Southwest Consortium for the Improvement of Mathematics and Science Teaching

Classroom Compass

Winter 1995 • Volume 1, Number 3

HIGHLIGHTS

Constructing Knowledge in the Classroom

...a known truth owes its existence to the mind that knows it...
Giambattista Vico, 1668–1744

How do we learn? Watching a young child grow from infancy to toddlerhood, we marvel at the amount of learning that has allowed her to understand her expanding environment. Those early years provide the basis for language, physical dexterity, social understanding, and emotional development that she will use for the rest of her life. What a vast amount of knowledge is acquired before she sets foot in school!

This child taught herself by gathering information and experiencing the world around her. Such learning exemplifies constructivism—an idea that has caused much excitement and interest among educators. Constructivism emphasizes the importance of the knowledge, beliefs, and skills an individual brings to the experience of learning. It recognizes the construction of new understanding as a combination of prior learning, new information, and readiness to learn. Individuals make choices about what new ideas to accept and how to fit them into their established views of the world.

In the Classroom

A May 1990 article in *Phi Delta Kappan* recounts the story of a fourth-grade teacher who challenged her students to experiment with the idea of heat. Convinced that their hats, sweaters, blankets, and rugs all produced heat on a cold winter day, the children placed thermometers inside the garments and recorded the results. After three days the clothes still showed no rise in temperature. Although some of the students began to realize that they needed alternative explanations, many clung to their belief that the clothing generated heat. They were willing to continue testing the garments until their hypothesis was proven—the entire year, if necessary. The teacher had to set limits for the task and guide the students' examination of the evidence.

The constructivist teacher sets up problems and monitors student exploration, guides the direction of student inquiry, and promotes new patterns of thinking. Classes can take unexpected turns as students are given the autonomy to direct their own explorations. Raw data,

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Constructing Knowledge, *continued*

primary sources, and interactive materials provide experiences that students can use to build understanding. For example, rather than reading about the census, students in constructivist classrooms examine and interpret census data. Or better yet, they plan a mini-census, gather their own data, and interpret the results.

Holding on to What They Believe

Our students come from a rich array of different backgrounds and ways of thinking. Myths, taboos, things we learn from our families, friends, and teachers—all are part of cultural influence. Content is embedded in culture and it is difficult to separate the two. When presented with information in the classroom that contradicts existing ideas, a student may try to accommodate both interpretations, rather than change deeply held beliefs. Unless the teacher realizes what views the students hold, classroom teaching can actually help students construct faulty ideas.

If the classroom can provide a neutral zone where students exchange their personal views and test them against the ideas of others, each student can continue to build understanding based on empirical evidence. Hands-on activities and observations of the natural world provide shared experiences for those constructions. For example, to study the phases of the moon, the class could keep a "sky journal" (an observational log of the moon and its shape in the sky) for several weeks and discuss the various observations. If models, text references, or illustrations are available as resources, students should know that these are the results of others' observations and speculations. Such references are actually the "constructions" by others of the current understanding of the world around us.

In a Constructivist Classroom...

- **Student autonomy and initiative are accepted and encouraged.** By respecting students' ideas and encouraging independent thinking, teachers help students attain their own intellectual identity. Students who frame questions and issues and then go about analyzing and answering them take responsibility for their own learning and become problem solvers.
- **The teacher asks open-ended questions and allows wait time for responses.** Reflective thought takes time and is often built on others' ideas and comments. The ways teachers ask questions and the ways students respond will structure the success of student inquiry.
- **Higher-level thinking is encouraged.** The constructivist teacher challenges students to reach beyond the simple factual response. He encourages students to connect and summarize concepts by analyzing, predicting, justifying, and defending their ideas.
- **Students are engaged in dialogue with the teacher and with each other.** Social discourse helps students change or reinforce their ideas. If they have the chance to present what they think and hear others' ideas, students can build a personal knowledge base that they understand. Only when they feel comfortable enough to express their ideas will meaningful classroom dialogue occur.
- **Students are engaged in experiences that challenge hypotheses and encourage discussion.** When allowed to make predictions, students often generate varying hypotheses about natural phenomena. The constructivist teacher provides ample opportunities for students to test their hypotheses, especially through group discussion of concrete experiences.
- **The class uses raw data, primary sources, manipulatives, and physical, interactive materials.** The constructivist approach involves students in real-world possibilities, then helps them generate the abstractions that bind phenomena together.

These suggestions are adapted from *In Search of Understanding: The Case for Constructivist Classrooms* by Jacqueline G. Brooks and Martin G. Brooks (Alexandria, VA: Association for Supervision and Curriculum Development, 1993).

Easing into Constructivism

Just as students do not easily let go of their ideas, neither do school boards, principals, parents, or, for that matter, teachers. Ideas like student autonomy and learner-driven inquiry are not easily accepted. Required course content and externally applied assessments are realities that teachers must accommodate. A teacher inspired to change to constructivist instruction must incorporate those realities into her approach.

She might begin gradually, trying one or two "constructivist" explorations in the regular curriculum. Listening to students as they discuss ideas together is a good way to start shifting the balance of responsibility to the learner. Another step is using primary sources and raw data as the basis of inquiry, rather than relying solely on the text.

If students begin thinking about accumulated knowledge as an evolving explanation of natural phenomena, their questions can take on an exciting dimension. In the next two or three decades, research will change the way most of the accepted facts of today are perceived. Our challenge is to foster students' abilities so they can continue to learn and build their understanding based on the changing world around them.

Building an Understanding of Constructivism

Constructivism is based on doing.

References:

Dewey, John.
Democracy & Education.
New York: Free Press, 1966.

Piaget, Jean.
To Understand Is to Invent.
New York: Grossman, 1973.

Vygotsky, Lev S.
Mind in Society: The Development of Higher Psychological Processes.
Cambridge, MA: Harvard University Press, 1978.

The Vygotsky Reader.
René van der Veer and Jaan Valsiner, eds. Cambridge, MA: Blackwell, 1994.

Since the groundwork of constructivism was laid, several authors have added to it. The following recent works (of varying levels of abstraction) provide further insights into constructivism and its relation to classroom learning. Most of these works have bibliographies that will be useful to those who wish to read more about these ideas:

Brooks, Jacqueline Grennon, and Martin G. Brooks. *In Search of Understanding: The Case for Constructivist Classrooms.* Alexandria, VA: Association for Supervision and Curriculum Development, 1993.

Duckworth, Eleanor, Jack Easley, David Hawkins, and Androula Henriques. *Science Education: A Minds-on Approach for the Elementary Years.* Hillsdale, NJ: Erlbaum, 1990.

Myers. Greg. *Writing Biology: Texts in the Social Construction of Scientific Knowledge.* Madison: University of Wisconsin Press, 1990.

Tobin, Kenneth, ed. *The Practice of Constructivism in Science Education.* Washington, DC: American Association for the Advancement of Science, 1993.

Written activities and exercises alone do not go to the heart of constructivism, but books have laid the groundwork for this approach to learning. The basic writings in this field are sometimes interesting and often illuminating, even though they cannot “give” anyone constructivism. Teachers, however, can use these works to build their own understanding of constructivism and its place in the classroom. Here are some representative selections of constructivist thinking and of useful guides to constructivist ideas.

As a philosophy of learning, constructivism can be traced at least to the eighteenth century and the work of the Neapolitan philosopher Giambattista Vico, who held that humans can only clearly understand what they have themselves constructed. Many others worked with these ideas, but the first major contemporaries to develop a clear idea of constructivism as applied to classrooms and childhood development were Jean Piaget and John Dewey.

For Dewey education depended on action. Knowledge and ideas emerged only from a situation in which learners had to draw them out of experiences that had meaning and importance to them (see *Democracy and Education,* 1916). These situations had to occur in a social context, such as a classroom, where students joined in manipulating materials and, thus, created a community of learners who built their knowledge together.

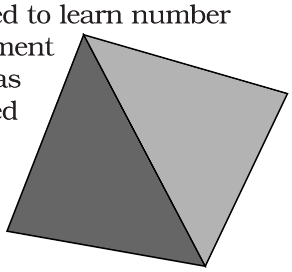
Piaget’s constructivism is based on his view of the psychological development of children. In a short summation of his educational thoughts (*To Understand Is to Invent,* 1973), Piaget called for teachers to understand the steps in the development of the child’s mind. The fundamental basis of learning, he believed, was discovery: “To understand is to discover, or reconstruct by rediscovery, and such conditions must be complied with if in the future individuals are to be formed who are capable of production and creativity and not simply repetition.” To reach an understanding of basic phenomena, according to Piaget, children have to go through stages in which they accept ideas they may later see as not truthful. In autonomous activity, children must discover relationships and ideas in classroom situations that involve activities of interest to them. Understanding is built up step by step through active involvement.

The Russian Lev S. Vygotsky is also important to constructivism, although his ideas have not always been clear to the English-reading public both because of political constraints and because of mistranslations. Some commentators believe that Vygotsky is not a constructivist because of his emphasis on the social context in learning, but others see his stress on children creating their own concepts as constructivist to the core. *Mind in Society* (English translation, 1978) is a popularization of some of his ideas for an American audience; also available is a collection of shorter works, *The Vygotsky Reader* (ed. René van der Veer and Jaan Valsiner, 1994). Vygotsky believed that children learn scientific concepts out of a “tension” between their everyday notions and adult concepts. Presented with a preformed concept from the adult world, the child will only memorize what the adult says about the idea. To make it her property the child must use the concept and link that use to the idea as first presented to her. But the relation between everyday notions and scientific concepts was not a straight development to Vygotsky. Instead the prior conceptions and the introduced scientific concepts are interwoven and influence each other as the child works out her own ideas from the generalizations that she had already and that have been introduced to her.

Geometry for the Early and Middle Grades

The following syntheses (pages 4 and 7), which are based on the *Curriculum and Evaluation Standards for School Mathematics*, outline some basic aspects of teaching geometry. The accompanying activities, "Which Container Holds the Most?" and "Building Houses," provide practical examples for translating the *Standards'* recommendations into classroom instruction.

Geometry is an orderly way to describe and represent our inherently geometric world. Basic to the understanding of geometry is the development of spatial sense—an intuitive feel for our surroundings and the objects in them. Spatial capabilities appear early in life, and tapping into these strengths can foster an interest in mathematics. Children who develop a strong sense of spatial relationships and master the concepts of geometry are better prepared to learn number and measurement ideas as well as other advanced mathematical topics.



Classroom experiences that focus on geometric relationships will develop children's spatial sense. They should examine the direction, orientation, and perspective of objects in space; the relative shapes and sizes of figures and objects; and how a change in shape relates to a change in size. Children can begin with activities that use words like *above, below,* and *behind* and progress to using a computer to reproduce a pattern-block design.

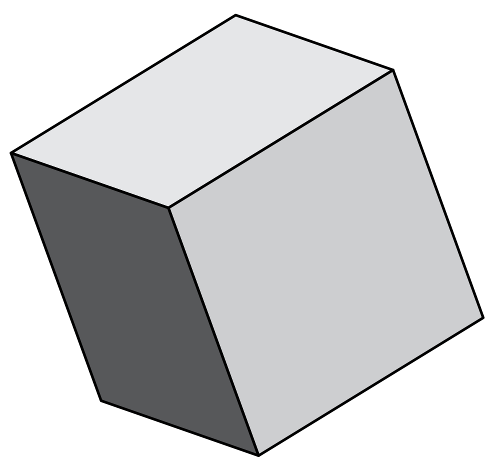
Evidence suggests that the development of geometric ideas progresses through a hierarchy. Students first learn to recognize whole shapes and then to analyze properties of a shape. Later they can see relationships between shapes and make simple deductions. Instruction must consider this hierarchy because, although learning can occur at several levels at once, the learning of more complex ideas requires a firm foundation of basic skills.

For middle school students the informal exploration of geometry can be mathematically productive. Geometry at this level links the informal explorations begun in grades K–4 to the more formal processes of grades 9–12. Students draw inferences and make logical deductions from geometric problem situations. They can also analyze their thought processes and explanations. Allow sufficient time to discuss the quality of their answers and to think about such questions as: Could it be another way?

Students should learn to use correct vocabulary, including such common reasoning terms as *and, or, all, some, always, never,* and *if...then,* as well as such descriptors as *parallel, perpendicular,* and *similar.* Geometry has its own vocabulary including terms like *rhombus, trapezoid,* and *dodecahedron,* and students need ample time to develop confidence in their use of this new and unique language. Definitions should evolve from experiences in constructing, visualizing, drawing, measuring, contrasting, and classifying figures according to their properties. Students who memorize a definition and a textbook example or two are less likely to remember the term or its application.

Computer software allows students to construct two- and three-dimensional shapes on a screen and then flip, turn, or slide them to view from a new perspective. Explorations of flips, slides, turns, stretchers, and shrinkers will illuminate the concepts of congruence and similarity. Observing and learning to represent two- and three-dimensional figures in various positions by drawing and constructing also helps students develop spatial sense.

This synthesis is based on the chapters "Geometry and Spatial Sense" and "Geometry for Grades 5–8" from *Curriculum and Evaluation Standards for School Mathematics.* Order from NCTM, 1900 Association Drive, Reston, VA 22091. Telephone: 1-800-235-7566.



Which Container Holds the Most?

An Activity for Younger Children

Most children will come to this activity with memories of filling containers with water, sand, dirt, or objects. Although they may not hold a sophisticated understanding of volume and surface area, their experiences will provide a learning base.

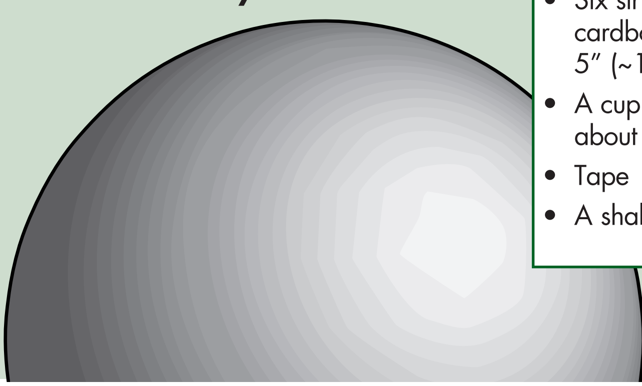
Within each group the members should comment on the activity, observing each container and projecting the outcome of the bead count. Ask the students to discuss their observations among themselves before sharing with the class.

The containers' constant outer surface area allows comparison of their volumes. The children may need some direction to understand this idea.

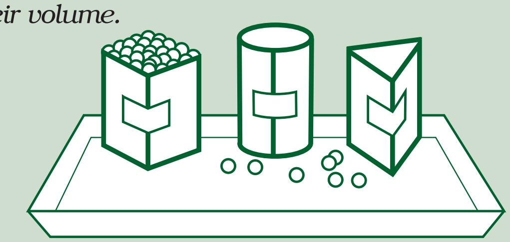
Young children may need help accurately taping the strips. Constructing the containers will help them understand that the surface area is the same for each.

Moving the beads from one container to the next helps students see that the quantity needed to fill them increases or decreases as the shapes change.

Use this activity to introduce vocabulary words such as *cylinder, volume,* and *surface.* The children can hear the words and practice using them as they explore the activity. Remember, however, that success at this level does not depend on using correct vocabulary. Continued practice with the ideas and use of appropriate words will instill the vocabulary over time.



This activity lets younger children build several different-shaped containers and compare their volume.



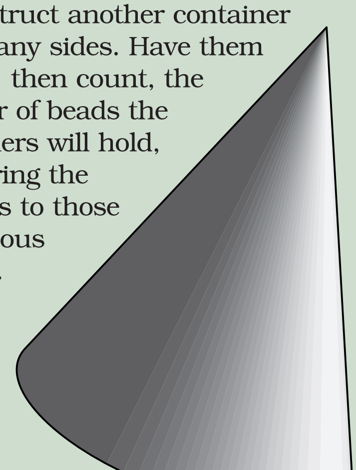
To introduce this activity, link the students' experiences with the concept of volume. Who has filled buckets with water or dirt? What other containers have you used? What is in an empty container? What shape of container would you predict holds the most? How can you test your hypothesis? Here is a way to build containers of different shapes and find out how much each will hold.

Divide the students into groups of three. Each group receives three equal strips of card stock and a cupful of small beads in a shallow tray. Groups are to build three containers of different shapes. Each container is constructed by joining the 1.5" (~4 cm) ends of a 5" (~18 cm) long strip, taping the edges where they meet so there is no overlap. The tray bottom serves as the container's bottom piece. For all shapes except a cylinder, creases in the strip help define the shape. The children will need to work together to tape the strips.

Ask the children to predict which shapes will hold the most material and record their responses on a class chart. Then the group fills one container with beads, counts the number it holds, and records its results for that shape. They then transfer the beads to another container, adding or removing beads if necessary. Then they do the same for the third container. Caution the groups to keep the container sides straight and not to let the walls bulge from the weight of the beads. A group member records the results of each container's capacity.

When the measuring is complete, the results can be compared across the groups and recorded on a class chart. What can be seen from the data? How does the number of container sides compare with the number of beads it can hold? Does it matter if the sides are of equal length? If we had to choose a shape that holds the most, which would it be?

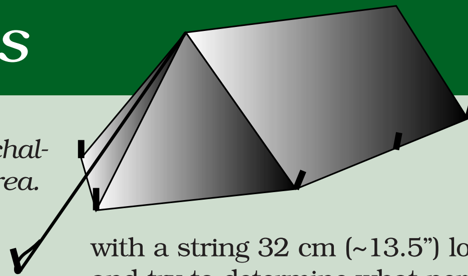
An Extension: Give every student another strip. Ask them to construct another container with many sides. Have them predict, then count, the number of beads the containers will hold, comparing the volumes to those of previous shapes.



For each small group you will need:

- Six strips of card stock or light cardboard cut into the dimensions 5″ (~18 cm) X 1.5″ (~4 cm).
- A cup of wooden or plastic beads about the size of small lima beans.
- Tape
- A shallow plastic tub or metal tray

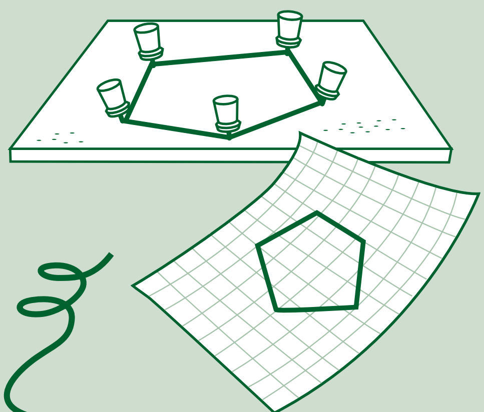
Building Houses
An Activity for Older Students

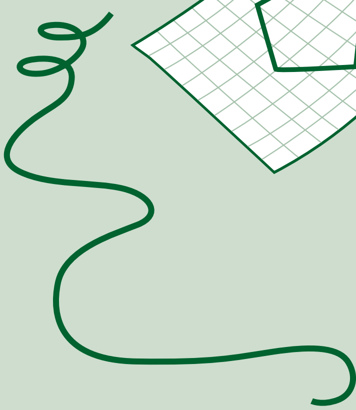


Set in the context of building a house with limited resources, this activity challenges students to determine what shape provides the greatest internal area.

You will need:

- String cut in 32 cm (~13.5″) lengths
- Graph paper
- Rulers, compasses, other drawing and measuring tools
- Pins
- Corkboard squares





The Scenario

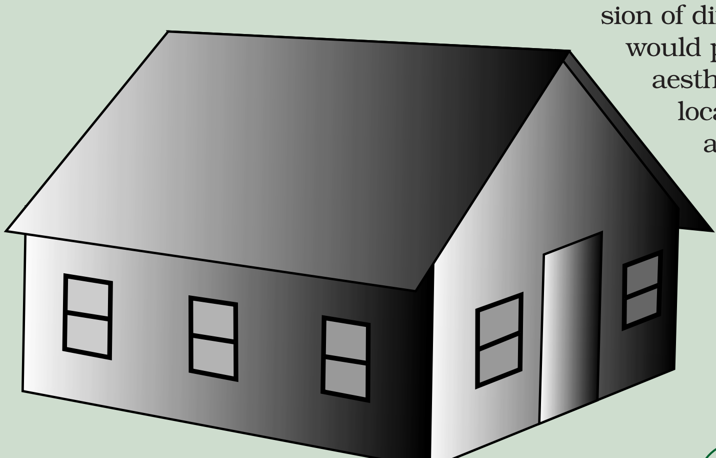
Imagine that you live in a society in which people produce almost everything they need by their own efforts. Your family is planning to build a house and your family and neighbors must gather all the materials. Some of the materials are scarce and you want to be as efficient as possible. You have collected all of the materials you can for the walls, but you are concerned that you might not be able to build a house with enough space for your family. Design a floor plan that will give your house the largest amount of enclosed space.

To begin thinking about this activity, the class might discuss the different styles and shapes of dwellings seen around the world. Examples of teepees, tents, one- and two-story houses, apartments, yurts, igloos, and other structures indicate the variety of the world's structures. Students might be interested in the work of Buckminster Fuller or homes designed for fuel efficiency or other environmental concerns. A discussion of different dwellings would probably touch on aesthetics, weather, and local terrain as well as availability of structural materials.

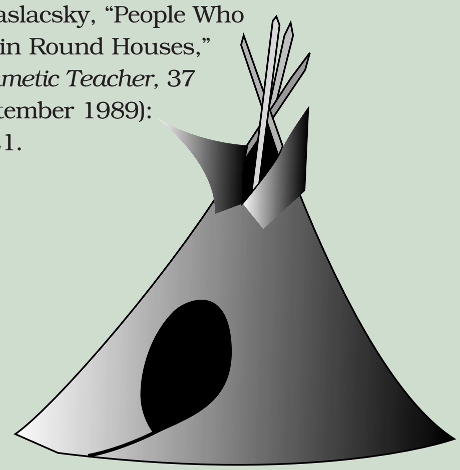
Each student group will work with a string 32 cm (~13.5") long, and try to determine what perimeter shape provides the greatest internal area. Encourage the groups to try a variety of shapes they think might be interesting.

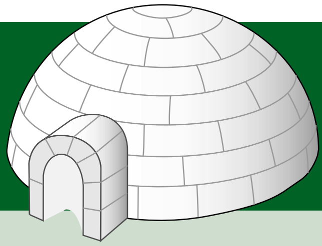
Students may find it helpful to pin the string onto corkboard to fix the shape, then transfer the dimensions to a rendition on graph paper. A variety of ways can be used to determine area including use of formulas or counting the number of graph squares enclosed in the shape. Some measuring and drawing tools, such as compasses, protractors, rulers, and t-squares, should be available, but they may not be needed.

When the groups are finished they can record their data on a class chart that allows comparison across the groups. Particular attention to the number of sides and the area dimensions for the various figures will allow a pattern to emerge. Discussion can focus on the comparison of data from the various figures. What can be inferred from the results? What predictions can be made about other kinds of figures?



This activity is adapted from C. Zaslacsky, "People Who Live in Round Houses," *Arithmetic Teacher*, 37 (September 1989): 18–21.





Geometry for Grades 9–12

Even though the teacher sets up the context of this activity, the students are in charge of the exploration. The drawings and data will present evidence that they can interpret within the small groups, compare across the groups, and discuss with the entire class.

Establish what ideas the students have about the relation of surface area and internal area. Placing the activity in the context of house construction takes mathematics out of the abstract and grounds it in the concrete world. If they were building a house, would the walls be vertical, as in a traditional Western house, or slanted, as are teepees or A-frame houses? What effect would a slanted wall have on the amount of interior space?

By designing the shapes and determining the internal areas, the students have produced raw data. They can examine and explain hypotheses about the figure that encompasses the largest area within a given perimeter.

As students plot the shapes of their houses, the spaces within the images will emerge as identifiable figures. The students will be able to see the areas change and enlarge as the number of sides increases and the figure nears the shape of a circle.

The groups may need encouragement to use many-sided figures as well as triangles and quadrilaterals. This is a good opportunity to reinforce use of mathematical terms and vocabulary.

This activity works well for student groups of three. The group should assure that every member understands what is being performed and discussed.

Geometry in grades 9–12 encompasses **algebraic** and **synthetic** (elementary euclidean) perspectives. The NCTM *Standards* recommend that topics be integrated across all grade levels. The *Standards* emphasize

- transformation and coordinate approaches,
- the development of short sequences of theorems,
- deductive arguments expressed orally and in sentence or paragraph form,
- computer-based explorations of 2-D and 3-D figures,
- three-dimensional geometry,
- real-world applications and modeling.

In the study of geometry of two and three dimensions from an **algebraic** point of view, students deduce properties of figures using transformations and coordinates. They should be able to identify congruent and similar figures using transformations, analyze properties of euclidean transformations, and relate translations to vectors. Students headed for college should also be able to deduce properties of figures using vectors and apply transformations, coordinates, and vectors in problem solving.

The student who understands the interplay between geometry and algebra has more power to construct and analyze problems. Objects and relations in geometry correspond directly to objects and relations in algebra. For example, a point in geometry corresponds to an ordered pair (x,y) of numbers in algebra. A line corresponds to a set of ordered pairs satisfying the equation ax + by = c. The intersection of two lines corresponds to the set of ordered pairs that satisfies the corresponding equations.

Connections like these allow translation between the two "languages" and permit concepts in one to clarify and reinforce concepts in the other.

The **synthetic** component of 9–12 geometry allows students to interpret and draw three-dimensional objects, represent problem situations with geometric models, and apply properties of figures. Students classify figures in terms of congruence and similarity and apply these relationships. Geometry instruction should deepen their understanding of shapes, their properties, and everyday applications. Examples from such activities as recreation (billiards and sailing), practical tasks (purchasing paint for a room), or the arts (perspective in drawing) should be evident throughout the curriculum.

Give students the opportunity to work with two- and three-dimensional figures so they can develop spatial skills that are basic to everyday life. Computer graphics software that allows students to create and manipulate shapes makes conjecturing and testing their attempts at visualization easier.

Computer microworlds, such as Logo turtle graphics, provide opportunities for a great deal of student involvement.

Of course there are many opportunities for visualization that do not use a computer. Exercises that require the student to draw a diagram provide opportunities for reading mathematics and problem translation.

This synthesis is based on the chapters "Geometry from a Synthetic Perspective" and "Geometry from an Algebraic Perspective" from *Curriculum and Evaluation Standards for School Mathematics.* Order from NCTM, 1900 Association Drive, Reston, VA 22091. Telephone: 1-800-235-7566.

Resources and Opportunities

Great Explorations in Math and Science (GEMS)

Science and mathematics teachers who need new ideas might look to GEMS for inspiration. These publications—teacher guides, handbooks, assembly presentations, and exhibit guides—include many of the essentials of hands-on science and mathematics instruction. GEMS workbooks (most of which range from $10 to $15) engage students in direct experience and experimentation before introducing explanations of principles and concepts. GEMS integrates mathematics with life, earth, and physical science.

GEMS offers titles for students from preschool to high school. Many of the guides offer suggestions for linking activities across the curriculum into language arts, social studies, and art.

A product of the Lawrence Hall of Science at the University of California, Berkeley, the activities and lessons were designed and refined in classrooms across the country. The growing list of titles now includes 37 teacher's guides and 5 GEMS handbooks. For more information:

LHS GEMS
Lawrence Hall of Science
University of California
Berkeley, CA 94720
Telephone: (510) 642-7771

Teacher Institutes

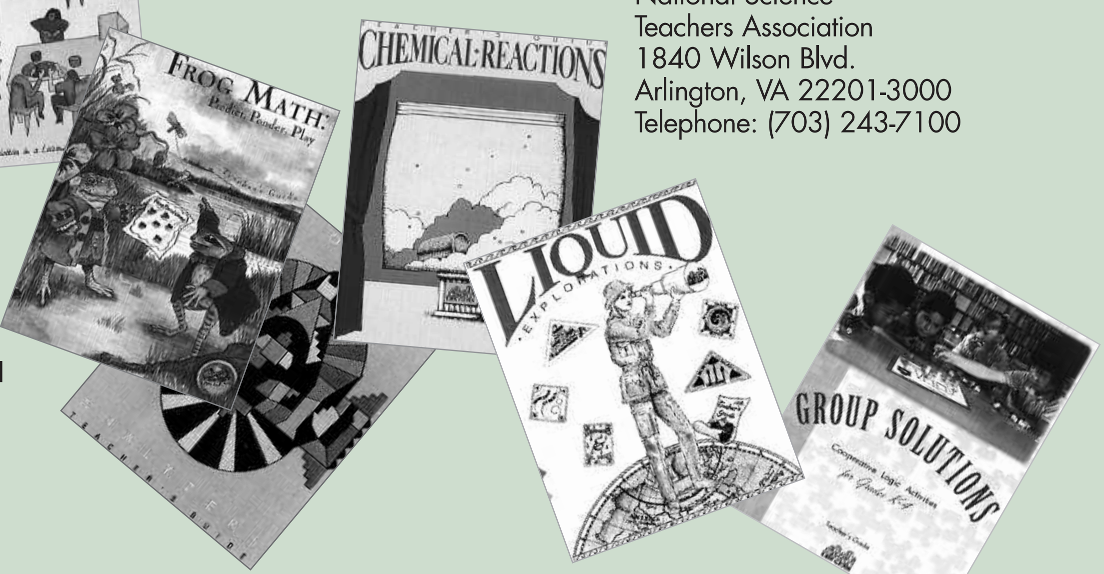
The Woodrow Wilson National Fellowship Foundation sponsors a program of professional support for science, mathematics, and history teachers in middle and secondary levels. In the TORCH (Teacher Outreach) program, teams of master teachers share new techniques, ideas, and resources with fellow teachers across the country. About 3,000 teachers attended last summer's institutes, which are hosted at colleges, universities, and other organizations. In the past two years TORCH institutes were held in Arkansas, New Mexico, Oklahoma, and Texas. While there is a registration fee, many Title II coordinators or school districts can offer assistance. Surveys of past participants of the one-week institutes provide strong evidence that the sessions are a lasting source of professional renewal. Contact the Woodrow Wilson Foundation for a summer 1995 schedule.

The Woodrow Wilson National Fellowship Foundation
CN 5281
Princeton, NJ 08543-5281
Telephone: (609) 452-7007

Reforming the Science Curriculum

The SS&C (Scope, Sequence and Coordination of Secondary School Science) project has been working for the reform of the science curriculum since 1990. Backed by the National Science Teachers Association (NSTA) and funded by the National Science Foundation (NSF) and the U.S. Department of Education, SS&C has concentrated on middle school science until this year, when its focus expanded to high school. SS&C offers two-day workshops for schools interested in making substantive changes in the way science is taught across the grades. Basic to the SS&C philosophy is the idea that students should study all topics from every major science discipline at every grade level, K–12. SS&C supports active student participation in the learning process, a curriculum that includes a modest number of topics treated in depth, and student assessment consistent with course goals and teaching strategies. For more information contact:

SS&C Project
National Science Teachers Association
1840 Wilson Blvd.
Arlington, VA 22201-3000
Telephone: (703) 243-7100



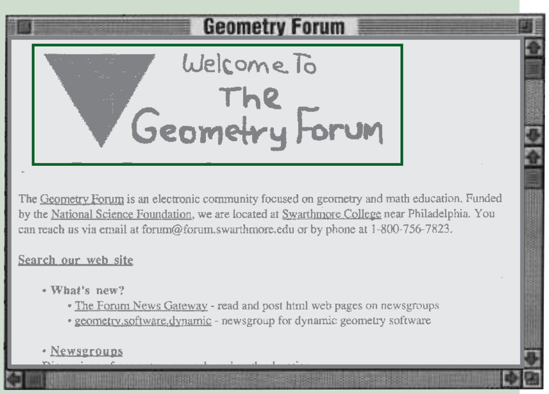
Geometry on the Internet

For teachers and students who are linking into Internet resources, a project from Swarthmore University might be of interest. The Geometry Forum provides a unique collection of geometry materials for the K–12 and college communities. The Forum includes a great number of sketches, scripts, and demos. Many of the examples can be downloaded and used with Geometers Sketchpad or Cabri Geometre software. The service provides abstracts of relevant books and articles and offers a bibliography of geometry-related articles in *Mathematics Teacher.* A problem of the week and a problem of the month are posted for student solutions, and successful answers are presented for readers' review. The Forum is packed with interesting exchanges and ideas and there is a real sense of shared excitement from its staff and participants.

The Geometry Forum can be accessed through Mosaic:
http://forum.swarthmore.edu

or with gopher software:
forum.swarthmore.edu

More information about joining the Forum's newsgroups or other questions can be sent by e-mail:
annie@forum.swarthmore.edu



What Is the Southwest Consortium?

The Southwest Consortium for the Improvement of Mathematics and Science Teaching (SCIMAST) is one of ten Eisenhower Mathematics and Science Regional Consortia established by the U.S.Department of Education. SCIMAST supports systemic reform through a variety of activities and services that include training, technical assistance, and a toll-free information service (1-800-201-7435). The SCIMAST Demonstration Center houses a multimedia collection of instructional materials for teachers of mathematics and science. Any of the materials can be used during resource center hours (Monday–Friday, 8:00 am–5:00 pm).

SCIMAST was funded in the fall of 1992 through a three-year grant, grant number R168R20003-94, from the U.S. Department of Education's Eisenhower National Program for Mathematics and Science Education. Third-year funds for SCIMAST total $1,348,100, representing 75 percent of the project's cost. An additional $499,367 is provided from nonfederal sources, making up 25 percent of project costs. SCIMAST is operated by the Southwest Educational Development Laboratory (SEDL) as part of the Center for the Improvement of Teaching in Mathematics and Science (CITMAS).

Eisenhower Southwest Consortium for the Improvement of Mathematics and Science Teaching

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Help for Mathematics and Science Teachers from ENC

Thousands of books, films, CDs, software packages, and other media are available for classroom use. Most teachers end up choosing items that they have seen at conferences, titles recommended by a friend or colleague, materials displayed in the library, or products presented by a sales rep. To help teachers look more systematically for the materials they need, the Eisenhower National Clearinghouse (ENC) is collecting K–12 instructional materials and has recently placed an electronic catalog online. While it is in its fledgling stage with about 800 items available, the Educational Materials Catalog gives a glimpse of the ability of this tool to help teachers track down relevant materials.

As part of the Eisenhower National Program for Mathematics and Science Education, ENC is located in Columbus, Ohio, and operates under contract with The Ohio State University. The project is establishing a national curriculum repository to support the online catalog. In addition, ENC is compiling databases of resource, evaluation, and support services, and plans to provide the means for teachers to interact electronically.

On the Internet, ENC has established a gopher site that will allow a visit. If you have telnet access to the Internet, you can reach ENC's gopher site by telneting to **enc.org** and entering the login **gopher**. No password is needed, just hit return.

If you have gopher software, the Internet address for ENC's gopher site is also **enc.org**.

If you have a modem but are not connected to the Internet, dial 1-800-362-4448. Set your communications software to VT100 terminal emulation. Terminal parameters should also be set to No parity, 8 data bits, 1 stop bit, and full duplex. When the ENC welcome screen appears, chose C to connect to ENC online services and log in as **guest**.

The ENC gopher site offers the following resources:

- **General**—Information about ENC.
- **Guides**—Information about Internet resources that may be useful to teachers under the headings Education, General, Government Information, and Sciences.
- **ENC Catalog of Curriculum Resources**
- **Vocabulary**—Terminology that ENC is using for catalog development.
- **Federal Programs**—The *Guidebook to Excellence*, a resource of federal programs committed to reform in mathematics and science education.
- **OERI**—Information from the Office of Educational Research and Improvement, U.S. Department of Education.
- **Other Education-Related Gophers**—Includes gophers at several regional consortia.

For more information concerning the Eisenhower National Clearinghouse, call the SCIMAST toll-free number, 1-800-201-7435.