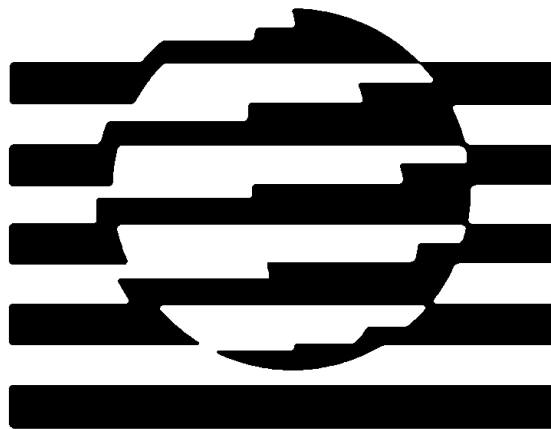


COOPERATIVE LEARNING IN TECHNOLOGY EDUCATION



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RATIONALE

Cooperation is a life skill; nearly every job or social relationship involves cooperating with another individual to accomplish a shared goal. In cooperative learning, students are organized into groups. Each group is given a goal and the achievement of that goal often requires group members to support each other. Cooperative learning tends to be student- (group-) centered, whereas individual and competitive learning tend to be teacher-centered. In a cooperative learning environment, students help each other learn the subject matter, but they also learn how to be a contributing member to a group.

There is more to cooperative learning than "just having students work in groups." Cooperative learning strategies differ based on: group size and logistics, task specialization, inter-group competition, group rewards, method of student evaluation, and appropriateness to a given learning objective or situation.

Technology teachers have a unique opportunity to use cooperative learning strategies. Learning modules, which are beginning to dominate middle school technology programs, are well-suited to cooperative rather than individualistic learning. Problem solving and design can likewise be very effective if students work together toward a common goal, building on each other's ideas, expertise, and efforts. Certain tasks are just too large for a single individual and absolutely require cooperative efforts. As the technology laboratory becomes a place for integration of learning with other disciplines, it is reasonable to use cooperative learning strategies that make use of a variety of "students/experts" in different disciplines.

COMPETENCIES

TASK 1.0. Describe cooperative learning.

TASK 2.0. List benefits of cooperative learning.

PERFORMANCE OBJECTIVES:

2.1. List benefits of cooperative learning for the learner.

2.2. Assess benefits of cooperative learning for the teacher.

TASK 3.0. Analyze the use of small, large, and whole-class cooperative learning groups.

PERFORMANCE OBJECTIVES:

3.1. Explain the use of small cooperative learning groups.

3.2. Explain the use of large cooperative learning groups.

3.3. Analyze the use of whole-class cooperative learning groups.

TASK 4.0. Explain the student's and teacher's roles in cooperative learning.

PERFORMANCE OBJECTIVES:

4.1. Describe the role of the cooperative learner.

4.2. Assess the role of the cooperative learning teacher/facilitator.

TASK 5.0. Describe how student performance might be assessed when cooperative learning is used.

INFORMATION SECTION

1.0 Defining Cooperative Learning

Everyone learns individually. Our interests and genetic make-up determine what we can learn and how well we may learn. They also determine how well we can apply what has been learned. Some people excel at analytical tasks, such as determining how many gallons of paint it will take to cover the interior walls of a room, while others are more concrete in nature and can paint the rooms very efficiently. Not everyone has the innate abilities to perform these tasks easily. Consequently, all methods of instruction do not align with the learning capabilities of each individual learner.

Accepting that people learn individually is an important step toward improving instruction. Either we must devote time to each learner individually or rely on other means to assist each learner to progress. Individualized instruction requires more human resources than are available to schools. Consequently, many teachers rely on large group instruction. Most students are capable of learning in large groups, but each may experience problems with particular methods of presentation, e.g., individual readings, questions and answers, experiments or projects.

However, in many work and social activities, teams of individuals must pull together to get tasks accomplished. Working together means cooperation. It also means taking the talents of individuals and pooling these together to get the job done.

This is the basis for the theory behind cooperative learning. Cooperative learning is a *teaching strategy where teams of two or more work together on learning tasks*. This could include working together on an electrical circuit problem (small group) to the entire class (large group) manufacturing toys for a "Toys for Tots" program. Each member of the team brings special talents to the group, i.e., concrete or analytical abilities or others. Also other team members cooperate on the achievement of the tasks and learn from each other. As a result, students learn both academic and social skills from a cooperative learning environment.

2.0 The Benefits of Cooperative Learning

Society requires its members to exhibit cooperative behavior. Success on a job often depends on one's ability to work well with others. By fostering social skills, cooperative learning aims to fill this social need. Furthermore, cooperative learning techniques have numerous benefits to both the teacher and the learner.

2.1 Benefits to the Learner

Johnson, Johnson & Smith (1991) synthesized over 375 studies on the effect of cooperative, competitive and individualistic efforts on student achievement and productivity. They found that students in cooperative learning settings performed better than students in either competitive or individualistic settings. They also noted that cooperative learning "resulted in more higher-level reasoning, more frequent generation of new ideas and solutions (i.e., process gain), and greater transfer of what is learned within one situation to another (i.e., group to individual transfer) than did competitive or individualistic learning" (p. 2:12).

Based on experimentation, Hamm and Adams (1992) drew the following conclusions about the benefits of cooperative learning to the student:

1. Cooperative learning improves academic performance among high- and low- achieving students.
2. Minority students have made consistently favorable achievement in cooperative classes.
3. Disadvantaged students significantly benefit from collaborative learning techniques.
4. Working in mixed-ability groups doesn't stifle individual initiative.
5. Cooperative learning has positive effects on students' self-esteem, social relations, attitudes toward mainstreamed students, and race relations.
6. By teaching others, all of the students actually come to understand the material better.
7. Children's cooperative behavior skills were shown to transfer to interaction with peers who weren't members of the same learning teams. It also transferred to their behavior in social situations not structured by the teacher. (Hamm & Adams, 1992, p. 8)

Many different cooperative learning techniques have been developed; some of these have advantages over others, depending on the circumstances in which they are applied. In general, cooperative learning should be viewed in terms of its ability to both foster social skills and enhance academic learning.

2.2 Benefits to the Teacher

Cooperative learning can also benefit the teacher. Hamm and Adams (1992) noted that teachers who began using collaborative learning "became more cooperative in their own professional interactions and more willing to collaborate with their peers" (p. 8).

Teachers who use cooperative learning may feel that their time is spent more effectively.

Dividing the class into groups means the teacher has five, six or seven groups instead of 25 to 35 individuals to make good contact with each day. In addition there are 25 to 35 aides in the classroom. Pupils monitor each other while creating a spirit of cooperation and helpfulness. (Hamm & Adams, 1992, p. 15)

In addition, teachers who try cooperative learning techniques often adopt a fresh, new attitude toward their jobs. It can be exciting for a teacher when a group has the freedom to generate their own ideas and to make their own decisions. Some teachers who experiment with cooperative learning techniques are pleasantly surprised at how well their students perform in collaborative group settings.

While cooperative learning requires a lot from the teacher, the teacher may begin to feel that teaching and classroom management become easier.

Cooperative learning can help teachers spend less time being policemen as students learn that they are capable of validating their own values and ideas.

Teachers are freer to move about, work with small groups and interact in a more personal manner with students. Cooperative group learning can also be arranged so there is less paperwork for the teacher. [Evaluating] six or eight group papers is less [work for the teacher] than 24 or 32 individual ones. (Hamm & Adams, 1992, pp. 15-16)

As a result of employing cooperative learning techniques, the teacher might feel less stress. Although the teacher is still responsible for the learning in the classroom, some of the authority is delegated to the students. Even if a teacher uses cooperative learning on only a few occasions, it might give a welcomed relief (to both the teacher and the students) from the traditional instructional format.

3.0 Class Organization for Cooperative Learning

Technology education classes may be organized into different cooperative learning configurations. These can include small groups, large groups, or whole-class groups. Following is discussion regarding each configuration.

3.1 Small Group

Small group cooperative learning has been used for many years in technology education. Small groups usually consist of two to three learners. The most typical examples of employing this strategy have been with electronics or energy and power units of instruction. Probably this strategy was first employed due to insufficient equipment. If a teacher had 24 students in class and students worked two on a team, then only twelve electrical trainers or small engines would have been needed for instruction.

However, if you were ever personally involved in small group cooperative instruction (technology education or science labs), you realized that your learning partner could also assist you. In science you or your partner might have understood the lab experiment and could explain it to the other team member. If you did not understand what was happening, each of you had to pay particular attention and then both of you used your joint abilities to solve the experiment. This was the key to the learning activity. You had someone you could rely on to assist you. In short, you were participating in one-on-one tutoring. In real life, we often seek out others who understand a particular topic to get solutions, or we work with others to find solutions to problems.

Small Group Benefits

The benefits of small group instruction are many. Some include reducing learning anxiety, becoming a team player, participating in peer tutoring, and building cooperative teams.

Reducing Learning Anxiety. Whenever each of us encounters new situations, anxiety usually results. This is not uncommon. The same can occur with materials to be learned. Graduate students fear research, since it is an unknown. Many people have anxiety when it comes to mathematics. Others fear giving speeches or writing papers.

Often this occurs because learners are afraid to fail. As a result, anxiety sets in. Through cooperative methods, learning anxiety can be reduced. Learners use these techniques out of class when they have a friend with whom they will compare answers on

homework. The same can take place in class by pairing groups of learners to work on experiments or other problem solving activities.

When we work with others the burden of fear is reduced. Not many people go camping alone. So if you require students to disassemble a small engine in a transportation unit, pairing two students to a single engine may lessen the fear of botching the job.

Becoming a Team Player. Life, in most situations, requires team work. For teachers to restructure their technology education programs, they must work together. For an athletic team to win, it takes the combined efforts of the team members. Some great players have participated in sports, but no one player can do it all for a team.

It is not easy to become a team member. Trust must be developed. Abilities must also become known. If one member cannot perform adequately in certain areas, s/he must count on the other members to pull them through in the situation. Consequently, teams require leaders and those who are willing to support the team's efforts. A family works this way. Each member learns and knows which tasks they must perform. Other members count on that member to do their job and do it correctly when it needs to be accomplished, e.g., cooking, grass cutting, etc.

Small group cooperative learning establishes mutual responsibility toward learning. If small groups are given problems to solve or assignments to complete, the learners will rely on each other to get the tasks accomplished. Many times the small group divides segments of the activity among its members. Each member knows that the whole team relies on the individual contributions of each member. Therefore, each member does his or her part. One example is a small group that would build a prototype for a classroom game. One member may draw the final plans, another writes the instructions, while a third member gathers the components for the game. The total team could assemble the components to complete the game.

Participating in Peer Tutoring. Great trust and pride can develop through small group cooperative learning. Trust comes from the ability to rely on someone else. You trust your mother or a best friend. You can also learn to trust others through experiences in learning. That is, one team member can assist another team member to better understand a task or new information. Suppose a team is to use a computer paint program to develop a flyer. One team member may know the computer program commands better and should instruct a partner who does not yet have that knowledge. This sharing of knowledge is known as peer tutoring.

Pride also can be gained through cooperative learning. When you help bring your team through a learning experience, you know that they appreciate your efforts. Many times the team members will show their appreciation to a supportive teacher.

Cooperative Team Building. Finally small group cooperative learning can build team cooperation. Cooperation is a learned trait. Not everyone gets along well with others. Prejudices exist in society. Through cooperative learning, people can learn to get along with others. This can occur between classmates and also with those from other genders, races or handicapping conditions. Through cooperative learning, relationships can be nurtured.

Adolescents usually spend a lot of their free time with friends. Usually they learn to get along. In learning, the same team building can occur. This is an important social aspect

needed to get tasks accomplished. Each day in business and industry, people are required to work together to get the job done. All too often the task is too large for a single individual to accomplish. Therefore, cooperative team building can have its attributes in school, but also build cooperative skills that will assist the learner later in life.

Potential Problems with Small Groups

Although there are many benefits that can result from cooperative learning techniques, there can be some potential problems. These can focus on attitudes or not contributing to the fullest of an individual's ability.

In the area of attitudes, students may not want to work with certain other students or may not want to work in a team situation. Some students may be looked down on by other students. They may think the student dresses strangely, looks nerdy, or is slow, or they may just not like the individual. They may complain to you as the teacher that they do not want to work with this particular student. What should you do in your role as teacher? Probably not force the students to team together.

Another attitude problem that you may encounter is having a student or two who do not want to work as team members or rely on other students. They may just like to learn by themselves or be a "loner". Again, you must analyze the situation and then make your best professional judgement to determine if you will require this type of student to work as a team member. Sometimes this type of situation can be overcome by teaming these students with their friends.

Another problem that arises with small group teaming is that some students will not cooperate and do their part for the team. As a result, other team members must do the work for these students. This is very similar to real life where some try to get-by on the merits of others. You should probably deduct from this student's grade on the activity.

Examples of Small Groups in Technology Education

There are many excellent situations for applying small group cooperative learning strategies for technology education. Examples include the use of simulator technology, conducting experiments, doing computer work, and solving technological problems.

Since budgets are limited, sufficient simulator equipment often does not exist for each student to undertake certain activities on their own. Popular simulator equipment includes Lego, MFA Electronics, and Capsula for use in modeling and controlling model machines. Consequently, teaming students into small groups to use this equipment allows for the development of simulated machines, while at the same time allowing students to interact and share ideas and also assist others with prototyping work.

Experiments are another excellent use for employing small group strategies. If students are working on electronic or fluid power problems, sharing equipment and possible answers is a benefit to cooperative learning.

Because of the limited number of computers and utility software available in classes, small group instruction can also be beneficial in this area. Computer work requires learners to develop many skills. These include knowing commands and applying design capabilities. Through cooperative techniques, student teams can share knowledge to get the task accomplished.

Problem solving activities, such as using design briefs, is another excellent area for employing small groups of students. Again, members can use their combined technical and analytical knowledge to develop more realistic and detailed solutions to problems.

3.2 Large Group

Large group cooperative learning strategies have also been common to instruction in technology education. A large group is usually made up of five to seven students. Most typically, we have used such strategies in communication and manufacturing technology classes. Through mass production activities, we have orchestrated the class so that teams would have a specific task which must be performed to achieve the final outcome. If we mass produced a leisure time game, some student teams could cut or form parts, others could assemble the sub-components, while other students could package the product.

In the large group cooperative strategy, we require sufficient human resources to accomplish a larger task. This strategy is used daily in business and industry to get our consumer products produced or to provide services to customers. Extensive planning on the part of the teacher is required to use large group strategies and cooperation is required of students to produce as a team.

Large Group Benefits

There are a number of benefits for student learning and for teachers to apply classroom management techniques through large group cooperative learning. These include learning to work together, understanding the work world, and experiencing enterprising opportunities.

Learning to Work Together. If students do not participate in organized sports or the school band, they probably will not have many other in-school opportunities to work as a large functional team. In business, industry, and the military, large groups of individuals must bring their talents together and fill vital roles to have things happen. For instance, an appliance manufacturer must have teams that develop new product ideas, engineer the product, develop manufacturing plans, order materials, produce the product, and market the product to both retailers and customers. All of these people and teams must do their part in an organized manner for the product to become a part of the consumer's life. Large groups of human resources must function as a team.

The same teamwork is required for a military operation. In an artillery unit, some people are leaders (officers) who direct the operations. Others must know how to set the artillery pieces in positions. Teams of soldiers must identify targets and determine coordinates for aiming the artillery pieces, while other team members must aim, load, and fire the weapons. As the battle progresses, other team members must continue to supply the munitions, while others feed and provide human comforts for the soldiers.

Understanding the Work World. Besides working as team members, large group cooperative learning experiences show learners how many tasks are accomplished in the "real" work world. This provides examples for career evaluations and later life expectations for learners. They must become aware of how businesses operate and what will be required of them in their future. Today in business, total quality management is essential for companies to be more productive and produce products with improved quality at a lower

cost. Through large group cooperative instruction, students will experience real world activities that require quality operations.

Experiencing Enterprising Opportunities. A final benefit of large group cooperative instruction is for students to experience enterprising opportunities within the confines of the school. They can learn to design and produce products for sale to the public. Through these experiences, they can learn how investments work and why quality products need to be produced and sold to make a profit. In brief, they may learn how an economic system operates.

Potential Problems with Large Groups

If detailed planning is not undertaken by the teacher, large group cooperative activities can be disastrous. Much of the success or failure for this type of learning rests with the teacher. If a product is to be mass produced, are there enough operations to keep teams of students involved simultaneously? Are materials available and on hand? Does the product have a potential market? Do the students have the necessary skills to manufacture the product? As you can imagine, your planning can make or break this type of activity.

As with all teaching activities, students must be excited and willing to participate. In a large group activity, some students may not want to participate. With large numbers of learners, it is easier for some to "get lost in the crowd" and fail to carry out their assigned tasks. Can you monitor the behaviors of all your students? In industry this is also a problem. Because of the size of the operation, people can leave their positions or hide. As a result, not all team members are as productive as they can be.

Examples of Large Groups in Technology Education

The most common use of large group cooperative learning is in the manufacturing activity known as mass production or the enterprise. As discussed above, human resources are organized for the production and distribution of a product.

Another use of large group instruction is in the construction technologies. A large team may be used to construct structures such as barns or buildings. With this type of activity, usually not all group members get to do all tasks, however teamwork and "real world" experiences needed to construct projects can be learned.

Large group cooperative learning can also be used in the communication technology program. As an example, a large team may produce a technology education newsletter. Some or all students must write articles, take photographs, use word processing and page layout software, and print and assemble the newsletter. Again, a teacher's planning skills are essential if this activity is to be accomplished in an efficient manner.

3.3 Whole-Class and Larger Groups

For some activities, a teacher may choose to have a cooperative learning group comprised of all of the students in a class. It might even be appropriate for the teacher to form a cooperative learning group that is larger than a class. Students in a club, such as the Technology Student Association (TSA), can work together to accomplish goals that are beyond the scope of ordinary classroom activities. It is also possible to form cooperative learning groups made up of different classes within a school. Even larger groups are possible

if different schools send cooperative learning teams to a centralized location so they can collaborate on a shared goal, such as putting on a technology fair.

A classroom full of students is not necessarily a whole-class cooperative learning group. For example, it is not cooperative learning when each student in a class is working independently on a task, or when they compete with one another. What makes a class of students into a cooperative learning group is their ability to work together toward a shared goal. The teacher delegates responsibility to the class, as a whole, for completing an assigned task.

In general, whole-class cooperative learning groups can be effectively used for the following:

1. to support questions or student concerns;
2. to summarize and review, providing closure to other activities;
3. to allow a class to discuss, debate, and make decisions;
4. to elicit a wide range of ideas and opinions;
5. to accomplish major tasks.

Benefits of Whole-Class Groups

There are specific advantages to whole-class cooperative learning groups when compared with cooperative learning groups of smaller size. Since many students are involved, the group benefits from a wide variety of ideas, opinions, values, and abilities. Whole-class groups require no separate "grouping" activity and may be easier for a teacher to monitor.

Easy to Establish and Monitor. Whole-class groups can be quicker to establish and easier to manage than smaller groups. The teacher's attention is not divided among numerous groups. It can therefore be easier for a teacher to monitor a whole-class group and keep the group on-task than would be if the class were broken into many smaller groups.

Wide Variety of Individuals and Ideas. Society is comprised of a wide variety of individuals. Whole-class groups are better representations of society than are smaller groups. For example, if only two of the twenty students in a technology class are female, a whole-class group might benefit from a feminine point of view, whereas assigning groups of two to five students would result in a number of all-male groups.

Rather than reinforcing social cliques, whole-class groups promote cooperation among all smaller groups and, therefore, among students in general. For example, if students are in small self-chosen groups, there might be a tendency to select only close friends as group members. However, if all smaller groups are required to collaborate on a project, students will be forced to work with others outside their small, social group.

Potential Problems With Whole-Class Groups

While there are benefits to whole-class groups, there are also disadvantages. The amount of active participation by each student is likely to decrease as the size of the group increases. In very large groups, students are likely to feel that their input is unimportant, or that what the group is doing is inappropriate. Furthermore, students may be less likely to feel personal identification with larger groups. Some students who might volunteer for certain jobs in smaller groups might not volunteer in larger groups, thinking that the amount of work required would be excessive.

With a greater audience, some students may be more apt to ridicule their fellow students, while others may become too self-conscious to contribute with the rest of the class listening to them. Conversely, those students who have a tendency to use the attention of a class for disruptive purposes may pose more of a problem with whole-class groupings than they would in smaller groups.

Examples of Whole-Class and Larger Groups in Technology

There are a number of circumstances where a teacher should consider using whole-class cooperative learning. These may include: class-wide student concerns, lesson closure, discussion of current events, class-wide decision making, and activities that are too large for smaller groups.

There may be general student questions or concerns at any time in a class. Some of these concerns can be dealt with by having the whole class discuss and decide the issue. For instance, the introduction to a lesson or an instructional unit can be bewildering to some students. Introductions tend to be teacher-centered, often with little feedback from students. Students may have questions on the material that they are too shy to ask. By encouraging students to interact about the content with the teacher and with each other at intervals during the introduction, some of the initial confusion might be quickly resolved. Similarly, it might be helpful to have class-wide discussions on students' concerns during a unit of study. As an example, weekly seminars may be held to report student progress.

It may also be appropriate to use whole-class discussion to provide closure to cooperative learning experiences where students had been working in smaller groups. This inter-group sharing of experiences, comments, and questions can provide beneficial feedback to students and teachers alike. It helps ensure that all important issues are shared by everyone in the class and it gives credit to each smaller group in front of the entire class.

Within the body of a lesson, whole-class cooperative learning can be used to generate a very wide list of ideas. With a large number of viewpoints, controversial issues can be easier to examine in a whole-class group. Discussions on current events in technology are especially conducive to whole-class groups.

Another reason to form a whole-class cooperative learning group is if the teacher decides to have the class participate in a decision-making process. For example, the class might debate on whether they should take a field trip to a science museum or to a floppy disk manufacturing plant.

One of the quickest cooperative learning groups for the whole class is a brainstorming session. Here, the students provide responses to a problem statement. Rather than competing with each other, the students are encouraged, as a class, to generate as many responses as possible. Often, an idea mentioned by one brainstormer will cause another brainstormer to come up with a different, but related idea. A specific example of whole-class cooperative brainstorming is the following:

The teacher says, "We will begin our study of transportation by brainstorming. The goal is to list as many different responses as possible that fit a category. After I tell you the category, I will present a common example, and an uncommon example of a response. You will have one minute to quietly think of responses, then the entire class

will have 3 minutes to list as many responses as possible, while I write your responses on the board. Listen to each other; what someone else says might help you think of a different idea. Ready? Here is the category : '**Systems that transport things.**' You must name the system and state what it transports. A common response is **a car transports people**. An uncommon response is **a bloodstream transports nutrients.**" The teacher then gives the students one minute to think of responses. After that minute, the students provide answers for three minutes while the teacher writes their responses on a chalkboard.

Another example of a whole-class cooperative learning group is the establishment of a manufacturing enterprise. Here, the students from a single class in manufacturing technology form a manufacturing company. While various students may be assigned to small groups, such as production engineering, quality control, or packaging, all students must work together to achieve the company's goals. All students are involved in decision making, and all students stand to benefit from the production activity.

In circumstances where the class is working together toward a shared goal, but different students are assigned to different smaller groups, it is beneficial to encourage the various groups to present their progress to the entire class. This gives them credit for their work while teaching others and allowing for feedback. Competition between classes can also be used to stimulate cooperation within a class. This is better known as the seminar technique.

Another example of how the whole-class group method can be employed by a technology education class is a program exposition or fair. All class members would work on technology activities to display at the exposition. In addition, the class would also have to take on responsibilities such as advertising, setting up displays and live presentations, or providing refreshments. A planning team would organize the event and assign and monitor tasks for individual class members and small groups.

Cooperative learning groups may be small, large, or whole-class groups. In addition, it is possible to design cooperative ventures that go beyond classroom or school boundaries. For example, a number of classes can pool their efforts to build playground equipment for a local park. Others from the community might be invited to participate. While this cooperative activity is not primarily educational, all who participate can learn from working with one another.

Within your school, you can break down some of the artificial boundaries that separate subject areas by collaborating with other teachers. Technology classes should be places where learning of all subjects is integrated into a cohesive whole. Collaborative efforts, for example between technology classes and mathematics classes, can help achieve this integration. In fact, a creative technology teacher can probably envision a cooperative venture between technology classes and any other class in the school. The world is a complex assembly of many interrelated parts. By integrating across curricular boundaries, teachers might be able to offer their students an education that is more complete, where the whole is greater than the sum of the parts.

With the support of school administration, a technology teacher can host an inter-school cooperative event in technology. For example, a middle school technology teacher

might send the following announcement to other middle school technology programs in the vicinity:

Your middle school technology program is invited to participate:

Alpha-Seven: A Student-Designed Space Station Simulation

On {date}, students from neighboring middle school technology classes will tour our space station of the future. In order to be included, technology classes must contribute by designing and constructing part of the space station. There will be an initial meeting of designated student representatives from technology classes in each school. These representatives will coordinate the collaborative efforts of their classes, making sure that all systems (e.g., environmental control, communications, power) are covered and that everything fits together. Please call {name and phone number} to reserve your program's place in Alpha-Seven.

The success of Alpha-Seven would hinge on the cooperation of students within their technology classes as much as on the coordination of the different technology classes from different schools.

4.0 Roles in Cooperative Learning

Cooperative learning techniques might not be familiar to many teachers and students. There will be an adjustment period during which the teacher and the learner new to cooperative learning will assimilate to this new technique. The roles of the teacher and the learner are different in cooperative learning than they were in a traditional classroom.

4.1 The Role of the Cooperative Learner

By using cooperative learning techniques, a teacher can delegate authority to groups of students. Cooperative learners, therefore, have responsibilities that may be new to them. In general, each member of a cooperative learning group has the following responsibilities:

1. Each group member should make constructive contributions to the group's efforts.
2. Group members should encourage their fellow group members to contribute.
3. Group members should keep each other on task, working toward their shared goal.
4. Compromise is required from all cooperative learners.
5. Those in a cooperative learning group should treat each other with care and respect. They should do their best to teach and learn from each other. They should adopt the axioms: "All for one and one for all," and "The whole is greater than the sum of the parts."

It can sometimes aid cooperative learning if the different members of a cooperative learning group have distinct jobs within that group. For example, a different person may be assigned for each of the following jobs: researcher, designer, production manager, production engineer, production worker, quality control inspector, safety inspector. Jobs vary and they are not intended to prevent any group member from contributing in any way toward a group's effort. However, specific jobs for students tend to keep them on task and help them each keep track of the group's efforts.

Some students or observers might at first be unaccustomed to and confused by cooperative learning. They might have a notion that the teacher is the only person in the class capable of disseminating information and that the job of the student is only to recant the information supplied by the teacher. Students with high achievement can become resentful if their grades are based on fellow group members who might lack their ability or motivation. It is the job of the student to see the value of fellow group members and to encourage them to perform at their highest levels.

There might be a tendency for students to underestimate the efforts of fellow group members. If all group members refuse to contribute more than "their fair share," the group, as a whole, may suffer. Students should be encouraged to each contribute "more than their fair share" to the group.

Compromise is also needed. Students should make every attempt to resolve interpersonal problems within their groups. Only when this fails should students seek out the teacher for resolution of the problems.

4.2 The Role of the Cooperative Learning Teacher/Facilitator

On the surface, a teacher who uses cooperative learning techniques might seem to have less work than one who uses traditional techniques, since a good deal of academic learning time is dedicated to students learning from other students. On the contrary, a teacher who uses cooperative learning assumes a number of responsibilities. These include the following:

1. planning lessons, activities, and evaluation;
2. grouping students;
3. physical placement of students;
4. presenting and explaining the task to the students;
5. monitoring group activities and intervening when necessary;
6. helping students with social skills; and
7. evaluating students.

It is advised that the teacher use a wide variety of cooperative learning groupings, in addition to individual and competitive learning. It would probably be a mistake to have students work in the same self-selected group for a number of activities. Instead, a teacher should place students in a wide variety of groups of 2, 3, 4, and more students. During the course of a semester, there is usually enough time for every student in a class to work with every other as a pair for some activity. Many different pairs and threesomes should also be established. At times, students should be given the opportunity to select their own groups. This can provide a type of support for the learner that might not be possible with teacher-selected groups.

By grouping together students with different capabilities, it might be possible to significantly improve the performance of under-achievers.

Heterogeneity can lead to greater confrontation but can also provide the group with a wider range of resources. Homogeneity, on the other hand, may lead to greater intimacy/affection, but promote less variety. This effect can restrict the number of learning possibilities available to the group. (Cooper, 1979, p. 55)

Figure 1. A comparison of the behaviors used in direct and supportive supervision (Cohen, 1972, p.97)

Direct Supervision	Supportive Supervision
Lecturing and instructing	Giving feedback
Telling students how to do task	Redirecting group with questions
Disciplining	Encouraging group to solve its own problems
Getting students back on task	Extending activity
Working with one group	Encouraging thinking
Recitation	Managing conflict
Monitoring seatwork	Observing students

In general, the teacher should create groups that are heterogenous in regard to: academic performance, sex, race, culture, physical ability, and experience. However, the teacher should realize that homogenous groupings may at times be useful to the students, academically, socially and psychologically.

Cohen (1972) suggests that cooperative learning teachers become accustomed to "supportive supervision" rather than the traditional "direct supervision." As illustrated in Figure 1, supportive supervision entails jobs associated with facilitating the learning process.

A cooperative learning teacher must be patient enough for the group members to interact. Groups require a crucial amount of time before the students begin to feel relaxed and comfortable with each other. Group time is also required for ideas to incubate and grow. Some traditional teachers may not be accustomed to allowing groups to have this important time. This is not to say that the teacher should wait for the slowest group to finish their discussions before bringing everyone back together. On the contrary, the teacher might subtly prompt all groups with a statement such as: "Please finish your group work in three minutes." Conversely, some groups will tend to finish much quicker than others. The teacher should encourage these groups to enhance their results, elaborate, or explore other avenues or tangents.

Probably the most difficult aspect of cooperative learning for many teachers is to have enough self control to let the students make their own discoveries and solve their own problems. Some teachers are easily tempted to intervene wherever students disagree with one another. Teacher intervention should only be a last resort; the students should first try to work out their conflicts on their own and with the help of their fellow students.

As with traditional learning, a key to successful cooperative learning is teacher preparation. Cooperative learning activities may require more planning than traditional lectures. The teacher must not only plan his or her delivery of the content, it is also necessary to plan student activities and evaluation. Timing is especially important in dynamic cooperative learning settings where students are to accomplish different tasks at different stations with different partners.

5.0 Assessing Cooperative Learning Experiences

When it comes time to assess students and assign grades, how does one evaluate student progress? Two major areas may be assessed. First the teacher may assess what each

individual learner accomplished. And secondly, you may assess how well the student participated as a member of the team.

If the students participated in a small group cooperative learning team, did all team members contribute equally and what were the results of their efforts? Did they have to build a project or complete an experiment? What quality were the results? How did the written material to support the activity appear? If the work met the criteria for the grade of B, assign that grade or its corresponding points. If it was A or C level quality, assign that grade to all members of the team. This should only be done if all members of the small group participated equally.

In large group cooperative efforts, grades should be awarded toward individual member participation. If the student took part and achieved his/her role in the accomplishment of the activity, an appropriate grade should be assigned. In addition, tests could be given on the material learned or papers or student logs describing what they did could also be evaluated. Overall, team participation is a somewhat subjective assessment (what did you observe).

SUMMARY

Technology teachers should use a variety of small, large and whole-class cooperative learning groups. However, cooperative learning is not always appropriate; at times, the teacher should use non-cooperative learning, where the students work individually or competitively.

Cooperative learning may take some time to get used to. A teacher who is accustomed to being the sole source of information and learning in the classroom must not only allow, but should actively encourage students to help each other and to learn from each other. The appropriate use of cooperative learning techniques has been shown to have both academic and social benefits to students, while also offering benefits to the teacher. Technology education is especially well suited for cooperative learning

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