Bringing Science to Life

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How To Use Cooperative Learning

Secondary Learners:

- Group members are responsible for the performance of each individual learner.
- Group members are individually accountable and must be able to report on or explain the team's results.
- The groups are to be assigned by the teacher. Their make-up should be heterogeneous with respect to sex, race, socioeconomic status, ability/learning styles, cliques, and other important factors.
- Leadership is shared on a rotating basis. Each team member has a job and responsibilities.
- The teacher is a resource; students are in charge of their own learning.
- Time must be allowed for group processing and self-evaluation.

Job Assignments:

Group Leader

1. Reads all directions to group
2. Leads the discussions
3. Checks the data sheet
4. Helps with clean-up
5. Is the only one who can ask a question of the teacher

Materials Manager

1. Is responsible for collecting and returning all materials & supplies to the appropriate place(s)
2. Is the only one who can get up for materials and supplies
3. Makes sure the everyone in the group has equal access to the materials and supplies
4. Checks the data sheet
5. Helps with clean-up

Time Keeper

1. Holds the team stopwatch (or watches the clock)
2. Keeps group on task and reminds them about time
3. Is responsible for getting the group to finish on time
4. Checks the data sheet
5. Helps with clean-up

Data Collector

1. Collects the data for the activity
2. Records data on the appropriate form or sheet
3. Returns data sheet to teacher and/or records group data on class data sheet
4. Makes sure all other team members check the data sheet
5. Helps with clean-up

Since this is not a perfect world, and all class populations are not divisible by four, I have a fifth job that can be assigned in a group:

Encourager

1. Monitors other team members to make sure they do their own jobs
2. Takes responsibility for praising and affirming jobs that are well done
3. Records comments and actions that show positive interpersonal communication
4. Reports recorded data to group at de-briefing session
5. Helps with clean-up

If a group of four has one member absent, two of the jobs can be combined for that day.

Part of the group's participation grade is based on how well each team member performs her/his job. Points are deducted if one team member does another team member's assigned responsibility.

Group Participation Number Line

Date: _____**Group Number:** _____

Group Members Present: _____
_____
_____

100 95 90 85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10 5 0

Participation Points Earned: _____

There is nothing chaotic about cooperative learning that is well-planned and well-managed. Teachers should plan activities that are challenging and yet doable if the group members work together. Tasks should require the concentrated efforts of all team members doing their jobs and working with in the allotted time. Materials and supplies should be out and sorted before students arrive. During the cooperative learning activity it is the responsibility of the teacher to monitor the students and:

- Give immediate feedback and reinforcement for learning
- Re-teach certain concepts if necessary
- Clarify directions
- Encourage oral elaboration
- Affirm positive interactions and efforts
- Informally assess student learning and collaboration

MISSING MOTHS

From AIMS Activities Critters Life Science

This activity helps students discover the relationship between camouflage and survival. It also teaches them about adaptation.

MATERIALS:

- pieces of different colored construction paper
- newspaper
- moth patterns
- activity sheets
- glue and/or tape
- scissors
- crayons, markers, colored pencils

BACKGROUND INFORMATION:

Animals are adapted to their environments in many ways. Animals may be adapted to changes in their habitats. For example, snowshoe rabbits have a white winter coat to blend with a snowy environment and a tan summer coat to blend with summer ground and vegetation colors. Chameleons change color to blend with their surroundings. The walking-stick insect can look like a twig or stick. Fawns have spotted hair that resembles dappled light on the forest floor.

Some animals use their coloration to hide from predators. One dramatic example of protective coloration occurred with the sphinx moths in Manchester, England in the 1880s. Before 1850 most of the moths were light colored. They escaped birds that would eat them by blending into the light-colored bark on surrounding trees. Beginning in the Industrial Revolution the factories burned materials that coated the surrounding trees with black soot. This made the light-colored moths easy prey for their predators. Gradually the light-colored moths diminished and were replaced by dark-colored moths. The first black moth was recorded in 1848. By the 1900's about 95% of the sphinx moths were dark-colored. However, due to cleaner fuel being burned in recent years, the light colored moths are now increasing in population. This example clearly illustrates the concept of adaptation.

PROCEDURE:

1. Before the lesson, prepare the "moth environment" by taping together two sheets of newspaper want ads. (Be sure to use parts with small print.)

2. Use the moth pattern to cut out moths from green, brown, and white paper. Also cut moths from newspaper want ads. (You can use identical want ads so that the newspaper moths will blend perfectly to their environment.)

3. The "moth environment" can be laminated, if you wish.

4. Place the “moth environment with the moths in a visible location in the classroom. Cover it with newspaper, butcher paper, or whatever is convenient.

5. After student arrive, tell them that when you drop the cover they will have 15 seconds to estimate the total number of moths.

6. Pass out the activity sheets.

7. Remove the cover for 15 seconds, then replace it.

8. Have the students complete the first section of their activity sheets by recording their estimates of the number of each type moth and the total number of moths. Discuss the estimates.

9. Uncover the “moth environment” and count the actual number of each type moth and total number of moths. Have students write the data on their activity sheets.

10. Discuss the reason for the difference between the estimated and actual numbers. Reinforce the idea of camouflage as a means of survival.

11. Have students complete the graph on their activity sheets.

12. Have students cut out the moth pattern from their activity sheets. Tell them they are going to choose a spot in the room to hide a moth. Encourage them to use crayons, markers, colored pencils, etc. to camouflage their moths.

13. Students play “Missing Moths” much like the children’s game, *I Spy*. One group of students places their moths in their chosen “habitats” while the rest of the students hide their eyes. (Moths must be placed in plain sight and not hidden under or behind something.)

14. When the rest of the students uncover their eyes, have them count how many moths they actually see.

15. Discuss why some moths are easier to see than others. Tell them about the sphinx moth (from Background Information).

DISCUSSION QUESTIONS:

1. Discuss other animals that use camouflage and tell how it is important to their survival.

2. Does a mountain lion use its coloration to protect it from predators? How else could its coloration help it survive?

3. How have humans adapted camouflage for their use? Describe several situations in which humans use coloration for a purpose.

4. Is color the only part of camouflage? What are some ways other than color that animals can be disguised?

EXTENSIONS:
Do Project WILD activities, *The Thicket Game* and *Surprise Terrarium*.

Name- _____

MISSING MOTHS

Types of Moths Estimate Total # of Moths Estimate

1. _____ _____ _____ _____

Types of Moths Actual Total # of Moths Actual

2. _____ _____ _____ _____

Actual Number of Each Type of Moth

3.

_____	_____	_____	_____
#1	#2	#3	#4
green	brown	white	other

4. Circle the type of moth that was easiest for you to see.

EASY TO SEE MOTHS

# of Students	Type 1	Type 2	Type 3	Type 4
26				
24				
22				
20				
18				
16				
14				
12				
10				
8				
6				
4				
2				
0				

Invent an Animal

Adaptation and Camouflage

Objectives: To invent an imaginary animal that is camouflaged for hunting and or hiding in its habitat. Students will gain an appreciation of how animals "fit" their environment.

Concepts: All life forms show adaptations to the environments in which they live. Many species over time have evolved coloration, form, and patterns to help them blend with their natural surroundings.

Materials: Potatoes, paint, brushes, toothpicks, tongue depressors, pipe cleaners, clay, tape, sticks, glue, and other materials used for constructing animals.

Procedure: Discuss with students about general concepts of protective coloration and camouflage. Challenge students to invent an animal that can best be adapted to its habitat and niche.

Divide the students into two groups. Ask each group to examine a different habitat previously selected by the teacher. (Try to use areas as diverse as possible). Allow them to collect natural objects to use in disguising their animals. Give students time to construct their animals (20 -30 minutes) then hide them in their designated habitat.

Ask one group to try to find the other group's animals. Time how long it takes to locate all the creatures. Reverse the process, and let the hiding team try to find the recovering team's animals. Note time and compare teams' results.

Discussion:

1. Why were some animals easier to find than others?
2. In what other habitats would your animal be well camouflaged? Not at all camouflaged?
3. What special adaptations to you include on your animal to help it adapt to its environment?
4. Name some animals not protected by camouflage. How do they protect themselves from predators? How are they able to capture prey?

Extensions:

- Invent a plant that might be adapted in one or more of these ways:
  - lawnmower-proof
  - able to catch insects
  - able to compete for sunlight
  - able to store water
  - inedible to animals
  - other _____

BIRD BEAKS

(adapted from "Breakfast for the Birds" National Science & Technology Week '88 Elementary Activity Guide)

OBJECTIVES:

- Students will describe the relationship between beak shape and size and the type of food the bird eats.
- Students will graph the data they collect.
- Students will describe similarities and differences among a variety of beaks.

MATERIALS:

for bird beaks

- Unsweetened puffed cereal, one box
- Plastic, paper, or styrofoam cups, 3-ounce or larger, one per student
- Craft or popsicle sticks, one per student
- Pictures of birds with varied beaks
- Experience chart
- Markers
- Student activity sheets, one per student

Before class, fill each cup half full of puffed cereal and insert a craft stick

For the best beak

- small marbles (about 60)
- raisins (about 60)
- uncooked cylinder macaroni or short lengths of drinking straws (about 60)
- styrofom packing beads (about 60)
- one box of round wooden or plastic toothpicks
- 8 large spring-type clothespins
- 8 pair of student scissors
- large plastic containers, one per group of 4 students
- plastic sandwich bags, one per student

Before class, fill the plastic containers 2/3 full of water

Best beak graphs

* Pictures of a hummingbird and a blue jay
* Crayons
- Graphs, one per student

BACKGROUND FOR THE TEACHER

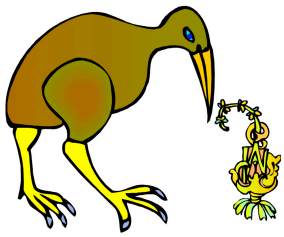
"Tie a man's hands behind his back, stand him on his feet, and tell him that he must thereafter find, catch, and prepare his food, build his house, defend himself against his enemies, and perform all the business of life in such a position, and what a pitiable object he would be." -- *William Beebe, naturalist*

Birds are in a position similar to the one Beebe described. Through time, the forelimbs of ancient birds evolved into wings, which are superb for flying, but

relatively useless for the tasks mentioned in the quotation. Instead of using forelimbs and hands to perform survival tasks, birds have a unique and wonderful tool – a beak. The beak of a bird is essentially a lightweight, bony extension of the skull. The skin covering the beak of a bird generates ***keratin*** (the same material that makes up the fingernails and hair of humans). The keratin compacts and dries, forming the tough, glossy, hard outer covering of the beaks of most birds. The tip and cutting edge of the beak are continually renewed as they wear away. Beaks weave nests, defend territories, attach rivals, groom feathers, communicate, and most importantly, gather or capture food.

A wide diversity of bird beaks has evolved over time. Although many birds have straight beaks adapted to general feeding, the following birds have beaks that are examples of unique adaptations:

- Eagles and other raptors have strong, hooked beaks that tear flesh.
- Anhingas and herons spear or grasp fish and frogs with dagger-like bills.
- Pelicans use their pouched beaks as nets to dip for fish.
- A flamingo holds its bent bill upside down in shallow water. As the flamingo's tongue pumps water in and out, the teeth-like ridges of the bill strain out algae and small animals.
- The red crossbill's upper beak twists in one direction and the lower beak twists in the opposite direction, creating a unique tool for extracting pine seeds from an open cone.
- Hummingbirds draw nectar from flowers with a tubular tongue protected by a hollow beak.
- Swallows and whippoorwills catch flying insects with their large, gaping mouths.
- Cardinals and grosbeaks use their short, cone-shaped beaks to crack open seeds.
- Snipes and kiwis have long beaks they use to probe for worms and other small animals in the mud and water.
- Woodpeckers use a chisel-type beak to search for insects in trees.
- The yellow-bellied sapsucker drills into living trees, and feeds on the sap and the insects attracted to the holes.



BIRD BEAKS

1. Give each student a cup of cereal. Tell students to eat the ceral using the craft stick as an eating utensil. Explain that they can use their finers to hold the craft stick and cup, but they cannot pick up the cereal with their fingers. (Hint: This should be a difficult task for the students).

2. After one minute of attempted feeding, gather the class for a discussion. Ask the students what happened when they tried to eat the ceral. Then ask for suggestions of better things to use to eat puffed cereal.

3. Help the students realize that different foods require different utensils or tools by asking questions such as:
   a. Would you use a straw to cut a watermelon? Why not?
   b. Would you eat soup with a fork? Why not?
   c. Would you use a spoon to eat a raw apple? Why not/

4. Ask the students to name the utensil or tool birds use to capture their food. Show the class pictures of birds with different beaks. Ask the students to look at the birds' beaks and describe the similarities and differences. List these on an ALL BEAKS/SOME BEAKS experience chart.

ALL BEAKS	SOME BEAKS

THE BEST BEAK

1. Ask students why they think different birds have different kinds of beaks. Accept reasonable answers.

2. Tell the class that they are going to play a simulation game and pretend to be birds with a variety of beaks. In this game, each student will pretend to be a bird and will have a beak. The beaks do not work exactly like actual bird beaks, but they do represent the variety that exists in nature. In this activity, clothespins, spoons, scissors, and toothpicks represent beaks. Marbles, raisins, styrofoam beads, and macaroni represent snails, grubs, water bugs, worms respectively. The cereal cups represent the birds' stomachs.

3. Demonstrate the use of each beak (utensil) and the stomach (cup) as follows:
   - Clothespin: Hold the clothespin at the very end so that it opens as wide as possible. Pinch and release with one hand.
   - Toothpick: Hold the toothpick in one hand and carefully spear the food with it. Use one finger of the opposite hand to push the food off the toothpick into the cup.
   - Scissors: Insert the thumb and finger in the holes and hold the scissors downward. Use the scissors like tweezers. Do NOT use the scissors like a spear.
   - Spoon: Hold the end of the spoon and scoop the food. Use only one hand.
   - Stomach cup: Cups can be moved to the source of food, but they must be left upright on the floor or table for the food to be deposited.

4. Divide the class into groups of four students. Distribute a variety of beaks to each group and let each member of the group select a beak. (Be sure each type of beak is represented in each group). The students will keep the same beaks throughout the entire game. Supply a stomach (cup) for each group member.

5. Scatter approximately the same number of macaroni worms in the center of each circle. Give students a signal to begin picking up worms with their beaks and putting them into their stomachs. Once the students have exhausted the food source, discuss the difficulties they encountered in capturing the worms with various beaks.

6. Distribute a plastic bag to each student in the class. Tell the students to store their worms in the plastic bag. Refer to the contents of the plastic bag as *representative evidence*. Reassure unsuccessful students that they will have a chance to collect a food better suited to their beaks.

7. Repeat the “food-capturing” activity with the raisins, grubs, marble snails, and then with the styrofoam water bugs floating in the water-filled plastic containers. After each activity allow the students time to add their captures to their evidence bags.

8. Collect the beaks, cups, and water-filled containers.

BEST BEAK GRAPHS

1. Distribute *Best Beak Graphs* to students.

2. Tell students to empty the contents of their bas and sort the different foods into piles.

3. Have students record the data from their evidence bags on the graph.

4. Show cumulative data for the class on 3 Best Beak Graph overheads or on 3 large reproductions taped to a wall.

5. Discuss with students:

   - Which beak was best for capturing a variety of food?
   - Which beak was best at capturing only one or two foods? Which foods were captured? Why those foods?
   - What inferences can be drawn about the types of food best suited for certain birds?

6. Explain that birds that eat only one or few types of food are called *food specialists*. Most food specialists have beaks specially adapted (changed through time) for certain foods. If these foods are not available in the bird’s habitat, the bird must go somewhere else to find the special food or it will die. Ask the students to indicate which of the beaks belong to food specialist.

7. Ask the students to give examples of real birds that are food specialists. Show the class a picture of a hummingbird. Have students make inferences about what a hummingbird eats.

8. Explain that birds that eat a wide variety of food are called *food generalists*. These birsd can live in a greater variety of places than food specialists. Ask the students to indicate which of the beaks might belong to food generalists. Show the picture of the blue jay. Tell students that blue jays eat seeds, berries, nuts, grains, fruit, insects snails, small birds, frogs, salamanders, and eggs. Ask the class whether they would call a blue jay a food specialist or generalist.

Name- _____

BEST BEAK GRAPH

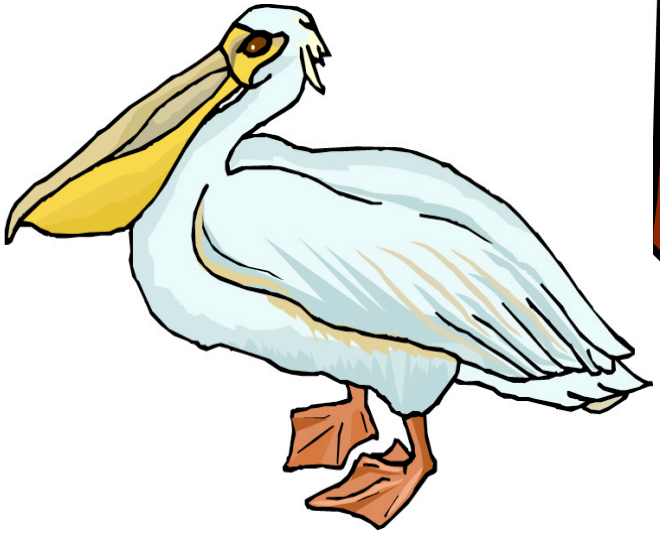
Type of Beak --

16				
15				
14				
13				
12				
11				
10				
09				
08				
07				
06				
05				
04				
03				
02				
01				
00				
	Worms	Grubs	Snails	Water Bugs

Crossbill

Woodpecker

Bluejay



Pelican

Hummingbird

Snipe

Fashion A Fish

(adapted from Project Aquatic by Debbie Silver)

Description

In this activity students will work in small groups to design habitats for their mystery fish. After selecting random structural traits from cards provided by the teacher, students will create a fish that combines all the characteristics they chose. They will name their creation as well as design its habitat.

Materials

Fish Trait Cards
Poster paper
Markers, colors, colored pencils, etc.
Printed materials and web resources about fish

Procedure

1. The teacher introduces the activity with a discussion about adaptive structures used by plants and animals to ensure their survival.
2. The teacher asks one member from each group to select one face-down card from each color group (each trait is a different color).
3. Group members create a fish that encompasses each characteristic on their cards. They name it and put its name on their poster along with the picture.
4. Group members decide the kind of habitat that would best suit their particular fish and draw it. (Discussion should include what it eats, what eats it, and how the adaptive structures help the fish survive.)
5. One member of each group (selected randomly by the teacher) presents their poster to the class and answers questions about their decisions.

Activity Resources: Monterey Bay Aquarium Web Site www.montereybayaquarium.org

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Fish Trait Cards (different colors for each trait)

Bodies
Streamlined
Torpedo-like
Flat side to side
Flat top to bottom

Eyes
Large
Small
Looking upward
Looking downward

Teeth
Small
Large
Sharp
Triangular

Tails
Squared
Forked
Pointed
Rounded

Mouth
Beaklike
Long jaws
Lower jaw extends beyond upper
Upper jaw extends beyond lower

Movement
Fast
Slow

Fins
Student choice

Colors
Dark on top and light on bottom
Light on top and dark on bottom
Brightly colored
Spotted

GALLERY WALKS

The Gallery Walk is an assessment that It can be used as a diagnostic, formative, or summative assessment. The teachers poses challenge questions for students to answer in small groups (2 to 5). Student groups rotate among the questions written on large pieces of newsprint or giant poster paper placed around the room. Each group has a different colored felt-tip marker with which they give one answer per poster. Answers cannot be duplicated.

Imagine that you are a bright orange butterfly. A predator moves into your habitat that preys on bright orange butterflies. *What could you do so that the population of bright orange butterflies survives?*

1. Start coming out at night when predators can't distinguish color very well.

2. Sit with wings folded up tight so color can't be seen.

3. Sit underneath leaves where they are less likely to be seen.

4. Spend time in fields of bright orange flowers where they would be hard to see.

5. Migrate to an area where other bright orange colored butterflies contain a poison and predators avoid <u>all</u> brightly colored butterflies.

6. Move to a place where there are no predators.

Helpful Internet Sites for Secondary

Activities for Secondary Science Students
http://www.asta.edu.au/st2003/audience/secondary.html
Excellent resource. Science & Technology Directory for 2003-2004.

Classroom Activities for Secondary Science
http://www.greece.k12.ny.us/task/activities/secondscience.htm
More resources and activities for secondary science teachers

KCK Secondary Science Assessment Prompts
http://kancrn.kckps.k12.ks.us/science/assessment/prompts.cfm
Great downloadable resources for alternative secondary science assessments

ICT Teaching and Assessing Science
http://ecs.lewisham.gov.uk/talent/secsci/TaLENT_SC5.htm
Ideas for teaching and assessing secondary science through ICT

New Teacher Resources
http://www.teachersfirst.com/unitlist.htm
Articles by and for new teachers. Suggested lesson plans with attention to the planning and management issues concerning new teachers

Sensational Science Activities
http://www.tufts.edu/as/wright_center/fellows/jbm_info/jbm6.html
Home page created for secondary science educators by John Banister-Marx. Good stuff!

Science Lesson Plans
http://www.col-ed.org/cur/science.html#sci1
This site, sponsored by the Columbia Education Center in Oregon provides a tremendous collection of elementary/middle level science lessons.

Teachernet Science Resources
http://www.teachernet.gov.uk/teachingandlearning/subjects/science/primaryscience/
One of the best sites on the internet for all kinds of activities, ideas, and integrated lesson plans for primary school science.

Using Lower Secondary Science Activities to Engage Below Level Students
www.eddept.wa.edu.au/outcomes/**science**/suppLsec.pdf
This downloadable PDF file has excellent ideas for differentiating secondary science activities for below level students.

Compiled by Debbie Silver, 2005

Helpful Internet Sites for Elementary

Assessment Ideas for the Elementary Science Classroom
http://www.sasked.gov.sk.ca/docs/elemsci/ideass.html
This site deals specifically with the needs of elementary/middle level science teachers. This is a wonderful resource! (Includes templates).

Children's Literature for Teaching Science
http://www.indiana.edu/~reading/ieo/bibs/childsci.html
ERIC resources for teaching science through children's literature.

Integrating Science in the elementary classroom
http://www.mcps.k12.md.us/curriculum/science/elem/elem.htm
Montgomery County, MD has a website that offers some of the most helpful teacher resources on the web. This page will help science teachers with integrating science and other subject areas.

New Teacher Resources
http://www.teachersfirst.com/unitlist.htm
Articles by and for new teachers. Suggested lesson plans with attention to the planning and management issues concerning new teachers

Problem Solving in Elementary Schools
http://www.indiana.edu/~reading/ieo/bibs/probele.html
ERIC resources that address problem solving. Useful links to other Internet resources.

Science Lesson Plans
http://www.col-ed.org/cur/science.html#sci1
This site, sponsored by the Columbia Education Center in Oregon provides a tremendous collection of elementary/middle level science lessons.

Supplements to Science Lessons
http://www.monroe2boces.org/programs.cfm?sublevel=350&subsubpage=82&subpage=54&master=3
BOCES2 website provides an array of elementary science lesson supplements. Excellent resources for teachers trying to differentiate instruction on particular topics.

Teachernet Science Resources
http://www.teachernet.gov.uk/teachingandlearning/subjects/science/primaryscience/
One of the best sites on the internet for all kinds of activities, ideas, and integrated lesson plans for primary school science.

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LIST OF RELATED CITATIONS
Bringing Science to Life
Presented for Staff Development for Educators
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Abruscato, J. (2001). *Teaching Children Science: Discovery Methods for the Elementary and Middle Grades.* Boston, MA: Allyn and Bacon.

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Martin, D.J. (2002*). Elementary Science Methods: A Constructivist Approach.* Albany, NY: Delmar Publishers.

National Science Teachers Association. (1997). *NSTA Pathways to the Science Standards: Guidelines for Moving the Vision into Practice (elementary school edition).* Arlington, VA:
National Science Teachers Association.

Feldkamp-Price, B.; Rillero, P.; & Brownstein, E. (1994). "A Teacher's Guide to Choosing the Best Hands-on Activities." *Science and Children (31)* 6, pp 16-19.

Periodicals for Science Teachers

Science and Children (elementary—a journal of the National Science Teachers Association) 3140 N. Washington Blvd., Arlington, VA 22201 http://www.nsta.org

Science Scope (elementary/middle grades-- a journal of the National Science Teachers Association) 3140 N. Washington Blvd., Arlington, VA 22201 http://www.nsta.org

Periodicals for Science Students

Dragonfly. National Science Teachers Association) 3140 N. Washington Blvd., Arlington, VA 22201 http://www.nsta.org

WonderScience (grades 4-6). American Chemical Society, P.O. Box 57136, Washington, DC 20037.