Using Cooperative Learning in Design and Technology

Abstract

This paper examines some general aspects of cooperative learning in relation to the activity of designing and making by students in design and technology. Cooperative learning has a considerable body of research validating its effectiveness. Over the past 90 years, 550 studies have been conducted comparing the relative effectiveness of cooperative, competitive, and individualistic learning. Cooperative learning consistently proved that it improves achievement and retention, creates more positive relationships among students, and promotes students' psychological health and self-esteem.

Cooperative learning

Cooperative learning is a generic term for various small group interactive instructional procedures. Students work together on academic tasks in small groups to help themselves and their teammates learn together. Cooperative learning is the instructional use of small groups so that students work together to achieve shared goals. In cooperative learning groups, students are given two responsibilities: to learn the assigned material and to make sure that all other group members do likewise.

Cooperative learning may be used to teach specific content (formal cooperative learning groups) to ensure active cognitive processing information during teaching (informal cooperative learning groups), and to provide long-term support and assistance for academic progress (cooperative base groups). Any assignment in any curriculum for any age student can be structured cooperatively if the teacher has the relevant training.

The purpose of cooperative learning is to make each group member a stronger individual in his or her own right. There should be a pattern and flow to classroom learning – learn it together, perform it alone. Cooperative learning differs from traditional classroom grouping, demanding teachers to carefully structure the groups so that students believe they:

- sink or swim together

- assist and encourage others to achieve

- are individually accountable for doing their part of the group's work

- have to master the required interpersonal and small group skills to be an effective group member

- should discuss how well the group is working and what could be done to improve the group work.

Cooperative learning enhances student learning by:

- providing a shared cognitive set of information between students

- motivating students to learn the material

- ensuring that students construct their own knowledge

- providing formative feedback

- developing social and group skills necessary for success outside the classroom

- promoting positive interaction between members of different cultural and socio-economic groups.

Cooperative learning methods share five characteristics.

1. Students work together on common tasks or learning activities that are best handled through group work.

2. Students work together in small groups containing two to five members.

3. Students use cooperative, pro-social behaviour to accomplish their common tasks or learning activities.

4. Students are positively interdependent. Activities are structured so that students need each other to accomplish their common tasks or learning activities.

5. Students are individually accountable or responsible for their work or learning.
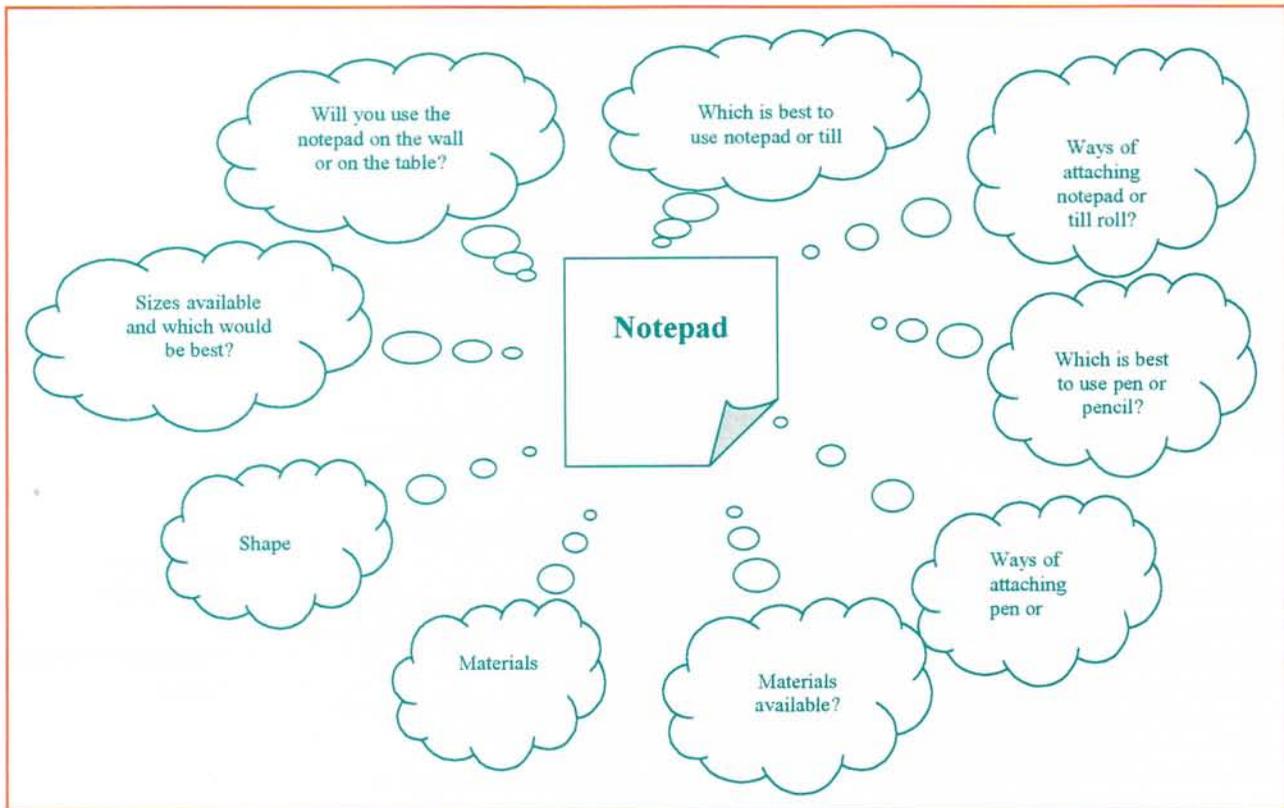
Task features

The effects of cooperation vary according to the task. Some tasks prevent the activation of the procedures mentioned above, while other tasks are appropriated. For instance, some tasks are inherently distributed and lead group members to work on their own, independently from each other. Interaction occurs when assembling partial results, but not during each individual's reasoning process. Without interaction, none of the described mechanisms can be activated.

Some tasks are so straightforward that they do not leave any opportunity for disagreement or misunderstanding. Some tasks do not involve any planning and hence create no need for mutual regulation. Some tasks cannot be shared, because they rely on processes (e.g. perception) which are not open to introspection or on skills (e.g. drilling) that leave no time for interaction.

Georgios Koutsides

Pedagogical Institute, Cyprus

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The following text appears in thought-bubble clouds surrounding a central "Notepad" box:

- Will you use the notepad on the wall or on the table?
- Which is best to use notepad or till
- Ways of attaching notepad or till roll?
- Sizes available and which would be best?
- **Notepad**
- Which is best to use pen or pencil?
- Shape
- Ways of attaching pen or
- Materials
- Materials available?

Cooperative learning structures and techniques

There are many different ways for a teacher to utilise group work. Below is a list of suggested types and descriptions of different cooperative learning styles.

STAD: Student teams achievement division

The teacher presents information to students. A cooperative task is tagged on at the end. Before the lesson begins, the students are placed in groups. The teacher explains the purpose of the lesson and then presents the necessary information. The teacher then gives the groups one handout with questions and another handout with the answers. Each group is given 20 minutes to figure out why the answers are correct. Next, the students are given a short quiz over the answers and the questions. The group with the highest average score is rewarded.

Structured academic controversy

The teacher introduces the topic the students will be studying. He or she then helps the students gather background information on that topic. The students are split into four-person groups, with two pairs of two. Each pair of students studies one side of the debate. Each pair presents their argument. As a test of their listening and questioning skills, the pairs reverse sides and argue for the opposing perspective. The students then get together and try to reach a consensus about the debate.

TGT: Teams-games-tournaments

Students are assigned to four- or five-member teams. Each week the teacher introduces new material. The teams then do study work sheets together as a group. At the end of the week, the team members compete in 'tournaments' with members of other teams to add points to their team scores.

Jigsaw II

Students are assigned to heterogeneous work groups. Each member is also a part of an expert group. Work groups meet and decide which part of the material each student will become an expert on. After becoming experts, team members join their expert groups and review what they have all learned. They will then return to their work groups and teach their work group the expert information.

Numbered heads together

Students are assigned to cooperative learning groups and count off by numbers. The teacher gives the group a question. The group works together to answer the question so that all members understand the answer and its reasoning. The teacher then calls on a number to answer the question.

Structured problem-solving

Structured problem-solving can be used in conjunction with several other cooperative

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learning structures. Have the participants brainstorm or select a problem for them to consider. Assign numbers to members of each group. Have each member of the group be a different number. Discuss the task as a group. Each participant should be prepared to respond. Each member of the group needs to understand the response well enough to give the response with no help from the other members of the group. Ask an individual from each group to respond. Call on the individual by number.

Double entry journal

The double entry journal can be used as a way for students to take notes on articles and other resources they read in preparation for class discussion. Students read and reflect on the assigned reading(s). Students prepare the double entry journal, listing critical points of the readings (as they see them) and any responses to the readings, in general, or specific critical points. Students bring their journal notes to class. Once in class, students may use their double entry journal to begin discussion, to do a paired annotation, or for other classroom and group activity.

Structured learning team group roles

When putting together groups, you may want to consider assigning (or having students select) their roles for the group. Students may also rotate group roles depending on the activity. Potential group roles and their functions include:

- Leader – The leader is responsible for keeping the group on the assigned task at hand. S/he also makes sure that all members of the group have an opportunity to participate, learn and have the respect of their team members. The leader may also want to check to make sure that all of the group members have mastered the learning points of a group exercise.

- Recorder – The recorder picks and maintains the group files and folders on a daily basis and keeps records of all group activities including the material contributed by each group member. The recorder writes out the solutions to problems for the group to use as notes or to submit to the instructor. The recorder may also prepare presentation materials when the group makes oral presentations to the class.

- Reporter – The reporter gives oral responses to the class about the group's activities or conclusions.

- Monitor – The monitor is responsible for making sure that the group's work area is left the way it was found and acts as a timekeeper for timed activities.

- Wildcard (in groups of five) – The wildcard acts as an assistant to the group leader and assumes the role of any member that may be missing.

Why try cooperative learning in design and technology?

Cooperative learning promotes academic achievement, is relatively easy to implement, and is not expensive. Children's improved behaviour and attendance, and increased liking of school, are some of the benefits of cooperative learning (Slavin, 1987). Macaulay and Gonzalez (1996) characterised it as the instructional use of small groups so that learners are able to work together in a manner which enhances both group and individual learning. Despite the rhetoric of any curriculum, the use of cooperation as a learning mechanism is almost ignored in practice in design and technology and has not previously been the subject of research.

The potential of design and technology as an environment for using cooperative learning will be discussed since peer collaboration is considered to be a valuable mechanism which has not been exploited by teachers or explored by researchers. Hennessy and Murphy (1999) believe that design and technology is a unique subject for involving procedural problem solving activity where cooperative learning between peers relates to physical manipulation and feedback and both concrete models and graphical representations play an important mediating role. Hendley and Lyle (1995), in an article they endorse, claim that design and technology is potentially a very rich environment for cooperative learning. I would like to assert that cooperative learning can assist students in developing a range of designing skills as outlined in the National Curriculum for design and technology in England and Wales, providing an opportunity to: generate and test out their ideas on each other, decide on a specific task to undertake, consider a design brief, develop product specifications, generate design proposals, choose materials and consider the capacities and limitations of tools and equipment (DFE/WO, 1995).

In addition to the positive outcomes, cooperative learning in design and technology also promotes student motivation, encourages group processes, fosters social and academic interaction among students, and rewards successful group participation. As part of a learning team, students can achieve success by working well with others. Students are also encouraged to learn material in greater depth than they might otherwise have done, and to think of creative ways to convince the teacher that they have mastered the required material.

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Cooperative learning helps students feel successful at every academic level. In cooperative learning teams, low-achieving students can make contributions to a group and experience success, and all students can increase their understanding of ideas by explaining them to others (Featherstone, 1986).

Components of the cooperative learning process as described by Johnson and Johnson (1984) are complimentary to the goals of primary and secondary education. For example, well-constructed cooperative learning tasks involve positive interdependence on others and individual accountability. To work successfully in a cooperative learning team, however, students must also master interpersonal skills needed for the group to accomplish its tasks. Cooperative learning has also been shown to improve relationships among students from different ethnic backgrounds. Slavin (1990) notes: 'Cooperative learning methods sanctioned by the school embody the requirements of cooperative, equal status interaction between students of different ethnic backgrounds...' When children are taught the skills needed for group participation when they first enter a structured setting, the foundation is laid for later school success.

Nevertheless, the literature converges on the conclusion that cooperative learning is an important aspect of problem solving and in general design and technology, which enhances learning (including planning) by making thinking more explicit and accessible and enabling students to construct joint understandings of tasks and solutions. The above is also leading us to conclude that despite the positive implications from the literature on the role of cooperative learning, there is a distinct lack of evidence for it in design and technology classrooms and a clear need for research in this area. This is very well in theory; classroom-based research is desperately needed to explore the role of cooperative learning in facilitating technological problem solving if we are to move away from the teacher-led problem solving we typically see.

How can teachers use cooperative learning strategies in design and technology?

Cooperative learning is important in education because it is one method through which a teacher can create a caring environment in the classroom. Group work allows the free expression of ideas through discussion, which also lays the foundation for the development of democratic citizenship. Cooperative learning can facilitate a multicultural classroom, for the teacher can ensure that learning groups are diverse in their composition. Inclusion of special education students is also promoted through the use of collaborative learning groups. Furthermore, a teacher can decrease the negative side effects of tracking by creating mixed ability groups in the classroom. Research has indicated that by working cooperatively in groups, students have improved their levels of academic achievement, interpersonal and social skills, increased their time on task, and have had positive effects of student self-concept. Throughout cooperative learning activities, a teacher must make sure that he or she is monitoring the effectiveness of the instructional approach and the effectiveness of the groups. By observing, a teacher can plan future lessons and address any prevalent issues on cooperative learning.

Foyle and Lyman (1988) identify the basic steps involved in successful implementation of cooperative learning activities:

1. The content to be taught is identified, and criteria for mastery are determined by the teacher.

2. The workshop is arranged to facilitate group interaction.

3. Group processes are taught or reviewed as needed to assure that the groups run smoothly.

4. The teacher develops expectations for group learning and makes sure students understand the purpose of the learning that will take place. A time line for activities is made clear to students.

5. The teacher presents initial material as appropriate, using whatever techniques she or he chooses.

6. The teacher monitors student interaction in the groups, and provides assistance and clarification as needed. The teacher reviews group skills and facilitates problem solving when necessary.

7. Student outcomes are evaluated. Students must individually demonstrate mastery of important skills or concepts of the learning. Evaluation is based on observations of student performance or oral responses to questions; paper and pencil need not be used.

8. Groups are rewarded for success. Verbal praise by the teacher, or recognition in the class newsletter or on the bulletin board can be used to reward high-achieving groups.

Conclusion

Cooperative learning methods hold great promise for accelerating students' attainment of high academic standards and the development of the knowledge and abilities necessary for thriving in a multicultural world. However, like other innovations, cooperative learning approaches need to be tailored to the cultural and linguistic context in which they are used. Designed and implemented by teachers who are loyal to the key elements of cooperative learning and dedicated to regarding diversity as a resource, cooperative approaches can create supportive environments that enable students to succeed academically, enhance their employability, and improve their interpersonal relationships.

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