative Learning & Technology

David A. Dockterman, Ed.D.



2

Copyright Notice

For further information about Tom Snyder Productions or for a free catalog, please call us at

1-800-342-0236

Contents

Introduction **5**
There Is No One Right Way to Teach 7
It Is Difficult. 8
It's More Than Kids in Groups. 8
The Key Is Interdependence. 9
Tips for Groupmaking **11**
Take Charge 12
Balance the Character of Each Group 13
Try This Group-Making Technique 14
Basic Setup and Ground Rules 15
Technology Can Help 17
Self-Allocating Roles **18**
Complementary Information **24**
Mixed-Expert Grouping 25
The Jigsaw Method 32
Conflicting Information **38**
Shared Responsibility **46**
Cooperative Math Talk 47
Funny Science 52
Software for Cooperative Learning **56**

Introduction

Cooperative learning is great. I'm completely sold. The research shows that fast learners don't suffer in mixed-ability groups and that slow learners really gain. In addition, teamwork is often at or near the top of the corporate training agenda. To be competitive in this tough global marketplace, businesses find they must train workers how to work together to solve problems. That's a pretty powerful incentive for schools to place high priority on group problem solving. If we want to prepare our kids for the workplace, we should teach them how to work cooperatively. The world is a social place; it's not surprising that the ability to communicate with one another constructively is so important.

But there's more. Work by folks like Robert Slavin at Johns Hopkins, Spencer Kagan at the University of California, and David and Roger Johnson at the University of Minnesota suggests that cooperative learning does much more than teach students how to work in groups. The process of learning cooperatively actually improves the acquisition and retention of content and skills throughout the curriculum. In short, kids may learn better when they learn cooperatively.

5

That shouldn't shock anyone. When you are forced to articulate your ideas and knowledge to another person or a group, you have to process the information in a new way. Think about your own experiences as a teacher preparing to teach material that is new to you. You not only have to learn the material yourself, you must strive to understand how others will learn it as well. You must organize and reorganize to an extent well beyond what you would do as an independent learner. This process can be a very potent learning mechanism.

Loaded with all this enthusiasm, I attended a session at an Association of Supervision and Curriculum Development conference several years ago to listen to some of the leaders in cooperative learning. And what did these collaborative learning gurus do? They lectured about how we learn more and better when we learn cooperatively. As I sat in the audience watching slides and overheads pass before my eyes, I became increasingly frustrated. If the speakers were so convinced of the value of cooperative learning, why weren't they doing it now? After all, they had all this evidence showing how great it is.

I questioned the experts after the session.

"Why don't you practice what you preach?"

"Well, we had a lot of information to cover in a short amount of time."

Just like school...

There are a number of morals to this short story. None of them is that cooperative learning is too hard or a bad idea. But no pedagogy, including cooperative learning, is right all the time. Even the most ardent cooperative learning enthusiasts recognize that sometimes you need to stand up in front of your class and do some frontal teaching, if only to lay the groundwork for the cooperative experience to follow.

There Is No One Right Way to Teach

So here is one moral: It's silly to look for the holy grail of pedagogy. You won't find it. There is no one right way to teach all kids all the time. Cooperative learning may be fantastic, but it's not the one and only way to teach kids. Rather, teachers should work to add cooperative learning strategies to their array of classroom teaching methods and strive to apply those strategies appropriately as they proceed through their curricula.

It Is Difficult

And here's another moral: Cooperative learning is difficult. First of all, it's a bit scary. Putting your students into small groups and telling them to talk to one another while you're on the other side of the room risks serious disruption. The noise level in your class can rise significantly. What if neighboring teachers complain? What if a group strays off task and the principal walks in at that moment? Wouldn't if be safer simply to stand in front of the entire class and lead them all down a directed path together? Safer? In some ways, yes. More managed? Likely. A better education? Probably not.

It's More Than Kids in Groups

It can work, but there is a learning curve to climb, both for you and your students. Which brings me to my third moral: Cooperative learning involves a lot more than simply sticking kids in groups. Schools have been doing group work for a long time. I remember forging semi-self-selected groups when I was a student in junior high math class. The teacher would write the assignment on the chalkboard. I would complete the work. My groupmates would then copy my answers. Cooperative learning at its best? Not exactly.

As a teacher I fell into the group trap myself. I let kids form their own teams for the most part. That kept the loud kids happy and the quiet kids left out. Then I'd give a team of four an assignment on Egypt: "You report on the pharaohs; you do ancient religions; you do the pyramids; and you do daily life. And don't forget to make some sample foods of ancient Egypt." The four groupmates would then head off on their own to complete their individual reports. At the end of the assignment, they would pile their results together and dump them on my desk. Again, their experience was hardly cooperative.

The Key Is Interdependence

The key to successful cooperative learning is interdependence. The members of the group must need each other and have a stake in each person's understanding and success. Creating this type of cooperative environment in your classroom is not at all easy, and few teachers (and few students) have had any experience doing it.

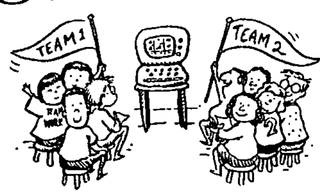
Even some of the "cooperative learning" techniques offered by its supporters can easily dissolve when both teachers and students are confused about their roles. For example, a beginning cooperative learning strategy is to divide your class into small groups of four.

Each member of the group should take a number from 1 to 4. Assign some questions to the class (whatever is appropriate for what you're teaching). Then randomly pick a number from 1 to 4, and that person from each group will be the one to present the answer to the question. Everyone in the group gets the same grade. In essence, this organization creates an incentive for the group to make sure that every one of its members knows the answers to the questions. They are forced to share ideas and information. It sounds cooperative. Interdependence, however, can quickly shift to dependency if, as so often happens in group work, the "smart" kid does all the work and then simply gives the answers to his or her teammates. That's just the way it worked in my junior high math class.

For many of these techniques to work, the kids must be prepared and willing to accept a variety of leadership and facilitator roles. Not surprisingly, they need to be liberated from some rather restrictive patterns of traditional schooling. This booklet offers some techniques for how to structure cooperative learning experiences in your classroom, using concrete examples. Hopefully these examples will spark your own ideas about how to weave this fantastic approach into your own teaching repertoire.

Start with Groups

Tips for Groupmaking



At the root of all cooperative learning experiences in the classroom are groups. Although this statement may appear incredibly obvious, we tend to take the creation and organization of these groups for granted. As a teacher, for instance, I sometimes felt reluctant to "place" kids in groups. I figured, wrongly, that everyone would be happier and more productive if they got to work with the peers of their choice. Consequently, I generally let kids make their own teams for small group work. That usually meant that friends got together with friends, and they had lots of things to talk about that didn't have anything to do with class. It also meant that the "unpopular" kids often found themselves left out of any group, which only further damaged their already low self-esteem.

These difficulties led me to try the random method of group creation. Everyone in the class got a number from, say, one to seven.

11

All the ones then formed a group, all the twos another group, and so on up to seven groups. Once again I was trying to rid myself of the responsibility of making decisions about who should work with whom. Maybe I just didn't want kids mad at me for making them be in a group with yucky peers. Young teachers like to be liked by their students, and I was a young teacher. Anyway, these groups seemed to perform better than my previous efforts, but they were notoriously inconsistent. The random method always generated volatile pairings, uniting students who were simply chemically incompatible. I ended up being forced to make adjustments anyway, moving kids around to accommodate problem spots.

Take Charge

Finally, I followed the advice of some great group teachers and some of the cooperative learning gurus. I took direct charge of constructing the groups. I purposefully matched some students with others. At first I felt a little guilty about imposing my will, but frankly that's the way the world works. When they leave school, graduating students won't have control over their workplace associates. They'll most likely be placed into teams, not allowed to pick their own. So it was okay for me to exert that control in my classroom. In fact, it was good for my students.

Balance the Character of Each Group

Here are the main characteristics I sought for each group and why:

Each team is composed of students whose performance levels range from low to high.

Among the many benefits of cooperative learning is the opportunity for "fast" students to enhance their understanding by explaining concepts to "slow" students, and for "slow" students to get peer support and acceptance.

The average performance level of all the teams in the class is about equal.

Students come to school with a competitive spirit. In fact, schools often foster competition. Creating equal, average ability groups makes for a level playing field. No one group has an obvious advantage over another group. (Even if there's no competition, it still matters.)

Ethnicity, race, and gender are evenly distributed among teams.

The main reason for this distribution is to help break down racial, ethnic, and gender barriers and stereotypes. When students of diverse backgrounds work together, they begin to respect each other as individuals rather than as members of a group.

The ideal size of a cooperative group is 4 students.

I honestly don't know where this number comes from, but it sure seems to work.

Generally, if the groups are too big, individual students have less opportunity to participate. If the groups are too small, there's not enough diversity. Trust me, four is a good number.

Try This Group-Making Technique

Given these characteristics, here is a time-tested technique for making cooperative groups in your classroom. Write each of your students' names in one of four columns: Strong, Above Average, Average, or Weak depending on his or her academic ability. This is, of course, a very subjective process, but do the best you can. Then attempt to make each column of names the same length by moving students to the left or right according to their social maturity. In the example below, I decided to move Andy from the Average column to the Weak column because Andy is among the less socially comfortable students in his column.

By thus juggling students, you will eventually have columns of roughly equal length. A team of 4 students can then be built by choosing one name from each column.

Strong	**Above Average**	**Average**	**Weak**
Jill	*Bob*	*Jamal*	*Sam*
	Cheryl	*Anita*	
	← *Kim*	*Andy* →	

Now that you've made the initial division of your class into groups, you will want to review the teams and make sure they are balanced by ethnicity, race, and gender. (Teams will rarely be balanced on the first try.) Finally, look for irreconcilable trouble spots, where two students simply can't be sitting next to one another. Don't be hasty, however, to rearrange groups to avoid problems you expect to occur. Good cooperative experiences provide excellent mechanisms to get formerly combative students working together. For the moment, simply highlight the potential trouble areas and be prepared to provide extra support through the cooperative experiences.

Basic Setup and Ground Rules

Once you've organized your small student groups, you're well on the way to successful cooperative learning, but you've still got a couple of preparatory steps. Arrange the physical resources of your classroom to facilitate the cooperative experience you're planning (we'll look at some examples in detail shortly). Group members should most likely sit in some form of a circle. Some things to consider include students' ability to communicate effectively without disrupting other groups, ease of eye contact with team members, adequate working space, and ability to access other resources (computer, videodisc, VCR, etc.) as needed.

If cooperative learning is unfamiliar to your students, you might want to set up some ground rules for group behavior.

A list of rules might include:

- Don't speak while others are speaking.
- Listen to what others have to say. Their ideas may influence what you think.
- Give everyone a chance. Sometimes the strangest idea may turn out to be the best.
- Use voting when necessary. Let the majority rule in all conflicts.
- Never take someone else's materials. Be patient and let others read and decipher information for themselves. They will then share it with the group.
- Don't be afraid to ask for help if you need it. The group is depending on you; your teammates want to help.

Some teachers have turned these rules into slogans that they post on the walls. Feel free to ritualize elements of the cooperative process. You want these behaviors ingrained in your students.

Technology Can Help

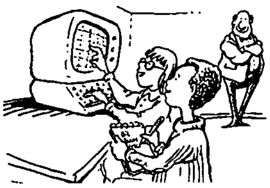
Once you've got your classroom organized and prepared, you're ready to try some cooperative learning activities. Your preparation will help ensure success, but you've still got your work cut out for you. Fortunately, technology can help.

There's a growing group of software programs that share some fundamental elements with cooperative learning. Both are designed to get students engaged in constructive, content-rich conversations, and both are made to get groups of students working together.

In the next four chapters I'm going to describe four different approaches to sparking cooperative learning in your classroom. For each approach, I'll offer a concrete example or two of a software-based activity so you can get a clear picture in your mind of how cooperative learning and technology can work together. Think of each example as a model rather than as a fixed prescription. I think you'll soon find yourself pondering nifty activities for your own students.

Approach 1

Self-Allocating Roles

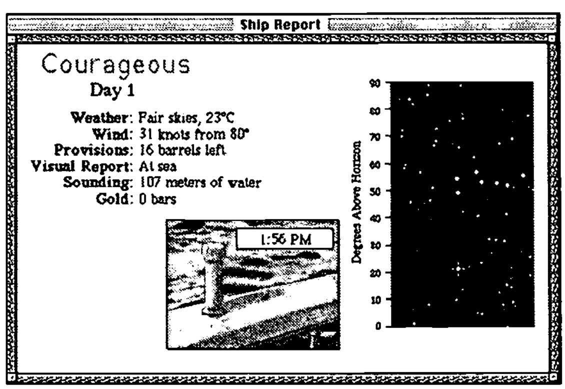


In the ideal world, students discover for themselves the value of working together. Nothing is stronger than a student's own "Aha!". The goal then is to construct an environment that nurtures this cooperative self-discovery. A number of tricks can help. One computer-based technique is best illustrated with the simulation titled *Geography Search*. The story began in the 1970s. Tom Snyder, now chairman of Tom Snyder Productions, was teaching 5th grade science and social studies at the Shady Hill School in Cambridge, MA. He was a popular and well-respected teacher, noted for his energy and creativity. He was also on the verge of burnout. Great teaching is simultaneously invigorating and draining, and Tom was (and is) a great teacher.

One of the amazing lessons Tom created had groups of students in his class sailing the open ocean in search of the New World. Each student team was the crew of a ship beginning its voyage at the port of Vesuvia. They had to gather stores and set sail for the City of Gold, if such a place truly existed. All the teams had been trained in reading latitude by the position of the North Star and longitude from the length of the sun's shadow at a fixed clock time of noon. They had also learned about ocean depth and seafloor structure. In other words, they had the skills of 16th century sailors. Armed with information of his own and a calculator, Tom presented all the teams with the same opening scenario, giving them the data necessary to determine their current location and the wind direction. One by one each team came up to Tom's desk to indicate their action for the first turn. Would they go ashore to gather stores or would they set sail? And if they set sail, in which direction would they go? Using his calculator and wind charts (the simulation mimicked the trade winds of the Atlantic), Tom would give the group some raw data to evaluate at their seats. The teams rotated turn after turn. Some headed directly toward the New World while others floundered in the open ocean. It was fun and exciting.

It was also exhausting. Managing all the data and calculations proved incredibly cumbersome. And it locked Tom to his desk while all these neat discussions were happening within the groups. Then Tom discovered the computer. At first he simply let the machine do all those calculations he had been doing by hand. The groups still came to him one by one with their sailing actions, and he would type their plan (sail at 230° for a half-day, for instance) into the computer and read them the results. The technology provided some much needed relief, and the simulation ran more smoothly. But the group dynamics would still occasionally break down. Mutiny grew among the crew of the Courageous, not because they had been lost in the North Atlantic for several days, but because some students had been left out of the process.

Then came the breakthrough, a subtle but incredibly powerful adjustment to the way the program worked. Students now got to type in their own sailing plans and see the results for themselves. But those results, displayed on different parts of the computer screen, only remained visible for a few seconds, then they disappeared.



Teammates gave each other a somewhat baffled look and trudged back to their seats. "Did you get the latitude information?" "Not me. I only got ship stores." "Me too." It never took more than two turns for the students to begin assigning roles. "You get longitude; I'll get depth..." All of a sudden, each student was an expert with crucial information about the ship's location. Only by working together could the teammates make the voyage to the New World.

Geography Search had become not just a cool simulation, but an awesome cooperative learning experience. Even the shy kids got involved. A tiny bit of ocean depth information could turn a quiet 5th grader into a seagoing heroine. "What do you mean the ocean depth is only 5 fathoms?!" the teammates might exclaim. "We must finally be near land!" Quickly, each student became an essential crew member, invited to participate in every decision. And what's especially neat about this and other simulations is that the involvement doesn't end when the bell rings. As Tom fondly points out, "Students lost in the north seas during class are still lost in the north seas all night long. And they're still lost the next day." Tom found students communicating out of class, talking about their situation in the cafeteria and on the phone at home. The kids had acquired the cooperative spirit through the activity, and it was spilling over into their lives.

Geography Search, in its current enhanced versions for Macintosh and Windows computers, continues to represent an off-center use of computer technology. Typically, educators promote interactive technologies for the incredible access they provide to massive amounts of information. That's all well and good. Computers do promise the ability to browse through previously unavailable sources of data as you wish. In *Geography Search*, however, the power of the computer emerges in the technology's ability to limit, rather than enlarge, access to information. It's a simple timer on a screen display that makes the cooperative nature of *Geography Search* really work.

I have to make a momentary digression here to talk about design strategies for educational technology in the classroom. The seemingly unusual use of the computer in *Geography Search* seems quite natural when one begins with the pedagogy — the experience you're trying to create — rather than with the technology itself. Tom's goal was not to use the computer in his classroom. His objective was to involve his students, all of his students, in a dynamic, cooperative simulation. The technology, applied in this manner, helped him accomplish that goal. This example offers a useful reminder to all of us to keep our perspective and our priorities straight. We seek interactive classrooms, not interactive technology.

Approach 2

Complementary Information

Geography Search uses timed displays to enforce a healthy distribution of information among the members of a group. Another approach, exemplified by such products as *Rainforest Researchers* and *PrimeTime Math*, relies more heavily on segregated print material to build dependency within a cooperative team. The underlying concept here is quite simple. Let's say you need a certain set of data to solve a problem, and only with all of the data can you possibly reach a successful conclusion or decision. Divide that data into separate pieces and spread them around among a group of students. All of a sudden, the students have to talk to one another in order to solve the problem.

Of course, in practice, this approach is a bit more complicated. First of all, information can't be divvied up arbitrarily. The divisions

24

must make sense, and they must respect the integrity of the content. Second, the problem that drives students to examine the information must be compelling and meaningful. Here are a couple of examples to illustrate the complementary information approach. The first example, *Rainforest Researchers*, employs mixed-expert grouping. The second example, *PrimeTime Math*, uses the jigsaw method. Here's what these variations mean:

Mixed-Expert Grouping

In mixed-expert grouping, each student on a cooperative team receives a unique but essential set of materials. He or she becomes an expert, complementary to the other experts in the group. One student, for instance, might be an expert in plant ecology, another in plant classification, a third in plant chemistry, and a fourth in how native cultures use plants. Like any good cooperative team, it performs best when the members work together on a task that truly demands each expert display his or her skills. Here's a description of a couple of computer software packages that integrate this cooperative learning approach about as well and as simply as any I've seen.

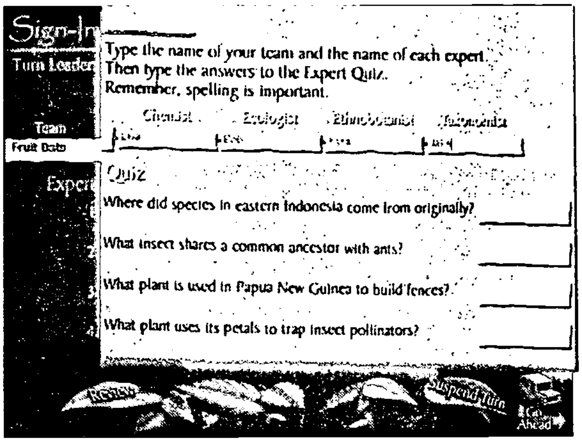
Rainforest Researchers is a classic example of software that fosters cooperative learning. It's also a big award-winner. It captured a Codie award for best middle-school curriculum software from the Software Publishers Association; a gold medal from the ITVA (International Television Association) for the quality of the multimedia production; and many other awards. This CD-ROM-based package is designed specifically to be used by groups of students, either sharing a single computer or as independent groups using a cluster of computers. Let me describe how it works with a single classroom computer.

Students are divided into teams of four. Each student in a team receives a different booklet along with one of four roles: chemist, taxonomist, ecologist, or ethnobotanist. The CD-ROM, which is placed in a convenient and accessible spot in the classroom, offers two "cases" for these teams of young scientists to tackle.

All teams start out together, and there's an introductory video segment on the CD-ROM that sets the general stage and introduces the roles. The package includes a videotape of this introductory segment, so if it's convenient, I'll pop it in the VCR and show it that way. Otherwise, I gather the class around the computer, and we watch it from the CD-ROM on the computer monitor. It's not long, and it's nice to have everybody together at the outset.

Having received the basic background — they're a group of scientists called in to solve some problems in the Indonesian rainforests —

students, within their groups, must complete a couple of preparatory tasks. Each member of a team is given a question to answer about one of the other scientific experts.



The chemist, for instance, has to answer a question about cultural uses of plants, but the answer is in the ethnobotanist's book. This forces team members to talk to each other, sharing a bit about what each scientist does. This relatively easy first step gets the cooperative effort underway with little stress, which is particularly important for students unfamiliar with collaborative exercises. Each team must also pick a team name (which can take longer and be more fun than you might expect). This process helps bond the team, identifying them as a unit. At this point students are warmed up and ready for some real group work.

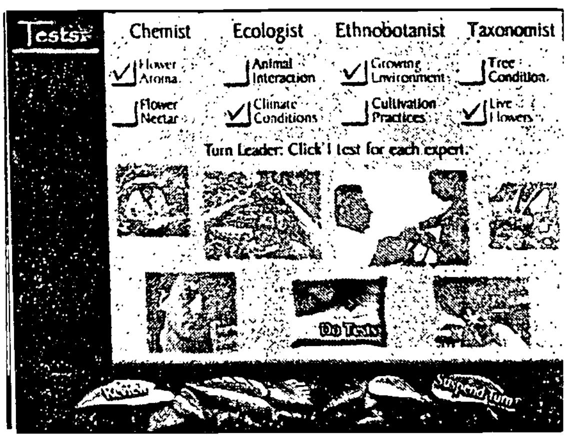
Each group now takes a turn to sign in at the CD-ROM. Each time a group comes to the computer, a not-so-random "expert picker" feature in the software selects a team member to take charge of the keyboard. With this simple feature we acknowledge that keyboard and mouse control are important in determining who's in charge of a group at the computer. By spreading that responsibility around over the course of several turns at the computer, the expert picker avoids a potential control battle among students. This is a great example of how technology can make a group experience flow more easily.

After signing in, students watch a video describing the specifics of the case. In "The Case of the Disappearing Durian" students are sent to the island of Sumatra to uncover why the cultivated durian trees are not producing their popular, but incredibly smelly, fruit, while the wild durians are doing just fine. By the way, if you've never tasted a durian fruit, I advise you to approach it with some caution. First, they're not easy to find. Even in Indonesia, uncovered durian fruit is banned from many hotels and airplanes because the smell is so strong and, to many, offensive. Try a little durian ice cream to start and work your way up to the pure version of this Southeast Asian delicacy. The original video, which I must say is stunning, depicts

Indonesian children scooping out the fruit with enthusiasm. They like it, but you may not.

Next, the groups pack for their excursion to the Sumatran rainforest. To do so, they must learn about this part of Indonesia and about the climate and topography of the rainforest. Again, teams rotate turns at the computer so that each group is making its own unique decisions.

For the next step, each expert selects a scientific test to collect more data.



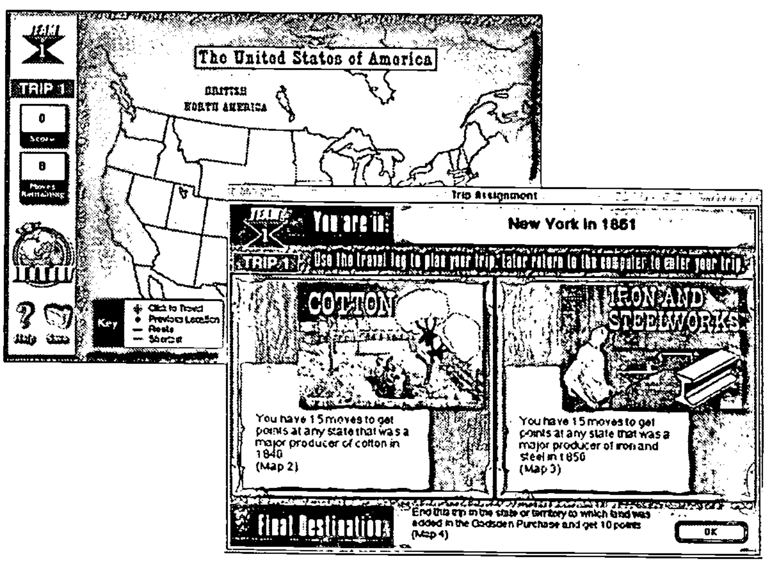
Once input into the computer, the results are displayed and then analyzed by students back at their seats. The expert booklets play an important role in supplying unique and essential information. Each expert looks at a different aspect of the durian life cycle, comparing the wild setting to the cultivated one. Pooling all available information, students develop a picture of how plants disperse and pollinate their seeds, and specifically what's happening with the durian.

After all the groups have indicated where they think the cycle is breaking down among the cultivated durians, the whole class gathers around the computer once again to learn whether they picked the right choice. This pause in the rotation serves a couple of important purposes. It allows everyone to give a group cheer, and it provides an opportunity for the teacher to do some debriefing, check for understanding, and offer clarifications.

The case isn't quite finished. Once students have identified the problem — in this case, that the cultivated plants aren't being pollinated by fruit bats — they must figure out why. Rotating turns, teams gather additional information about changes to the environment, both natural and man-made, that may have had an impact on the bats. Drawing on unique examples in their books, students deduce the cause of the problem. A concluding video brings the class back together to wrap up the case.

Rainforest Researchers is a highly effective way to use a single multimedia computer with a classroom full of students. The rotation of students allows groups to act independently. Yet the teacher can periodically bring the whole class together for clarification and explanation surrounding common content. The dramatic fiction keeps students focused and engaged. And the distribution of complementary information in the student booklets ensures positive collaboration within each group. It's a winner.

If social studies is your specialty, you might want to look at the *Inspirer* series, a collection of geography-based software programs. This series included *International Inspirer, National Inspirer, Europe Inspirer, Africa Inspirer,* and *American History Inspirer: The Civil War,* with more titles in development. The *Inspirer* series distributes complementary information in the form of maps and charts to cooperative groups of students. Each group goes on a scavenger hunt across geographical borders and even through time. But only by working together and sharing information can students plot a successful path.



As with *Rainforest Researchers,* teams take turns at the computer, entering their paths, seeing the results, and getting additional assignments. However, unlike *Rainforest Researchers,* the *Inspirer* series can become overtly competitive among teams, while staying collaborative within them. While learning how to cooperate remains a desirable goal in and of itself, we do live in a competitive world. And in many ways, it's that competition that makes teamwork all the more important. Don't be afraid to let competition work for you in creating collaborative environments in your classroom.

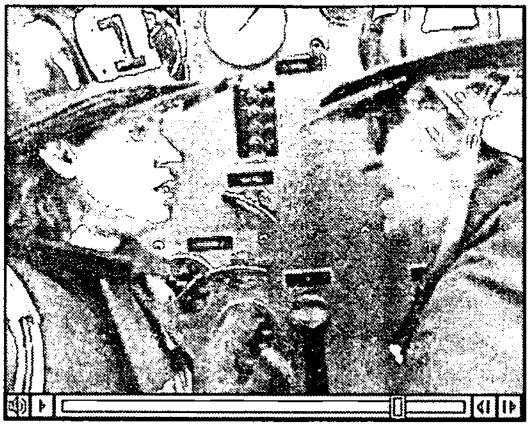
The Jigsaw Method

Another software series, this one for math, illustrates a variation on the complementary information approach. *Rainforest Researchers* and the *Inspirers* use mixed-expert grouping. On the other hand, *PrimeTime Math* works particularly well using the jigsaw method of cooperative grouping. The jigsaw method has students moving back and forth between single-expert and mixed-expert groups. An example will clarify how this method works.

PrimeTime Math puts students into real-life situations where math is happening (although not in any obvious way). One *PrimeTime Math* title is set in a hospital emergency room, one involves police officers investigating a rash of burglaries,

32

and a third title follows a group of firefighters tackling a dangerous building fire.



In each case there are lots of mathematics happening — some simple, some complicated, and most not noticeable, at first, to the layperson. *PrimeTime Math* makes the math discrete and then asks students to use that math to solve key problems during the program.

For example, in *PrimeTime Math: Fire!*, firefighters are called to an abandoned building blaze. Within moments the firefighters need to select the correct length and size of hose and then set the appropriate pressure best to attack the fire.

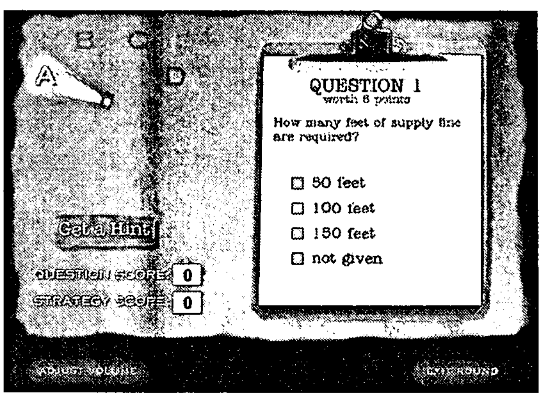
Students watch this dramatic scenario from the CD-ROM in full-motion video. Embedded in the video is crucial information that students will need to solve the math problems. Students assume one of four different roles, and, guided by different worksheets, record the information necessary for their role. One student, for instance, is concerned about the dimensions of the building and where in the building the fire is located. Another student listens to estimates about the distance of the fire trucks, which will be pumping the water, to the burning building. A third student needs to think about the size of the hoses, their diameter and length. And a fourth student pays attention to water pressure and flow.

Amazingly, real firefighters, who were consulted during the development of this package, evaluate all this information within a matter of moments. Their intuitive judgments and decisions are based on hard-learned experience. They don't have the time to pull out a calculator and measuring tape and actually do the math. Fortunately, your students do. They get to gather the information, perform the calculations, share what they've uncovered, and then make some critical decisions. But it's a lot to take in, so students need to work as a team.

Once they've gathered the information they need from the video, students could move directly into mixed-expert groups. However, some of the tasks are kind of tough, and in mixed-expert groups each student is left alone to digest and fulfill individual tasks. That's why I prefer the jigsaw method for this package.

In the jigsaw method all the students who are dealing with, say, building dimensions, get together after the video. They confirm with each other that they gathered the correct data, and they discuss what to do with it. They get to share problem-solving strategies for their particular task. It's a very valuable support system for students.

Once each expert group has accomplished its task, students shift into their mixed-expert groups to share what they've figured out. In some cases, the experts have multiple-step problems and can't proceed until they get some data from other experts. So students might move back again into their single-expert groups for more work before finishing up in their mixed-expert groups.



Each time students return to their expert groups, they likely find anxious teammates waiting for them. The rest of the group is depending on this expert to bring back crucial information that will allow them all to succeed. This kind of responsibility and peer pressure helps keep students focused and motivated throughout the activity.

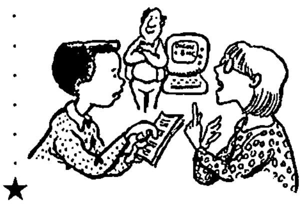
When students have completed their work, the teacher can use a built-in random student picker to select individuals to share their answers. The CD-ROM evaluates the answer and then asks for descriptions of how the answer was reached. Students need to "show their work" by articulating the process to their classmates. Those descriptions prompt additional discussion as other students and teams describe different ways they may have organized the problem, even to get to the same answer.

Having figured out how to attack the fire, students encounter additional problems within the program. The building isn't abandoned after all, and students need to determine the fastest way out in order to rescue the person inside. Which is the shortest and safest route: out the window and down the ladder or down the steps inside the building? And they'd better know how much air is left in the air tank for the firefighter who's got to carry the survivor out of danger. Dramatic and very real math abounds at every turn. It's great stuff.

Whether you use mixed-expert grouping or the jigsaw method, you can foster powerful cooperative learning experiences by giving students within a team responsibility for complementary information. Success depends on each student sharing and collaborating with his or her teammates. Students are compelled to make sure everyone is involved. Adding a bit of competition among teams can up the stakes and the motivation, enhancing the level of collaboration within each team. Fueling the right kind of positive peer pressure is an important step in making cooperative learning successful.

Approach 3

Conflicting Information



Just as supplying students with complementary information can create a cooperative environment, so too can conflicting ideas energize a collaborative spirit. The examples I've described thus far all pretty much deal with factual information. At least that's what the students have in their hands. But school isn't just about facts. Is there a way to get students working cooperatively with divisive issues, questions with no right or wrong answers? In fact, we do it all the time. In a good discussion students articulate ideas, listen to one another, respond to arguments, seek out and apply new information, and most importantly, they disagree. They cooperate in their conflict, for without dissonant points of view you can't really have a good discussion.

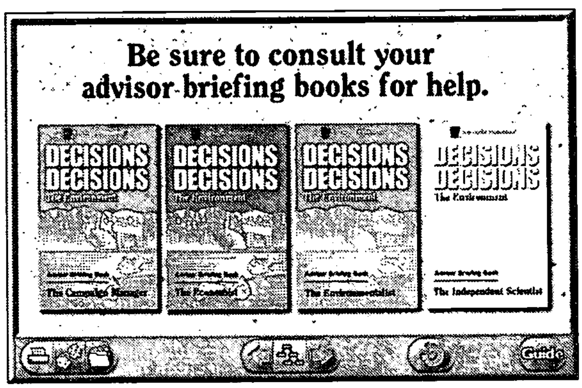
In a nutshell, here's how to generate cooperative conflict in your classroom. Break students into small groups. Give them a compelling context, a situation that requires a vital decision be made. Supply each student with an opinion, well-supported by historical or contemporary analogies, and tell them to make a decision. You'll get a lively, interactive experience that mixes conflict and cooperation in a powerful and innovative way.

Decisions, Decisions is the name of a series of role-playing software packages designed specifically to help you generate this type of informed discussion and decision-making in the classroom. The titles in the series deal with topics ranging from colonization to feudalism to town government to prejudice. I'll focus this example on *Decisions, Decisions: The Environment.*

The program can be used in a variety of ways. Four students can gather around their own computer in the back of a classroom or in a lab. Teams can rotate turns at a single computer in the classroom. Or you can mix small-group and large-group discussions. That's my favorite method and the one I'm going to describe. The physical set up is simple. I usually employ a single computer sitting on my desk or on a cart in the front of the room. You don't need a display system, although it's fine to use one. I then act as the interface between the class and the machine. That position makes it easier for me to orchestrate the large-group discussions.

Sometimes, before starting up the software, I'll prep the students for the issues they will face in the program using the lesson plans in the teacher's guide. Other times I'll just dive into the role-playing activity and use that as a jumping off point for additional lessons. In either case, I divide the class into teams of four students using the method discussed earlier.

Like many of the other programs I've described, this *Decisions, Decisions* title comes with seven each of four different advisor briefing books. Unlike programs such as *Rainforest Researchers,* however, students all assume the same role, in this case mayor of a small town. Each member of a team gets a different book filled with advice from one of the four advisors: a campaign manager, an environmentalist, a scientist, and an economist.



Students will share and debate the conflicting advice in the books as they work their way through an environmental crisis. That crisis is introduced to the class through an engaging slide show that plays from the CD-ROM.

Dead fish! The headline glares at you from your desk. The danger forced you, the mayor of Alpine, to close Snyder Pond. Could the nearby dump be polluting the pond and killing the fish? Or is it some other cause, like acid rain? Many people suspect the town dump! Who knows what Malaco, the mining company, is dumping there? Are Malaco and its jobs really good for Alpine? What if the company seeks to mine beautiful Gab's Gully? You're the mayor, and it's an election year.

It's up to the students to determine what the mayor should do.

Now it's time for students to turn to their briefing books to get briefed by the advisors. Each advisor summarizes what's happening from his or her perspective. Four people look at the same situation and see four different things.

What should the students do? Well, first they need to rank four goals: win reelection; protect the environment; hold down costs; and preserve Alpine's economy. Students are asked to turn these goals into a set of priorities, from most important to least important. I require students to complete this ranking exercise independently before initiating any discussions. That way they get invested in a point of view, so that when they do start talking, they have a lot more to say.

When students complete this individual task, I tell them to work with their teammates to come up with a team set of priorities. Most students are quickly off and running, and I'm free to move among the groups that were slow to get started. After a few prompts, they too are on their way. The discussions are great.

"We've got to make the environment our number one priority!"

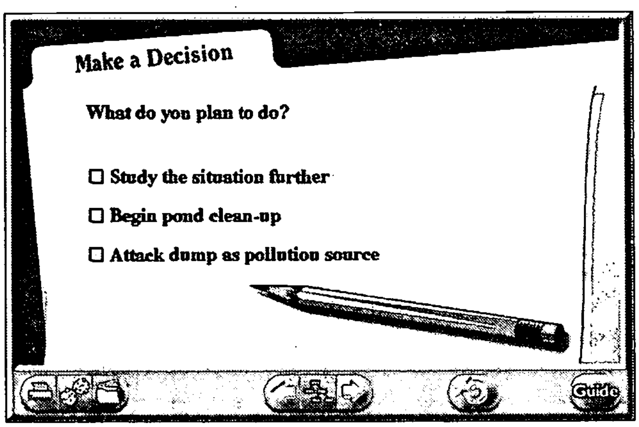
"But the economist says that Malaco provides most of the jobs in the town, and the economy isn't doing well."

"Hey, according to the campaign manager, if we don't get reelected we can't do anything."

Gradually, the teams reach some sort of agreement on the priorities. I then turn the class's attention back to the computer. It asks for the whole group's priorities. We now have to reach a class consensus. I'm selective about which group I call on to start things off. I want someone who will talk but not someone who will intimidate others. Watching the groups go through this initial stage will generally give you a good idea of whom to choose. Once you get one team's priorities, you can feel confident that hands will start shooting up around the room. Different teams will undoubtedly have different priorities. The whole-class discussion will be under way.

At this point, all you really have to do is manage the interactivity. Teams typically start out with simple negotiation. "We'll agree to make the environment number one if the economy is number two." "No way. Getting reelected is the most important." But they soon realize that they need to be more persuasive. Students begin building arguments, supported by evidence from the advisors and elsewhere, to convince one another to adopt their point of view. After a great amount of wrangling and some close votes, you will eventually end up with a set of class priorities.

I continue to use this same organizational style as the class moves into the decision-making phase. Once priorities are set, you still have to determine what action to take.



The program offers three options, and the advisors reappear to point the students back

43

to their briefing books for conflicting bits of advice and relevant information.

In their small groups, students read the advice, share the information with their teammates, and then debate which action to take. I then select a team to summarize its decision. Another class discussion follows.

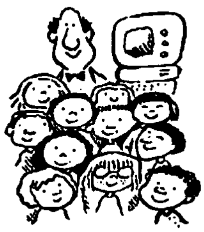
On it goes for five decisions. It's a fantastic exchange, full of the content you're covering in your curriculum, along with a terrific level of enthusiasm from students.

The reason I love this approach is that it hits all levels. I get students working alone to ensure individual accountability. Then they work in small groups where everyone has to contribute. Finally, I get to pull all the pieces together in the large-group discussion. It's fun and tremendously educational for students, plus it creates a very rewarding classroom experience for teachers.

Clearly, *Decisions, Decisions* is a great tool for sparking student-to-student interaction. The computer drives the discussion, but it is not the center of attention; the kids and their ideas are. The process works well in many areas and at many different levels, not just with the "smart" kids, as many teachers I've encountered assume.

Here's what one teacher wrote to the designers after using one of the titles: *"As I turned the computer on, my students waited to see color and magic light up the screen. How delighted they were to find that all the color and magic came from them and their ideas!"*

Approach 4
Shared Responsibility



As I mentioned briefly before, a popular cooperative learning technique involves giving a group of students a set of questions and holding each individual member of the group accountable for the answers. In theory, students will work as a team to come up with the correct responses. In practice, however, there's a tendency for most of the group to let the "smart" kid do the work. They then copy the answers and take equal credit. How do you make sure that everyone in the group actually participates and shares in the responsibility of figuring out and articulating the answers? In part it has to do with the type of questions you ask and the way you solicit the answers. Here are two software programs on CD-ROM, one for math and one for science, that illustrate ways to create shared responsibility within a group.

Cooperative Math Talk

I need to introduce this example with a little personal history, because it focuses on a crucial, but typically overlooked, part of learning math. I was a straight A student in math from elementary school right through high school. I was the odds-on favorite in any flashcard competition, and everyone wanted to be my partner in any group work. I remember my fifth grade teacher regularly urging me to show my work. Although I never did, she had to concede, "You can't argue with success." And success in K–12 math, whether multiplication and division or calculus, meant getting the correct answer.

Riding this history of right answers, I entered upper-level calculus as a freshman at Yale brimming with confidence. I had scored well on my APs, and I figured college math would continue to be easy. Wrong! I was completely lost. Suddenly, math wasn't just about right answers. Being able to complete volumes of computations wasn't enough. I had to know what I was doing, and I had to be able to articulate it. There was a large gap in my math education, one that needn't have waited until college to be filled. In fact, it needed to be addressed early on. Students need to be able to go beyond filling in the final answer; they need to be able to describe how they got there.

Fizz & Martina Math is a series of math CD-ROMs that attempts to fill this gap, forcing elementary students to articulate the process of math problem-solving. Here's how it works. Situate your computer (with CD-ROM) where kids can see it. Your computer monitor is likely big enough for the class if they gather around for the video segments. Otherwise, a large-screen display or monitor will help.

Divide your class into small groups, making sure to maintain a good mix of ability levels and backgrounds in each team. The software leads you through the distribution of follow-along worksheets and the assignment of a color to each team. Unlike the complementary information approach, this tactic requires that each team member have exactly the same print materials in hand.

The CD-ROM and worksheets operate in conjunction with one another. The software tells your students to get their pencils poised for taking notes. Then a video story unfolds, filling the computer monitor so that it resembles watching TV. If you're viewing *Fizz & Martina at Blue Falls High*, a title in the series that deals with multistep addition and multiplication, you'll see the characters gather for a special club meeting. The main order of business is Martina's late dues. The club desperately needs the money to continue work on Project

Sphinx. Martina is three weeks late with her dues. Students jot some notes on their worksheets. Dues are six dollars a week (more notes). Martina worries if she has enough money to get caught up with her dues. She has only twenty dollars (one final jot). Will she have to run home to get more money?

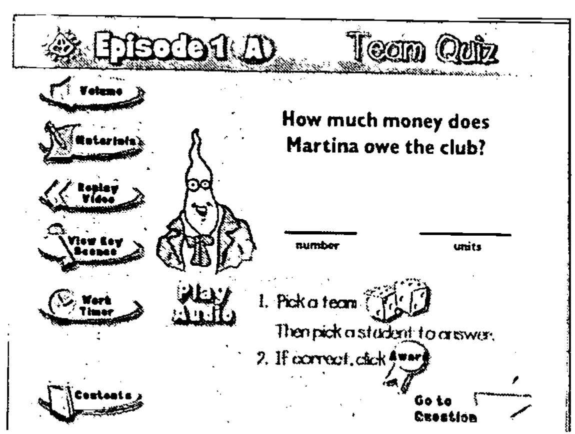
The video stops. You can see that, as in real life, there's a lot happening. Students are captured by the rich drama, but they have a problem to solve. In their small groups they sift through the information and set to work. The worksheet for this episode asks three questions. First, "How much does Martina owe for her dues?" Calculating this answer isn't usually the toughest challenge for the group, assuming they have all the correct information (and among the team members they almost always do). By the way, the answer to this problem is $18.

It's the second question that provides the most significant challenge for students, and not surprisingly, it's the question that builds the most understanding of what they have just done. "Write, in a complete sentence (or two), how you figured out the answer to question 1. Do NOT use numbers in your explanation." The computation is trivial compared to the task of articulating that mathematical process.

With this step, math becomes something more than mere number manipulation. It has to do with real life and concrete processes. Making this leap is an incredible effort for kids, but it is a worthwhile one. And they get better and better with practice.

The third question asks students to explain why the answer to the problem is important for Martina. The final step demands that the group return to the original context. In life, math doesn't end with the numerical answer. The response to a problem has consequences. In this case, Martina doesn't have to run home. As in life, the drama continues.

Okay, the students working in their groups have completed the three questions. Now what do you, the teacher, do? The CD-ROM walks you through a powerful, but simple, group process.



50

Click the random group picker, and the computer will select one of the groups. Walk over to the group and pick up the worksheet of someone on the team. I select individual students differently depending on my objective at the moment. If, for instance, the group has not been working well together, I might choose the team member who has been left out, because I can use this process to help get them involved. I hold the worksheet in my hand and ask the student to tell me the answer to the first question. He or she must remember the answer, not through memorization hopefully, but through understanding. This is especially likely for the second question. It's tough to memorize the way you solved the problem without using numbers. If the student response is correct, both orally and on the worksheet, everyone on the team gets an award card that depicts one of the characters from the video. You can give these award cards any value you want, but don't worry, the students will give them more worth than you could ever assign.

Some of the best dynamics occur, however, when the student's answer is wrong. In that case, no one on the team gets an award card. It's a standard cooperative learning technique used to diffuse responsibility. The important role for the teacher is constantly to reinforce the group over the individual. So when one team member is incorrect, it is not the single student who failed the group, it is the group that failed the student. So, in this case, you say to the student with the wrong answer, "Too bad your teammates let you down. I'm sure they won't let it happen again." It's amazing how quickly a group will then work to embrace its struggling members.

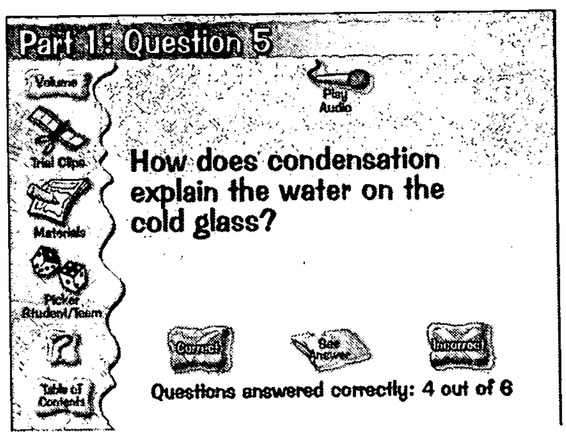
You follow the same technique for each of the three questions. The CD-ROM keeps track of where you should be, offering sample correct responses for students to compare to their own. When the video continues, the answers are immediately integrated into the story and new problems emerge. The video creates the setting, enhances the drama, and controls the pacing. Supported by the computer, you run the class, and with some simple cooperative learning strategies, it's a dynamic one.

Funny Science

Another CD-ROM series, called *Science Court,* uses many of the techniques of *Fizz & Martina Math,* with a few notable exceptions. First of all, I should tell you that besides being a series of CD-ROM titles that combines multimedia and hands-on science for the classroom, *Science Court* is also an animated series on ABC-TV. The TV show has won praise from the head of the FCC, the *New York Times,* and *The Wall Street Journal,* among others. The classroom CD-ROM continues to gain accolades from teachers and educational journals.

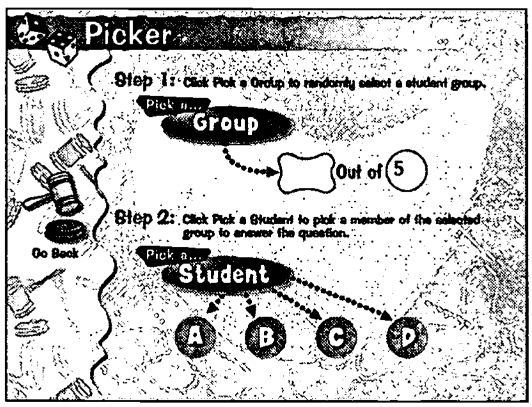
Our focus here, though, is solely on the classroom series. Like *Fizz & Martina Math, Science Court* calls for students to work in groups of four. Each student in the group gets a slightly different worksheet. They all have the same questions to answer, but each student has some different information to help answer those questions.

After watching some of the video on the CD-ROM, students are left with a cliffhanger. In *Water Cycle,* for instance, Pip Peterson is accused of making leaky pipes, which caused I. M. Richman to slip and fall in the subway. During the trial, the prosecuting attorney, the bumbling but lovable Doug Savage, argues that the moisture on the outside of a glass of ice water came from inside the glass. Is he right?

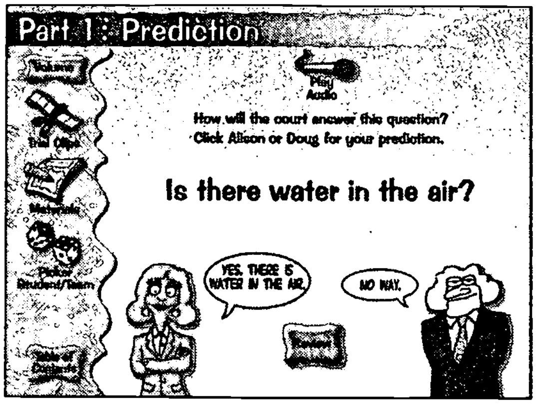


The video stops, and students turn to their worksheets to answer six questions. The different information spread among the worksheets, along with a hands-on experiment, will help them answer the questions. Students go to work in their groups. They talk to each other, sharing information and working through the hands-on activity (which in this case involves condensing water on the outside of an empty cold glass).

When they've answered all the questions in their group, students turn back to the CD-ROM. The program asks each question one at a time. Students turn their worksheets over. As in *Fizz & Martina Math*, they can't look at the answers. That means they really need to know the answer. After each question, you use a random student picker to select who should answer.



The class as a whole must answer at least four of the six questions correctly, or they have to start over. If they get enough right, they predict what will happen in the trial and watch the results.



The incentives here are different from *Fizz & Martina Math*, but they serve the same purpose. They focus students in a group on coaching each other to a level of unsupported understanding. Students can't just copy the answers, especially for the questions that require explanations and original thinking. If everyone in the group isn't adequately prepared, the whole team, or in the case of *Science Court* the whole class, suffers. That's positive peer pressure. Students need and want to collaborate. You've never heard such learning in your classroom.

55

Software for Cooperative Learning

Throughout this booklet, I've talked about examples of software specifically designed to support cooperative learning in the classroom. I thought it would be helpful to talk just a bit more about what underlies this group learning approach. As you would expect, this genre of software gets people in a group to interact, not with a machine, but with each other. That makes it ideal for classroom use, and I'd like to highlight three important educational beliefs upon which it is based.

1. Students learn best when they explain.
Progressive educational theory has historically been dominated by the works of Jean Piaget. His studies on cognitive development suggest that most of the action for learning takes place inside of our heads. Language, in this scheme, is the result of thought. While Piaget promoted his views in the limelight, however, another

great psychologist, laboring in the relative obscurity of Stalinist Russia, suggested something different. Lev Vygotsky, whose work in the first half of the 20th century is still just coming to the fore in this part of the world, found that language and thinking are interdependent. The process of creating language, of articulating ideas and understanding to someone else, is a critical step in building personal understanding. The most powerful learning happens when individuals in a group negotiate shared meaning. Educators are now agreeing: language unleashes true understanding. The primary goal of cooperative learning software in schools is to get students to explain relevant content and concepts to each other.

2. Teamwork is a new and essential basic skill. For the first 100 years of the industrial revolution, the goal was to manufacture more products faster than anyone else. Since consumers had so few goods, the first to produce would likely be the first to sell. Any old warm body on the assembly line would do. But no longer. Increased competition and affluence have made price and quality ever more important in distinguishing one product or service from another. Workers at all levels need to be able to identify ways to improve quality and reduce cost. And they need to be able to articulate their observations and suggestions to others, their teammates. So it's not surprising that economists, educators, and business leaders have begun to list teamwork as a basic skill for employment and success in life. Technology and the information age, rather than isolating us, have made it even more important to be able to communicate and work together.

3. The teacher is important.

Software designed to foster group learning respects teachers and acknowledges their importance in determining curriculum and orchestrating successful classrooms. In fact, cooperative learning software, like other successful classroom technologies, requires a teacher. The teacher sets the curricular agenda and the pedagogical tone of the classroom. It is the teacher who is sensitive enough to recognize student problems and to respond with genuine care. Whether an incredible group organizer or a dynamic presenter, the teacher shoulders the responsibility for motivating and guiding student learning. After all, the teacher is the one who will ultimately be held accountable for student performance. Software that facilitates cooperative learning is designed to assist you in that heroic effort.

For more information on the award-winning educational software described in this book, please visit our Web site at **www.teachtsp.com**, or call **1-800-342-0236** for a free catalog.

SE061654

ERIC®

U.S. Department of Education
Office of Educational Research and Improvement (OERI)
National Library of Education (NLE)
Educational Resources Information Center (ERIC)

REPRODUCTION RELEASE

(Specific Document)

I. DOCUMENT IDENTIFICATION:

Title: Cooperative Learning and Technology

Author(s):

Corporate Source: Tom Snyder Productions

Publication Date:

II. REPRODUCTION RELEASE:

In order to disseminate as widely as possible timely and significant materials of interest to the educational community, documents announced in the monthly abstract journal of the ERIC system, *Resources in Education* (RIE), are usually made available to users in microfiche, reproduced paper copy, and electronic media, and sold through the ERIC Document Reproduction Service (EDRS). Credit is given to the source of each document, and, if reproduction release is granted, one of the following notices is affixed to the document.

If permission is granted to reproduce and disseminate the identified document, please CHECK ONE of the following three options and sign at the bottom of the page.

The sample sticker shown below will be affixed to all Level 1 documents	The sample sticker shown below will be affixed to all Level 2A documents	The sample sticker shown below will be affixed to all Level 2B documents
PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY ____ Sample ____ TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)	PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE, AND IN ELECTRONIC MEDIA FOR ERIC COLLECTION SUBSCRIBERS ONLY, HAS BEEN GRANTED BY ____ Sample ____ TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)	PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY ____ Sample ____ TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
1	2A	2B
Level 1	Level 2A	Level 2B
☑	☐	☐
Check here for Level 1 release, permitting reproduction and dissemination in microfiche or other ERIC archival media (e.g., electronic) and paper copy.	Check here for Level 2A release, permitting reproduction and dissemination in microfiche and in electronic media for ERIC archival collection subscribers only	Check here for Level 2B release, permitting reproduction and dissemination in microfiche only

Documents will be processed as indicated provided reproduction quality permits.
If permission to reproduce is granted, but no box is checked, documents will be processed at Level 1.

I hereby grant to the Educational Resources Information Center (ERIC) nonexclusive permission to reproduce and disseminate this document as indicated above. Reproduction from the ERIC microfiche or electronic media by persons other than ERIC employees and its system contractors requires permission from the copyright holder. Exception is made for non-profit reproduction by libraries and other service agencies to satisfy information needs of educators in response to discrete inquiries.

Sign here,→ please

Signature: [signature]

Printed Name/Position/Title: Kim Goodman / Mktg. Comm. Coord.

Organization/Address: Tom Snyder Productions

Telephone: 617-926-6000 FAX: 617-926-6222

E-Mail Address: Kimgoodman @ tomsnyder.com Date: 10/12/99

(over)