PROGRAMS/RESOURCES

AVAILABLE FOR

K-12

TEACHERS

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ASSOCIATION OF PROFESSIONAL ENGINEERS OF THE PROVINCE OF MANITOBA

Programs/Resources Available for K-l2 Teachers

The following are examples of programs or activities geared toward K-12 students. These programs are sponsored by various engineering and technical societies. Posters for grades K-12 are also available from the Education Department at ASHRAE.

AMERICAN SOCIETY OF HEATING, REFRIGERATING & AIR-CONDITIONING ENGINEERS, INC.

K-12 CLASSROOM PROJECTS

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1. **Squidy**

Using a Squidy, a unique Cartesian toy created by Steven Spangler, students have an opportunity to see the effects of air pressure changes in a controlled air environment. The Squidy is a small, rubber squid with a controlled air chamber. When it is placed in a two-liter plastic soft drink bottle, which has been filled with water and then tightly sealed, it bobs to the top of the bottle. As the bottle is squeezed and released, the Squidy falls and then bobs back up. This is a fun project because students get to play with the Squidy as it bobs up and down. While demonstrating the experiment, you have the opportunity to explain the properties of air and how changes in pressure result in changes in volume. You can also encourage further discussion and thought about properties of air by using this as a starting place, and then talking about how air works in balloons, or, with older students, about differential tire pressures.

Squidy is available through:

WREN ENTERPRISES
3145 West Monmouth Avenue
Englewood, Colorado 80110
(303) 798-2778
FAX (303) 798-0485

Objective: To demonstrate that air has volume, that it exerts pressure and it can be squeezed or compressed.

Suggested Grades: Grades 1-6

Materials Needed:

1. Either a Squidy or a plastic eyedropper (which works as well, but isn't as visually compelling)
2. An empty plastic 2-liter soft drink bottle
3. A bowl of water to adjust the amount of air in the Squidy

Process:

1. Have the students assemble the Squidy.
2. Fill the bottle with water.
3. Fill the bowl with water.
4. Put the Squidy into the bowl of water, to test the buoyancy of the Squidy. Manipulate the amount of air in the Squidy until it just barely floats in the water. If it floats very high in the water, tip it to let some air out.
5. Once you have the correct amount of air in the Squidy, transfer it to the filled two-liter bottle. Screw the cap on the bottle tightly.
6. Tell the students that you are now going to squeeze the bottle. Ask them what they think will happen to the Squidy. Ask them why they think that will happen. Write down the suggestions and the reasons given.
7. Squeeze the bottle and the Squidy will sink. After the Squidy has sunk, release the bottle, and it will bob back up.
8. Encourage the students to play with the bottle and have fun with the Squidy as it dives up and down with changes in pressure.

Appropriate Questions:

1. Why do you think the Squidy sank?

   Explain that air has volume and can be squeezed and compressed. When you squeeze the bottle you increase the pressure in the bottle, which compresses the air in the Squidy. This allows more water into the Squidy causing it to sink.

2. Have the students noticed other times when air is squeezed or compressed?

3. Older students can be encouraged to talk about tire pressure and the differences in tire pressure if you take measurements before or after the tire gets hot from travelling.

4. Younger students can be encouraged to think about balloons and the effect of squeezing more and more air into a compressed space.

What We Learned:

Air has volume. It can be squeezed and compressed. Changes in pressure result in changes in volume.

Alternative:
There is an alternative to the above exercise that produces similar results. Take a long balloon and put a 3/16"x1" bolt into it leaving just enough air to fill it without elastic expansion. Put a temporary paper clip on the mouth of the balloon to see if it barely floats. Add or delete ballast as required before tying off the balloon. (Remember to adjust for the weight of the paper clip). You can leave the paper clip on the bottom of the balloon and possibly add a magnet to produce a successful result. However, when you squeeze the balloon on a metal surface, the object will still move to the bottom. This produces a great chance to talk about magnetism and how the unexpected can enter into your design if you do not give a project enough thought.

2. **Pentominoes**

Objective: Develop creativity, problem-solving skills, thinking skills, logic, and perseverance. If done in small groups, can build teamwork.

Suggested Grades: Grades 1-3

Time Required: 30 minutes

Spelling Words:

shapes	pentominoes	creativity
problem	laminated	

Materials Needed:

1. Tiles - each student needs 5 tiles in cardboard or heavy paper, about the size shown on the attached diagram, with a "5" in it. If you put 5 in an envelope for each student, distribution is easy!
2. Pencils
3. Paper

Process:

1. Ask: How many of you ever played Dominoes?

   Explain: The goal was to connect 2 pieces together to make a score. Today we are going to try to connect 5 pieces together. This is called a pentomino.

2. Tell the class they will use all 5 tiles to make all the possible configurations. The objective is to find out how many different shapes can be made with the 5 tiles. The rules are as follows:

   a) Use all 5 tiles for each shape.
   b) Full sides must be touching.
   c) No shape can be repeated. This includes turns, flips, and reversals.
   d) Draw pictures of the shapes as you construct them to keep track of what you've accomplished.
   e) Work until you have found all the shapes. (Do not tell them how many to find).

   (For purposes of clarity, items 2 and 3 may be demonstrated on an overhead or by hand with a small group.)

3. Let the students work for about 15 minutes.

4. Check their progress.

5. Survey the group for the number of shapes found so far. If the numbers are less than 12, tell them to keep working. If the numbers are greater than 12, tell them to check for duplicates. Let them work 5 more minutes.

6. Check their answers, but don't tell them how many they should have yet. Continue as follows:

a) Ask them to describe their shapes, and hold up their laminated shapes for everyone to see.
b) After everyone has shared their shapes, show any remaining solutions so that there is a total of 12. (Note to leader: Can YOU get them all?) Some may insist they have another shape -- Ask them to prove it.

Potential Extension Activities:

Sort the shapes into categories, identify which ones would fold to make a five-sided box, change the shape by starting with the tiles laid end-to-end, and then move one at a time to create new shapes.

3. **Drops on a Penny**

Objective: Learn about cohesion, surface tension, concept of "variables"

Suggested Grades: Grades 1-3

Time: 30 minutes

Spelling Words:

cohesion penny variable
surface tension dropper

Materials Needed:

1. 6" by 6" wax paper
2. eye dropper
3. water
4. toothpick
5. small cup
6. penny
7. paper towels (clean-up)

Process:

Part I

1. Each participant gets a piece of wax paper and toothpick. Leader places a single drop of water on each piece of wax paper. Participants explore the cohesive characteristics of the drop of water by pushing and pulling on it with the toothpick. Split the drop - rejoin it - drag it around.

Part II

1. Distribute eyedroppers and cups with water to each participant. Let them practice making drops while you hand out pennies.

   Ask: How many drops of water do you think will fit on the head side of a penny? (Accept all answers)

2. Drop water on penny, counting the drops. Stop when the penny overflows. Observe the water on the penny as you drop. Repeat 2 more times.

Appropriate Questions

1. What was the highest number of drops of your three tests? (One student may have 12, another 30. Keep track of the highest number.)
2. Why might there be such discrepancy? (Different size drops, distance from penny when dropping, angle of dropper, age/condition of penny, etc. Explain that these are called "variables.")
3. What kind of results would we get if all of these "variables" were the same? (Our drop counts would be closer or the same.)
4. Discuss: The shape of the water on the penny -- Explain that the reason is due to surface tension. Describe cohesion. What other possible investigations could be done with these materials? (Use the tail side, different liquid, different types of coins, etc.)

4. **Building Bridges: Fun With A Plain Piece of Paper** by Robert and Jo-Anne McDowall

A sheet of 8.5 by 11-inch paper is so weak that it cannot even hold itself up...but put a crease in it and now it will support a quarter. Roll it into a tube and it makes a column strong enough to support a heavy book. Attach a few together and you can build tall towers or long, strong bridges.

This is an experiment with paper to demonstrate the behavior of materials as they are shaped in various ways. Playing with paper is a fun and valuable learning experience for students and teacher. It can be adapted in different ways and can be used for a presentation as short as 45 minutes or the basis for a half-day lesson.

The general method for all of these experiments is the same: Introduce the idea that you are going to demonstrate. Let the students, singly or in groups of four or five, experiment to establish that what you showed them is true, or not quite true for them. Encourage questions and spend time responding in a respectful way to all questions. Your interest in the students will be what creates excitement in the room. Questions like: What is going on here? What do you think went wrong? Who needs help? How can you wind the paper up really tight (around a pencil is one way)? How much easier is it if one member of the group winds the paper and another group member sticks on the tape? Encourage all the problems out into the open and find them interesting, different, funny, and special. Some of the students will experiment with ideas beyond what you are presenting. If they are not disruptive or unsafe, then encourage further experimentation.

Suggested Grades: Can be adapted for grades 5 and up.

Materials Needed:

1. 8.5 by 11-inch paper (suggest using bright orange)
2. Rolls of Scotch tape or drafting tape
3. Several quarters (or something which can be used as a weight, like an eraser)
4. Two books of about the same size for each group

Process:

1. Begin by demonstrating to the students the qualities of the paper. Its weakness can be shown if you just hold the paper out straight. Have the students notice that it sags.
2. The strength of the paper can be shown if you tug on it, demonstrating that it is so strong that it can't be pulled apart.
3. Place two books flat on the table with about four inches between them.
4. Place the paper so that it balances on both books, forming a bridge.
5. Have the students suggest what will happen if you place a quarter at the midpoint of your bridge.
6. Place the quarter and watch the bridge sag to the table or collapse completely.
7. Make two lateral creases in the paper, so it forms an U-shape. Place the U on the books to form a bridge.
8. Again, ask the students what will happen if a quarter is placed on the bridge. Keep piling on quarters until the bridge collapses.
9. Now fold a paper width-wise and, with the books in identical positions, again place the paper to form a bridge. Ask the students what will happen to the bridge when you put the quarter on now. As expected, the bridge will collapse because the crease has to go from book to book for it to be strong.

Once you have established for the students that paper is potentially very strong, you can show them just how strong it can be.

5. **Structural Supports** by Robert McDowall and Jo-Anne McDowall

Materials Needed:

1. 8.5 by 11 inch paper
2. Rolls of Scotch or drafting tape

Process:

1. Roll several pieces of paper into tubes of varying tightness. Roll some of the tubes width-wise and some lengthwise.
2. Take each tube and balance a book (the same book, with the same weight) on each tube. Some tubes will collapse. Others will hold the weight. Allow the students to continue piling more and more articles onto the tubes to find their relative strengths.
3. Use four columns of equal size and tightness and stand them at the four corners of another 8.5 by 11" paper. Then using a book that is at least 8.5 by 11" for the first book in the set, start to pile books onto the columns. This will demonstrate to the children how strong columns are and why they are used as structural supports.

6. **Triangle Power** by Robert McDowall and Jo-Anne McDowall

Materials Needed:

1. Large quantities of newspapers, rolled into tubes and taped
2. More tape

Process:

1. Join three of the rolled tubes end to end to make a triangle. Squash the ends as needed for joining. Demonstrate the rigidity and strength of the triangle, the basis of so much structural design. Using the triangle base, join a tube to each point and join the ends to a single point to form a tetrahedron.
2. Repeat several times.
3. Join tetrahedrons end to end to form a strong structure that will bridge from desk to desk.
4. Use this structure to demonstrate that the bottom of the structure is in tension...being pulled apart, but that the top is in compression...being pushed together.
5. With this base of understanding, let the students use rolled newspapers to experiment with structural design. Long bridges, high structures, strong structures...you will be amazed at their ability to build on the ideas you have given them.
6. If you want, after you have demonstrated the above 3 experiments (Building Bridges, Structural Supports, and Triangle Power), you can leave it to the teacher to organize the newspaper tube rolling, and the subsequent construction projects, perhaps at a later time.

7. **The Car Project** by David J. Vasey, Punta Gorda, Florida

Mr. Vasey presented this project to a small, private school in Florida. The teacher used it as a science project that was required of all students. The students received a grade that was included in their six-weeks report card.

Objectives: The goal is to encourage creativity and to help students see that frequently a problem initially looks impossible, but with teamwork many obstacles can be conquered. Students should be encouraged to keep a project journal. This will probably be their first experience with one. Some of the students may unknowingly address problems with strength of materials and friction as they work on their projects.

The teacher should monitor which team members are given the responsibility of maintaining the journal (this should be a significant part of the team's grade). The teacher will be surprised to see the quick assignment of tasks in each group. Students who are good artists will provide the drawings for the journal. Mechanically oriented students concentrate on the car's construction, while other group members will design car trim, colors, accessories, etc. Everyone in the group will have a special talent or skill to contribute.

Suggested Grades: High school students are most successful with this project; younger students lose interest too quickly. This project was designed for use in groups of 3-5 students in a small to medium classroom setting (15-20 students). The project could also be used as an individual project with a shortened time period.

Suggested Time Period: This project was designed for weekly sessions (approximately 1 hour each) over a 4 to 5 week period. If an ASHRAE volunteer is assisting, he/she should attend weekly and meet with each group to verify completion of each deadline task. He/she should provide encouragement and guidance without contributing to the teams' designs. This project will not be a quick, easy project for the volunteer. However, it is exciting to watch the students' weekly progress on their design.

Materials Needed: The students furnish all the materials they utilize. The presenter (or a volunteer) will need to construct a ramp for the cars to roll down. In some cases, the cars will slide instead of roll, so it is recommended that the ramp be approximately 24" high and 48" long. Be careful! You will probably spend more time building the ramp than many students will spend constructing their cars! **NOTE:** Some students may not be able to afford to purchase materials for the car project. Volunteers may be needed to assist in the purchase of car components for some students.

Process: After the teacher has assigned the students to groups of 3-4 students, give instructions. Each group should design and construct a car that could roll down a 24"high ramp -- in one piece! The car must be 12-15" long and 6-9" wide. The car components must include 4 wheels, 2 axles, and a body. Beyond that, they can use their imaginations. ***There is just one more requirement, the car must be constructed entirely of food or edible products.***

Each group is required to keep a journal with weekly entries about their car designs, weekly progress, problems encountered, and car modifications to overcome their obstacles. The journal should include entries from each group meeting. Additionally, the journal must include a list of each item used in the final design.

After cries of "We can't do that!", the students will start to think.
"Can we use toothpicks," a student might ask.
"Do you eat toothpicks?" should be the response.
"You use them after you eat. How else can we hold the wheels on the axle," is the comeback.
"Nice try, but the answer is 'no.'"
"Hey, I've got an idea," another student will shout.

Immediately the groups separate into different sections of the room to start planning.

Grading Criteria (optional): The students might receive grades based on a point structure as follows:

First Deadline (1 week)	wheel & axle design	15 points
Second Deadline (2 weeks)	body design	15 points
Third Deadline (3 weeks)	test run	15 points
Final Design (4 weeks)	final run	15 points
Project Journal		40 points

The groups should present the teacher and/or volunteer with the progress in each of the first 3 deadlines. Separate classrooms should be used for each group's progress report. The entire class should not be aware of other group's designs until the Final Run in Week 4. Because some of the students will use food products that need refrigeration, allow any group that successfully completes the Test Run in Week 3 to opt out of the Final Run in Week 4, without penalty.

The journal should receive a high point value because not all groups will have a final design. With a detailed journal and completion of the first 3 deadlines, students without a "Final Run" can still score an 85. Remind the students that many discoveries and inventions are completed with the assistance of journals or notes from previous experimenters or scientists.

ASHRAE *Cool Science Kit*

Has your chapter been looking for the perfect tool to encourage a student to pursue a career in the HVAC&R industry? Would you like to be responsible for shaping the engineers of tomorrow? Then look no further than ASHRAE's **Cool Science Kit**.

As part of assisting chapters in introducing students to the exciting world of engineering and HVAC&R, the Student Activities Committee has developed a valuable teaching tool to *"connect"* you with students in classrooms around the globe and in your neighborhood. Through teaching modules containing demonstrations and student investigations, future engineers in grades 3-12 will have the opportunity to actually engage in the presentation to experience first-hand the scientific concepts that govern heating and cooling.

The Teaching Kit contains most of the necessary hardware to conduct science demonstrations, and the modules include background to allow students to observe and participate in the demonstrations and scientific investigations. The included instructions allow you to tailor the presentation to the student's age, the level of understanding, and the time available for the program.

As with the ASHRAE Audiovisual Program, these Teaching Kits are available on a loan basis. If your chapter is interested in requesting a kit for an upcoming presentation, please contact the ASHRAE Education Coordinator, through email at jwaits@ashrae.org or by phone at 404-636-8400.

We look forward to working with you in building the future leaders of our industry!

Society of Automotive Engineers

1. A World in Motion

This is a fully integrated print and video program that emphasizes hands-on discovery of science principles in a cooperative learning setting. The program is geared toward 4th, 5th, and 6th graders and is designed to teach basic mobility physics concepts. The program's goal is to maintain, support, and increase curiosity in the technological world. It also adds new dimensions of math and science to impressionable students.

The project is two-phase:

1. Phase One -- 7 periods of teacher-directed instruction with students working on projects. In this phase, engineers may assist with instruction.
2. Phase Two -- Five units of student exercises expanding concepts from Phase One. Again, engineers may assist with exercises.

SAE members volunteer to assist teachers in implementing the program by providing math/science assistance to teachers, assisting with classroom presentations and the administration and implementation of the program. The volunteer should allot at least 1-2 weeks to assist with obtaining supplies, instruction, and motivating teachers and students.

To get involved, the engineer should contact a local elementary school or superintendent's office to determine interest (over 10,000 schools already have materials). Then the volunteer should contact SAE at:

World in Motion
SAE, Inc.
400 Commonwealth Drive
Warrendale, PA 15096
1-800-457-2946 or (412) 776-4841
www.sae.org

Some of Canada's Innovators in the Schools Coordinators offer "A World in Motion" too. Call 1-800-465-7766 to determine if the Innovators in the Schools Program in your province offers this program. The text of the program is available on the Innovators in the Schools website: **http://schoolnet.carleton.ca.**

The program is distributed free to schools.

Optical Society of America

1. Optics Discovery Kit

This kit contains 11 detailed experiments and most of the equipment necessary to perform the experiments. The kit is designed to stimulate interest in science to sixth through ninth graders. OSA members are encouraged to spend time in the classroom working with the teacher to demonstrate the kit's use. Then the kit is donated to the school and the OSA member agrees to serve as a local resource in the future.

Contact Optical Society of America at:
Optical Society of America
2010 Massachusetts Avenue, NW
Washington, D.C. 20036-1023
(202) 223-8130
Fax: 202-223-1096 - www.osa.org

National Society of Professional Engineers

1. Discover Engineering (Discover-E)/National Engineer's Week -- See Appendix A

NSPE states that this is "an excellent opportunity to initiate involvement with schools." This program is a part of **National Engineer's Week**, when engineers visit classrooms to develop enthusiasm and interest in math and science applications. The Discover-E program often grows into long-term involvement between engineer, student, and teacher. NSPE provides materials for the visiting engineer that may be left with the teacher for use in future classes.

2. MathCounts -- See Appendix B

This is a national math competition for 7th and 8th graders (it is also available in some Canadian provinces, for example, British Columbia. Contact Innovators in the Schools for availability: 1-800-465-7766). Competitions are held at the chapter, regional, and national levels. MathCounts builds skills, promotes strategic problem solving, challenges students to sharpen their analytical abilities, and encourages them to continue in a college math track in high school.

The program's schedule begins when volunteers register teams in the fall. Then volunteers coach students throughout the fall. The students compete in the spring in both individual and team events beginning at the local level and progressing through the regional, state, and national levels.

Volunteers may mentor/tutor students for the competitions, assist with administration of the program, and/or work at the competition. Volunteers' time commitments can range from half a day (e.g., in an administrative capacity) to year-round support (e.g., administrative or mentoring).

To get involved, a volunteer should contact the MathCounts national office for an annual published list of state coordinators. The volunteer may also contact the local NSPE chapter to determine whether the chapter is already involved in MathCounts.

Call or write MathCounts at:

Mathcounts (National Society of Professional Engineers)
1420 King Street
Alexandria, VA 22314
(703) 684-2858
www.mathcounts.org

3. Bicycle Video

7-10 minute video relating math, science, and engineering to bicycle design. This video is suited for junior high or middle school students. Support materials come with the tape. The tape and support materials may be used, if care is taken with the surrounding presentation, with selected high school students or upper-elementary students. The Bikes video may also be shown during a MathCounts competition.

4. Engineering and You brochure

This brochure provides an excellent overview of engineering as a career field. It is written for high school students or advanced junior high/middle school students. NSPE suggests distributing the brochure at the end of a Discover-E teach-in, during a JETS-TEAMS or NEDC competition, or during a Mathcounts program.

5. NSPE Scholarship Program

This program is administered through the local chapter. NSPE makes materials available between August and November of each year. State societies and local chapters distribute these materials to high schools in their area. The materials are distributed through direct mail, personal visits, and at teachers' meetings and conventions.

Junior Engineering Technical Society (JETS) -- See Appendix C

1. NEAS (National Engineering Aptitude Search)

This individual aptitude test allows students to assess their abilities for an engineering career. The NEAS provides a realistic assessment of the student's potential.

Volunteers may serve as personal mentors or exam proctors. The time required of a personal mentor is determined by the mentor and the student. Follow-up activities are determined by the engineer. Volunteers may "adopt a student" for the $30 test registration fee.

2. Teams (Tests of Engineering Aptitude, Mathematics, and Science Competition)

This academic competition allows students to work in "engineering teams" to solve problems in six subject areas. Discussion is encouraged, as is the use of student peers as consultants in the process. Both varsity and junior varsity competitions.

Volunteer may mentor a team in applying math/science to engineering. An engineer may also assist at the competition's host university. No maximum or minimum time requirements -- may participate for 1 day to all year. Companies may support teams (Varsity $100, Jr. Varsity $50). Volunteers invest personal time and travel, supplemental field trips, and awards (optional).

3. NEDC (National Engineering Design Challenge)

This program requires students to integrate both theoretical and applied concepts of engineering to the solution of real problems. Students must design, fabricate, and demonstrate a working solution to a societal need. The NEDC is conducted in the fall and early winter of each year.

Volunteers advise teams on engineering principles and applications. Volunteers may also judge or assist in competition administration. Time required is 4 to 8 weeks prior to the competition and a debriefing afterward. Companies may support a team for $100 and/or the construction materials. Volunteers invest personal time and travel, supplemental field trips, and awards (optional). This program is being phased in nation-wide; contact JETS for status in your area.

4. JETS Guidance and Instructional Materials

These materials support all JETS programs. Volunteers can introduce and explain these materials to local high school teachers and students or provide schools with these materials.

For further information on JETS programs contact JETS at:

JETS, Inc.
1420 King Street, Suite 405
Alexandria, VA 22314-2794
(703) 548-5387 - www.asee.org/jets

American Chemical Society

1. Wonder Science -- See Appendix D

   This is a full-color magazine for students in grades 3-6 that contains hands-on activities for parents and children to do together.

   Volunteers/local chapters may donate/provide the magazine for elementary schools.

2. Chemistry Walks

   These are a series of two-sided posters for display in the elementary school classroom. They take students on a "chemistry walk" through a variety of different settings.

3. Detroit Science Center/Black Achievers Project

   ACS worked with the Detroit Science Center to set up family science workshops. These workshops were based on the work of scientists highlighted in the touring Black Achievers in Science Exhibit.

4. Operation Chemistry

   This is a national effort to train 36 four-member teams to conduct upper elementary and middle school chemistry workshops for teachers in each team's local area.

5. Parents and Children for Terrific Science (PACTS)

   The PACTS program provides mini-grants to support hands-on science workshops for parents and children across the country. There is one funding cycle per year, with sums of up to $1200 granted to local groups interested in family science activities. These groups have included elementary and high schools, two- and four-year colleges, ACS local chapters, museums, church groups, etc.

6. Chemistry for Kids

   At ACS National Meetings, a time is set aside for parents and children to engage in hands-on science activities.

7. Chemists in the Classroom Videotape

   The purpose of the tape is to provide assistance to academic and industrial chemists who volunteer to visit elementary school classrooms. It is accompanied by a booklet, which gives advice on activities, instructional methods, and safety guidelines.

8. Pre-high School Day at the ACS Meetings

   This event is a series of workshops and discussion-type presentations centered around current happenings in pre-high school science education. Attendees include chemists, chemical educators, teachers, school administrators, and teacher educators.

9. PACTS in Science Museums

This project provides participating science museums across the country with six rotating programs. Each of these programs consists of hands-on activities and a slide/tape program focused on the achievements of African-American scientists and inventors.

Proposed programs:

1. FACETS (Foundation and Challenges to Encourage Technology-based Science)

   This is a proposed integrated science curriculum with a science/technology society focus designed for seventh and eighth graders.

2. Short Science

   This is a proposed materials development project designed to introduce hands-on physical science activities to four, five, and six-year-olds in pre-school, kindergarten, and first grade.

For further information on these programs contact ACS at:

American Chemical Society
1155 Sixteenth Street, NW
Washington, D.C. 20036
(202) 872-4600
www.acs.org

American Society of Mechanical Engineers

1. Engineering is for Everyone

   This 12-minute video is geared for kindergarten through 6th graders. It depicts elementary school children discussing engineering concepts in an enthusiastic, easy to understand manner. The educational focus is to teach children to make connections (i.e., between the scientific/mathematical world and what they take for granted), while at the same time showing them that these disciplines are both fun and easy to understand.

2. Career Encounters: Mechanical Engineering (video)/Tools of Discovery Teacher's Guide and Student Activities

   This educational video provides science students with information about the challenges that mechanical engineers face today in a variety of professional settings. The 13-minute video is intended for classroom use with the "Tools of Discovery" printed Teacher's Guide and Student Activities (this is a classroom discussion kit). The engineers featured in the video work in many industries including computer, automotive, biotechnology research, manufacturing, product marketing, power generation, and petro-chemical.

For more information on these programs contact ASME at:

American Society of Mechanical Engineers
3 Park Avenue
New York, NY 10016-5990
(212) 591-7674
www.asme.org

National Action Council for Minorities in Engineering

1. The Challenge, A Kid's Introduction to Engineering
This educational video kit is a "fast-paced, upbeat introduction to engineering careers designed to influence children before the critical point at which they decide whether or not to take Algebra I and academic track science. Through graphic design, music, and a unique interactive format, the 33-minute video focuses the attention of young viewers on visits to six minority engineers..." The kit is geared to a 4th-7th grade audience.

2. *Math Is Power* is a national public service advertising campaign developed by NACME in collaboration with the Advertising Council to provide information to parents and students about the importance of advanced mathematics courses in high school. The knowledge base of algebra, geometry, trigonometry, precalculus or the equivalent in integrated curricula are crucial gatekeepers for access to a broad range of careers, including engineering, the natural sciences, accounting, investment banking and many others. Students who opt out of academic mathematics as early as eighth grade, essentially forego any future opportunity to pursue a career in such fields.

3. TechForce Partnership for Scientific Learning
NACME implemented this program in two New York City school districts, in partnership with the Efficacy Institute. The program "trained 110 teachers, administrators and staff, creating a fundamental shift in the educational paradigm." The training was followed by professional development seminars that taught effective math/science delivery strategies and state-of-the-art learning technologies.

4. NACME/Say YES Workshops
Taught 200 parents, teachers, and students to explore mathematics and science as a community of peers. These workshops are an ongoing series in collaboration with National Urban Coalition. The series offered summer seminars, exposure to science-rich facilities, and an overview of historically neglected contributions of many cultures to math and science.

5. Challenge Grant Program
NACME supported program development in elementary education, curriculum innovation, and community college articulation.

6. Scholarship Programs
   - ***Corporate Scholars Program*** -Developed training modules on mentoring and leadership development in cooperation with corporate partners.
   - ***TechForce Scholarships*** - This prestigious, highly competitive national award was renamed the TechForce Pre-Engineering Prize. Scholarships are presented to high-achieving high school seniors nominated by precollege programs throughout the country.
   - ***The NACME/NASA Partnership*** - Since 1998, the National Aeronautics and Space Administration (NASA), and NACME have partnered to provide enriched scholarships to students at 22 select institutions. Both the USAR Program and the Space Station Engineering Scholars Program are administered by NACME under the direction of the Minority University Research and Education Division of the NASA Office of Equal Opportunity through the NASA Glenn Research Center.

For more information on these programs contact NACME at:
The Empire State Building
350 Fifth Avenue, Suite 2212
New York, NY 10118-2299
Phone - (212) 279 - 2626
Fax - (212) 629 - 5178
www.nacme.org

National Association of Women in Construction

The National Association of Women in Construction (NAWIC) was founded in Ft. Worth, Texas in 1955. Since its founding, NAWIC has grown to a membership of 6,500 with more than 200 chapters in 47 U.S. States and in three Canadian provinces.

NAWIC is an international association that promotes and supports the advancement and employment of women in the construction industry. NAWIC's commitment to education and skilled training can be seen in a variety of areas. For more than 20 years, the NAWIC Education Foundation has offered creative and educational programs for students from the grade school to high school level.

For more information contact NAWIC at:

National Association of Women in Construction (NAWIC)
327 S. Adams St.
Ft. Worth, TX 76104-1081
817-877-5551 (P)
817-877-0324 (F)
www.nawic.org

National Science Resources Center
(National Academy of Science & Smithsonian Institution)

1. NSRC's National Outreach Program

This program works closely with teachers, school administrators, parent and community organizations, and representatives in business and industry to stimulate public support for reform of science education and to enhance local, regional, and state efforts to improve science teaching in schools.

National Convocations -- Leaders from school districts, state departments of education, colleges & universities, professional organizations, and business & industry meet to develop consensus and public support on science education reforms.

Leadership Institutes -- NSRC conducts two Elementary Science Leadership Institutes each summer. These institutes provide teams of administrators, curriculum specialists, teachers, and scientists from school districts across the country with information and skills necessary to develop and maintain effective hands-on elementary science programs. Science educators and scientists who have implemented exemplary elementary science programs in their districts staff the institutes. Since 1990, 72 school districts (serving 2 million children) have participated in the institute programs.

Working Conferences for Scientists and Engineers -- This program is an annual working conference for scientists and engineers from colleges and universities, federal research laboratories, and private industry. These conferences are designed to prepare scientists and engineers for leadership roles in precollege science education. The conferences inform participants about current issues and new developments in science and technology education. Participants learn to identify ways they can help improve K-12 science education, in cooperation with teachers and school districts.

Technical Assistance -- These include a variety of networking activities and responses to individual requests. These activities include: helping school districts identify effective science curriculum materials, design teacher in-service education programs, establish effective science materials support systems, and build community support for science programs.

2. Disseminating Information

Resource Collection -- NSRC library at the Smithsonian holds over 5,000 volumes, including:

- Science curriculum materials developed by national curriculum projects and by school systems with exemplary science programs.
- Textbooks, science activity guides, and other materials developed by commercial publishers.
- Science teaching materials published by science museums and science-technology centers.
- Foreign curriculum materials.

Information Databases -- The resource collection is catalogued through computerized information databases including annotations and bibliographic data. Off-site users can access the data by sending requests through People Sharing Information Network (PSI-NET, a nation-wide computer telecommunications network organized by the Council of State Science Supervisors).

Resource Guides -- Include information about teaching materials and sources of assistance for science teachers. The *Science for Children: Resources for Teachers* guide was first published in 1990, and it received the "Outstanding Academic Book Award." This elementary science guide includes entries about

- elementary science curriculum materials supporting hands-on activities
- periodicals on science and science education for teachers and children
- national elementary science curriculum projects
- assistance available to elementary school teachers from museums, science and technology centers, and professional associations and organizations nationwide
- publishers and suppliers of elementary science teaching materials

A second edition of the elementary resource guide is being developed, as well as middle school and high school versions.

3. Science and Technology for Children

The NSRC curriculum project is producing a complete program of science instruction for grades 1-6. This program was developed in cooperation with school districts across the country. Its 24 curriculum units involve children in hands-on investigations of scientific phenomenon that enable them to learn science by doing science.

For more information on these programs contact NSRC at:

National Science Resource Center
Arts and Industries Building, Room 1201
Smithsonian Institution
Washington, D.C. 20560
(202) 357-2555

Boy Scouts of America

1. Exploring Engineering

The goal of this program is to provide young adults (14-20-yrs. old) exposure to engineering. The programs focus is on the club's activities in engineering/sciences. The activities include group approaches to programs, projects, and hands-on activities. The program should also include competitions and company tours.

Volunteers act as post advisors who plan the post's program. Volunteers may also offer company tours and assist with group activities. The program is a yearlong process, so the volunteer post advisor should plan to invest about a year of time. This program is available nationwide. See Appendix E for ASHRAE's Letter of Support for this program.

For more information on this program contact BSA Exploring at:

Boy Scouts of America
1325 Walnut Hill Lane
Irving, TX 75038
(214) 580-2429

Scholastic Academic Publishers -- Science and Math Magazines -- See Appendix F

1. Math -- Grades 2-9

Scholastic Math Power for Grades 2-4 -- Develops interest in, and understanding of, math problem solving through hands-on activities and cross-curricular approaches. Contains step-by-step exercises; a pull-out section featuring puzzles and reusable board games; exercises to develop statistics, problem solving, geometry, and computation abilities. Winner of 1993 Parents' Choice and 1991 EdPress Awards. 8 issues per school year (average issue size is 16 pages). Prices: $5.95 per student subscription (10 or more subscriptions). Teachers' edition with desk copy -- $25 per year (FREE with 10 or more subscriptions).

Dynamath for Grades 5-6 -- Develops and strengthens math skills by making math fun and relevant through use of real-life applications. Contains innovative problem solving, charts, graphs, and critical thinking questions, word problems, consumer math, "The Great Math Scavenger Hunt," and hands-on activities. Prepares students for standardized tests and integrates math lessons with science, social studies, and reading. Winner of 1991, 1992, 1993 Parents' Choice Awards and 1991-2 EdPress Awards. 8 issues per school year.

Price $6.50 per student subscription (10 or more subscriptions). Teachers/ Edition with desk copy -- $25 per year (FREE with 10 or more subscriptions).

Scholastic Math for Grades 7-9 -- Motivates math students by combining real-life applications with creative activities. Presents math in a way that applies to students' everyday lives. The magazine prepares students for standardized tests. Includes sections on charts, graphs, and statistics; overviews of math in different careers; consumer topics; and multicultural focus of math as it is used internationally. Winner of 1991 EdPress Best Feature Article Award. 14 issues per school year. $6.75 per student subscription (10 or more subscriptions). Teachers' edition -- $25 per year (FREE with 10 or more subscriptions)

2. Science -- Grades 1-9

SuperScience Red for Grades 1-3 -- Gives teachers user-friendly, hands-on science activities that support their science program. The magazine is clustered around a monthly topic covering science news and classroom-tested experiments that help teach the scientific method. Activities help students develop science process skills, like observation, classification, prediction, and gathering data. Includes take-home activities to do with parents. 8 issues per school year. Price $5.95 per student subscription (10 or more subscriptions). Teachers' edition -- $27 per year (FREE with 10 or more subscriptions).

SuperScience Blue for Grades 4-6 -- Makes science a classroom adventure and encourages a lifelong interest in scientific issues. The magazine provides hands-on classroom science experiments, current science and technology news, student surveys and experiments. This magazine was developed with a grant from the National Science Foundation. It won the 1991 Parents' Choice Award and 7 EdPress Distinguished Achievement Awards. 8 issues per school year. Price $6.75 per student subscription (10 or more subscriptions). Teachers' edition -- $27 per year (FREE with 10 or more subscriptions).

Science World for Grades 7-9 -- Engages teenage students in the processes and applications of science by presenting topics that interest this age group. Every issue contains briefs, debates, and three full-length features on current topics. Winner of 1991 and 1992 EdPress Distinguished Achievement awards. 14 issues per school year. $7.25 per student subscription (10 or more subscriptions). Teachers' edition -- $25 per year (FREE with 10 or more subscriptions).

For more information on these periodicals contact Scholastic at:
Scholastic
2931 East McCarty Street
Jefferson City, MO 65102-3710
To order: 1-800-807-2466
For Classroom Magazines Catalog: 1-800-631-1586

National Energy Foundation

1. Elementary Curriculum Materials & Teacher Guides

Quick Energy for Elementary Teachers -- Contains quick activities to fill 10-15 minutes. These activities require little preparation and introduce or reinforce energy concepts. These activities include drawing/verbal communication, research/written communication, energy experiments, and energy games. The guide contains 31 energy activity master sheets and 37 energy activity ideas. Price $5.00.

Quick Energy and Beyond -- The grades 5-9 version of the Quick Energy for Elementary School Teachers. Price $10.00.

Teach With Energy! K-3 -- Fundamental energy and science lessons emphasizing electrical energy. The book includes an energy education conceptual framework, 31 lesson plans, 15 Just for Fun reproducible activity

worksheets, background information for teachers, and an extensive glossary of energy and electricity related words. Price $20.00.

Teach With Energy! 4-6 -- 31 lessons and a collection of Just for Fun activities with an energy glossary. (This guide is modeled after the K-3 version, but the materials are geared toward the older grade levels.) The lessons are correlated with curricular subjects like social studies, language arts, science, math, and art. Price $20.00.

Top Hit Energy Lesson Plans -- The plans are divided in grade level books: K-l, 2, 3, 4, 5, and 6. The lessons have been selected from several hundred NEF lesson plans as those most preferred by students and teachers. The activities include a complete breakdown of time required, implementation procedure, assessment questions, student handout masters, and identification of optional activities or career education suggestions. The lessons may be purchased by grade level for $5.00 or as a set for $30.00.

For more information about National Energy Foundation educational publications contact NEF for a catalog:

National Energy Foundation
5160 Wiley Post Way, Suite 200
Salt Lake City, UT 84116
(801) 539-1406
www.nef1.org

The National Energy Education Development (NEED) Project

The NEED Project is a 501(c)(3) nonprofit organization launched by Congressional Resolution in 1980. Its mission is to promote an energy conscious and educated society by creating effective networks of students, educators, business, government, and community leaders to design and deliver objective, multi-sided energy education programs. NEED believes that teaching about energy is key to developing a society capable of making wise decisions about energy issues. In today's world, energy relates to almost everything. NEED educates Americans through the nation's students. Through workshops, activities, and curriculum, NEED empowers students to become leaders in their schools and communities.

All NEED schools have outstanding classroom-based programs in which students learn about energy. Some schools have student leaders who extend these activities into their communities. To recognize outstanding achievement and reward student leadership, The NEED Project conducts the **National Youth Awards Program for Energy Achievement**. This program combines academic competition with recognition to acknowledge everyone involved in NEED during the year – and to recognize those who achieve excellence in energy education in their schools and communities. The students and teachers set goals and objectives, and keep a record of their activities. In April, the students combine their materials into scrapbooks and send them to their state coordinators. The students themsleves write summaries of their projects for inclusion in the Annual Report. In addition, NEED conducts training conferences, creates educational materials, evaluates the nation's energy knowledge through a Report Card and plans recognition programs. NEED is active in 5000 schools across 35 states.

NEED
P.O. Box 2518
Reston, VA 20195
Phone: 703/860-5029 Fax: 703/860-2903
www.need.org/need

Society of Manufacturing Engineers

SME offers a website designed to bring the excitement of manufacturing technology and engineering to individuals and the K-12 classroom. Volunteers can advance their technological literacy and find interesting information about scholarships, tours, summer camps, and more all connected to the world of manufacturing, math and science.

www.manufacturingiscool.com

CANADIAN PROGRAMS

Innovators in the Schools Network

1. Volunteer Network

The Innovators in the Schools Network is a cooperative federal, provincial, and territorial initiative designed to assist educators in their delivery of science, mathematics, and technology curricula. The central aim is to excite students about science, technology, engineering, and mathematics (STEM).

Working together, educators and Innovators better prepare children for the increasingly complex and competitive scientific and technological world awaiting them.

Students are inspired with inquiry-based, hands-on STEM activities. They also experience first-hand today's technological innovations, which Innovators bring into their classrooms.

Innovators are professionals, university and college students working in or studying STEM. Innovators, by drawing from their academic and career experiences, provide a variety of services, including:

- making classroom presentations and demonstrations
- providing information resources and workshops for teachers
- participating in career awareness
- mentoring individual students
- job shadowing (students and teachers visiting the workplace)
- judging science fairs
- acting as science club advisors
- participating in extended partnerships with schools/classes (partners in education)

Industry and Science Canada (ISC) provides national coordination and undertakes the development of resources for volunteers and educators. Selected non-profit organizations, working with provincial and territorial governments, act as Innovator Coordinators and administer the Network under contract with ISC.

The Innovator Coordinators arrange visits and provide the volunteers with classroom training and suggested classroom activities. They also help link other groups, organizations, and companies (like local ASHRAE Chapters) that are active in the promotion of STEM.

Since its inception in 1991, the Network has flourished and innovators have reached over one million students across Canada. A national newsletter called *Innovation* is published to promote the program and report on activities nationally.

Innovators in the Schools is on the Internet as SCHOOLNET

with a gopher address of:	**gopher schoolnet.carleton.ca 420**
with a website of:	**http://schoolnet.carleton.ca**

To find a participating Innovator organization near you *contact*:
Innovators in the Schools
c/o Industry Canada
235 Queen Street
8th Floor W.

Ottawa, Ontario K1A 0H5
1-800-465-7766

Professional Engineers Ontario

1. Opening Doors to Your Future in Engineering

This brochure is aimed at a 7th-, 8th-, and 9th-grade audience. It gives students a yes/no test to determine students' interest in engineering. It then encourages them to consider a career in engineering by listing the many products engineers develop. The brochure directs students to talk to a professional engineer by contacting the Innovators in the Schools Program Coordinator at the Ontario Science Centre (416) 696-3149 or write to the Professional Engineers Ontario:

Professional Engineers Ontario
25 Sheppard Avenue West - Suite 1000
North York, Ontario M2N 6S9
Phone: 416-224-1100
Fax: 416-224-8168
Web site: www.peo.on.ca

Association of Professional Engineers of the Province of Manitoba

1. Intergalactic Bob Beaver and the Creators of Tomorrow

This comic is geared toward 4th, 5th, 6th, and 7th graders. It tells the story of two kids who would rather play video games than do their math and science homework. When they are sucked into the video game to help Bob Beaver, Brainbag, and Space Shuttle Lily save the Canadarm Robot, they realize how important math and science are to engineering. And, they realize how important engineering is in creating many things that kids think are "neat": planes, trains, space shuttles, robots, roller coasters, TVs, radios, computers, compact discs, ice-cream, and bubblegum! To order copies of the comic call:
C.C.P.E. Public Affairs Group
(613) 232-2474 extension 222

2. Opening Doors to Your Future in Engineering

This brochure is very similar to the version distributed by the Professional Engineers Ontario (see previous association entry). The same information is presented in a different format. The brochure suggests the 7th, 8th, and 9th grade students find some professional engineers to talk to (parents, teachers, or parents of friends may know an engineer).

3. A Career in Engineering - Discover the Possibilities

This booklet introduces 10th, 11th, and 12th graders to engineering. It describes what engineering is, what engineers do, educational requirements to become an engineer, and the variety of engineering fields.

4. Engineering: Creating the Future Today!

This brochure aimed at grades 9 through 12 describes 9 different engineering fields, including mechanical engineering.

To obtain any of these brochures contact:

Association of Professional Engineers of the Province of Manitoba
530-330 St. Mary Avenue
Winnipeg, Manitoba R3C 3Z5
Phone: (204) 942-6481

March 17, 1997

Robert L. Nichols, P.E., Chairman
Engineering and Technology Exploring Committee
Boy Scouts of America
P.O. Box 152079
Irving, TX 75015-2079

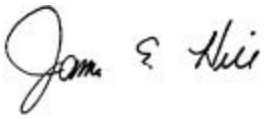
Dear Mr. Nichols:

ASHRAE is proud to join with the Exploring Division of the Boy Scouts of America (BSA) to promote the organization of Engineering and Technology Exploring Posts. ASHRAE believes that the Engineering and Technology Exploring Program can provide opportunity and encouragement for Exploring-age young men and women to learn about technology-related careers, as well as build a solid foundation for a productive role in our technically complex society.

Local Exploring volunteers and staff will provide organizing and program development help. We encourage all ASHRAE members to participate in this effort to involve young people in the excitement of engineering and technology.

We believe that a worthwhile and challenging program of outdoor, fitness, leadership, social, career, and service activities can be developed through Engineering and Technology Exploring. Together, we can enrich the lives of America's youth.

Sincerely,



James E. Hill, Ph.D.
ASHRAE President