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Activities

Getting Started

All the activities in this handbook are designed to be performed in cooperative groups. Each student in the group is assigned a specific responsibility or role. In this way everyone shares in the group's success and every student must participate. No one can easily take over a project, nor choose to let someone else do all the work. Whether you are new to using cooperative learning or are a veteran, here are some tips on getting started.

- Read the entire activity in advance. Each activity defines group roles and recommends group size. Determine specific roles and group size that will work best for your students.
- Students may have more than one role. Roles labelled 'optional' are not critical, but do offer roles for all students when larger groups are used.
- Assign roles in advance. This is your opportunity to have a quiet child practise a leadership role, or to have the overzealous child in a position of having to let other children participate.
- Form same gender groups. Children prefer this and it is more supportive to girls learning in science.
- Have all supplies ready. Materials listed are specified for individual or per group.
- The procedure is a guide for you, the teacher. It explains the steps necessary for performing the activity. Some steps need to be done in advance, making it important to read the procedure beforehand.
- Try the activity before presenting it to the students.
- The 'Additional Suggestions' section offers ways to expand student learning. Use these ideas, your own, or let your students take the lead in sharing their ideas.
- Look for 'Cooperative Learning Highlights' beginning on page 8. Try activity #1, 'Building a Structure', as a practice activity.
- Working in cooperative groups takes practice. The Group Evaluation Form (page 10) and Self-Evaluation Form (page 11) help students measure their growth in individual and group cooperative skills. They give students the opportunity to self-reflect and to work on areas of weakness. Look for improvements as students participate in more cooperative activities.
- Review role responsibilities at the beginning of each activity. Make sure the students keep their assigned roles. Role identification cards of some kind help avoid any confusion.
- Encourage students to take their roles seriously, to be respectful and to have fun.

PHYSICAL SCIENCE

Building a Structure

Build a freestanding marshmallow and straw structure at least 60 cm tall. Each member of a successful group will receive a prize.

Group size: 3 to 5 students

Group roles:
- Facilitator - gets materials, opens packages, coordinates cleanup
- Timekeeper - informs group of time remaining to complete activity
- Measurer - uses metre ruler to measure height of structure
- Worker - all students
- Encourager - all students
- Checker (optional) - makes sure group understands criteria for success
- Consultant (optional) - seeks answers to questions from outside sources
- Observer (optional) - observes and evaluates the group's collaborative process; does not participate in the activity (remains silent)

Materials: (Per group)
- One bag of normal size marshmallows
- 50 straws
- One metre ruler
- Prize for each group member

Procedure:
1. Explain to the students the goal of this activity.
2. Build a demonstration structure by inserting straws into the marshmallows.
3. All marshmallows and straws must be used. No eating allowed.
4. Set a reasonable time limit so that each group can complete the task (20–30 minutes).
5. Explain and assign roles.

Additional suggestions:
- This is a great activity to practise cooperative learning. Have students complete self-evaluations. Complete group evaluations.
- Have students evaluate each structure, noting what was successful and what failed. Then have each group design an improved structure. Repeat the activity to test the new design.

PHYSICAL SCIENCE

Build a Toothpick Bridge

Build a bridge using toothpicks and wooden skewers that will support the weight of 100 common nails. Each successful group will receive a surprise.

Group size: 3 to 5 students

Group roles:

- Facilitator - gets and hands out materials, coordinates cleanup
- Weigher - supervises weight-testing process within group
- Recorder - writes down design plans
- Checker (optional) - makes sure the group understands criteria for success
- Consultant (optional) - seeks answers to questions from outside sources
- Worker - all students
- Encourager - all students

Materials:

- 50 flat toothpicks per student
- 50 flat toothpicks per group
- 2 wooden skewers per student
- 2 wooden skewers per group
- PVA glue
- waxed paper
- two 1-metre lengths of twine per group
- 1 litre fruit basket or small basket with a handle per group
- 100 common nails (2 kilograms) per group
- newspaper to protect the desks
- group or individual prize, e.g. 'Engineer of the Year' certificate

Procedure:

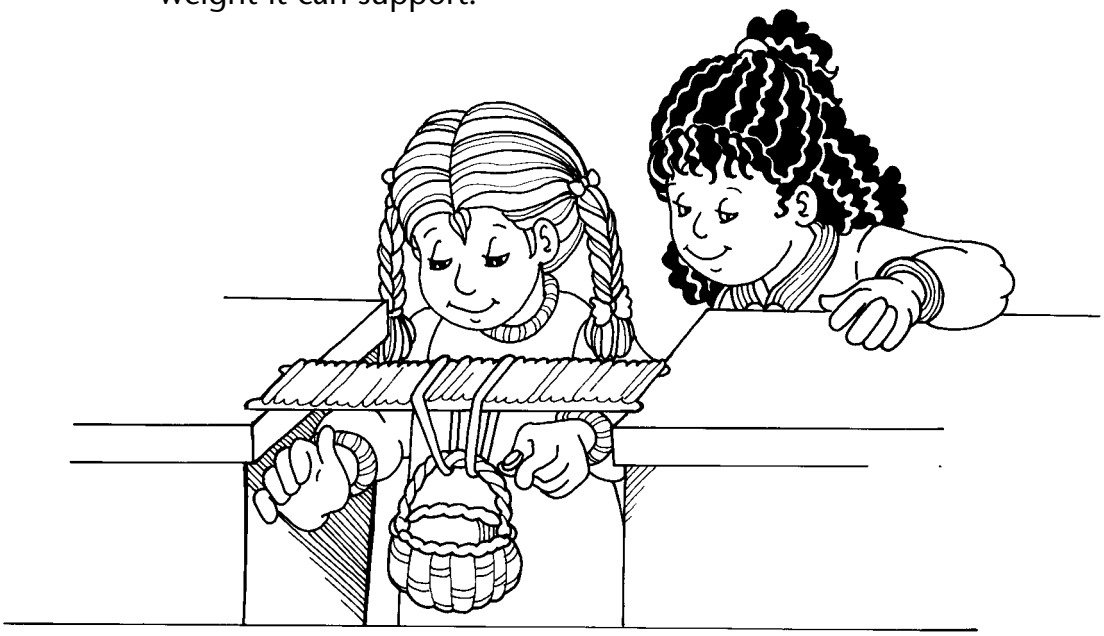
1. Show a model of a completed bridge and demonstrate how it will be tested (directions follow procedure).
2. Explain and assign roles.
3. With group support, students build toothpick bridges in designs they think will support the weight. Allow bridges to dry for at least one day.
4. Have groups determine the strongest design by testing the weight support capabilities of each bridge (see over 'Testing the bridge'). Remind students that the bridges might break and to learn from that outcome.
5. Each group should evaluate the designs of team members' bridges to determine the configurations that seem to provide strength.
6. Each group creates a design for a new bridge that the group feels will be the strongest. The recorder draws it.
7. Have each group build a new bridge based on its design.
8. Encourage each group to test the bridge's strength.

How to build a toothpick bridge:

1. On a piece of waxed paper lay two skewers parallel to each other approximately 5 cm apart.
2. Glue each toothpick across the skewers in any configuration. Do not break any toothpicks. Use no more than 50 toothpicks.
3. Do not lift the bridge until the glue is dry.
4. Let dry at least 24 hours. The waxed paper may stick to the bridge, but it can easily be ripped off.

Testing the bridge:

1. Tie one end of the twine to each corner of the basket so that the basket can hang down (if a handled basket is used, skip this step).
2. Carefully feed the bridge through the loops of the twine (or handle of the basket) so that the basket hangs below the bridge.
3. Push equal height desks near each other. Place the bridge across the gap created by the desks. The basket should hang freely in the gap.
4. Slowly add nails to the basket until the bridge cracks, falls or, if the bridge is structurally sound, supports the weight. The number of nails in the basket at the point when the bridge breaks or falls is the maximum weight it can support.



Additional suggestions:

- Have the students comment on designs of real bridges they have seen, particularly the undersides of the bridges.
- Encourage the students to design bridges that hold various amounts of weight.
- Experiment with differing numbers of toothpicks.
- Research careers in engineering and/or architecture.