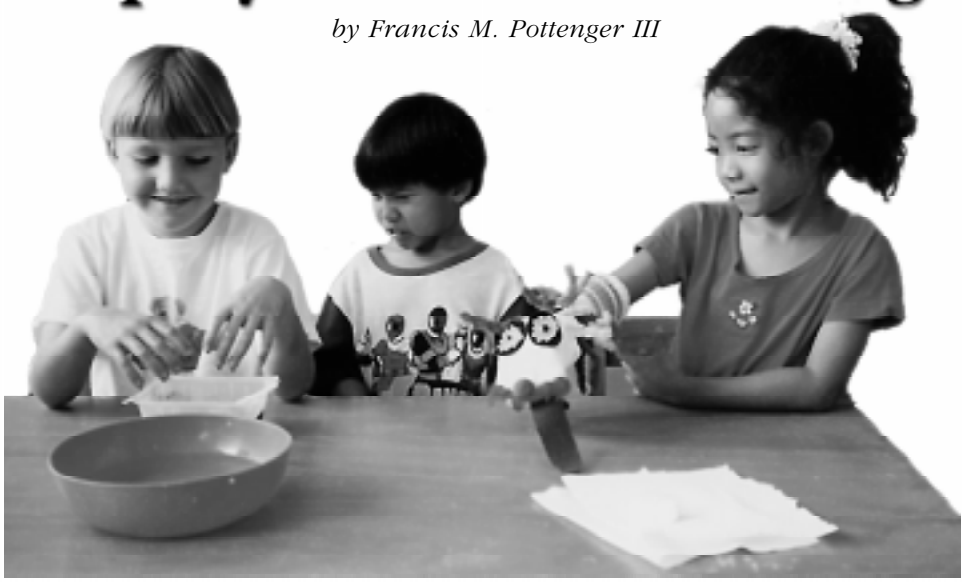
Science Education

VOLUME 18, NUMBER 2 SPRING 1999

Inquiry and Direct Teaching

by Francis M. Pottenger III



When teachers begin using a new curriculum that marches under the banner of inquiry, some expect to find inquiry as the sole mode of presentation. Instead they often find a mix of modes. Why? Because, for many reasons, students cannot possibly create and find anew all the knowledge our society deems essential for them to know.

Two general kinds of strategies are available for teaching concepts and skills required by society: direct teaching and inquiry teaching. Direct teaching transmits to students what is *known* via the teacher, a book, a video, or other repository of knowledge. In contrast, inquiry teaching instructs students in how to probe things *not known* (or treated as not known) so as to gain understanding of how knowledge has been made and how they themselves can make new knowledge on their own. Inquiry also teaches knowledge through the experience of inquiry itself.

Direct teaching is essential for transmitting conventions of communication and social behavior. It is also used to transmit conceptual, artifactual, and methodological knowledge. Conventions and crafted artifacts are unique inventions whose origins are lost in antiquity. They are the products of arbitrary creative decisions—for example, the words and syntax of language, accepted social behavior, forms of music, and so forth. Re-creation of these knowledge products is not possible, yet they are essential to cultural continuity. Hence they must be taught by techniques that assure precision in transmission, retrieval, and use. Their preservation depends on techniques of direct teaching, which typically use demonstration in some form, after which students internalize and replicate an invention, correcting it until it meets acceptable standards.

Inquiry is essential to finding out about things unknown or not understood. The natural sciences, which seek to make natural phenomena understandable, have been built with the methods of inquiry. Engineering, agriculture, medicine, and other technologies use these methods in testing the utility of invented devices, techniques, and systems. In parallel

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Published 2–3 times a year

NEW FEATURE

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Weird Science

by Mike Baiocchi

I was just strolling through, so to speak, my educational experience when I was broadsided by a most peculiar class. The first day I spent in freshman science was a bit awkward. There were no books. There was a lesson plan, but no lecture. This disturbed me. Until this freshman course, I had spent little time dwelling on science. I would do the necessary listening and memorizing, get my "A," and go home. All the while I was fooling myself into believing I was understanding new things, understanding in new ways, that which was around me.

I was taught the terms "density," "precipitation," and "heat," but I never owned the ideas that made these words. I could, on the day I walked into freshman science, tell you that "density" was "mass divided by volume," but comprehending what I meant when I said that was beyond me. My head was filled with ideas that were not my own. I had not participated in forming or realizing the concepts. I had no sovereign right to claim ownership of the ideas. I was a peon, far from the sovereign kings of these thoughts. "Density" was not vital to anything I did, so I learned its definition and moved on. In this freshman science class I was not allowed the luxury of moving on. I was asked "why?" so many times and in so many ways that I wanted to scream. The term "to grok" from Robert Heinlein's book *Stranger in a Strange Land* means to "understand completely, to understand to such a point that the idea is owned." For the first time in my education I was asked to do more than retain a word and someone else's idea. I was being asked to "own" it.

It was as if I had shattered the mirror, and moved beyond. No longer was I reflecting back information that was poured into me. I was finally engaged in discovering, for myself, the "why" of things. I moved to the front line of learning. Instead of absorbing others' ideas, I was recreating and ultimately "grokking" those terms I "learned" so long ago. I was amazed at my ability to take ideas apart and put them back together again. It was like peeling away layers of haze. The obscured abstract that had been my goal all along was now out of its package, shiny and new. Previously, I had never dared to change the equations I learned. Now I was finding that I could rearrange the ideas, my ideas, in new ways to make my way through the dark.

After learning that things could be learned in a truer way, I felt a need to re-examine the whole of my education. Had I spent all these years learning useless facts? Had I been distracted by the package all these years? I thought about what I felt I needed to know and how well I felt I needed to know those things. I concluded that only through meshing both styles of learning could I hope for the best education. To truly understand the idea takes considerable effort and a long, cumbersome process. Reinventing, in intimate detail, the knowledge of several thousand years of civilization is neither efficient nor practical, but every once in a while a jarring is necessary. A test, such as freshman science, is needed to prove just how firm your understanding really is. There are connections to be made between ideas that only a sovereign understanding can afford.

Editor's Note: Mike Baiocchi is a former student of Steve Bartasius, a FAST 1 *teacher from Gray-New Gloucester High School in Gray, Maine. Steve sent us this essay, written for a senior Honors English class, to share Mike's insightful reflections on his freshman* FAST *experience. Thank you both. Well done!*

Inquiry and Direct Teaching, continued from page 1

fashion to the teacher's role in direct teaching, nature serves as a scientist's teacher, providing demonstrations of phenomena and then correction of ideas formulated about those phenomena. But rather than simply internalizing and accepting nature's demonstration, scientists and students alike must process the experience of the demonstration by observing, testing, and interpreting.

A closer look at inquiry illuminates this observing, testing, and interpreting cycle. There are at least two general types of inquiry: discovery and experiment. Discovery happens when we find something new. The observation may be accidental—looking up and discovering the moon during the day, for example. Or it may be intentional—such as looking for bones in a tar pit. Once made, a discovery becomes a prototype for further discovery and a part for assemblage into larger wholes.

Experimentation entails testing. In its several forms, it can range from satisfying simple curiosity (for example, testing to see what will happen if I take that rock from under that wheel) to testing of an explanatory hypothesis (for example, growing grass under bushes with and without leaf mold to test the hypothesis that less grass grows under bushes than in an open meadow because bush leaf mold kills the grass). Discovery and experiment are often joined processes occurring sequentially or concurrently.

While the arbitrary character of social conventions requires direct teaching plus a teacher's corrections to assure fidelity in transmitting knowledge, nature is an even more rigorous overseer, correcting inquiry by the very regularities that inquiry seeks to understand. Since nature always points inquiry in the same direction, it can be re-experienced endlessly. However, the immensity of the body of knowledge compiled by the natural sciences, along with the difficulty of experiencing many phenomena (they occur on the ocean bottom or in distant space) limits the use of inquiry in teaching natural science in schools. There is only enough time and direct accessibility to phenomena for students to get the flavor of recapitulated science and associated technology. Hence the information base and the theory structure of much of science must be taught directly, just as it must be communicated through the journals of the sciences.

Precious then are the few things selected for students to know through discovery and experimentation, for what is selected carries the double burden of exciting students' imagination while teaching inquiry processes. Our CRDG programs emphasize inquiry in the early years to keep curiosity alive and to unfold the most fundamental ideas of the sciences. We have found that, once students know how the grounding ideas of a science are created, they can construct usable personal knowledge structures from direct teaching of evolved concepts and theory. For these reasons, inquiry and direct teaching are companions in CRDG's programs from the early grades upward.

IN THE WORKS

by Carol Ann Brennan

The *DASH* staff has been working on an assortment of projects, of which the following are just a sampling. We have formalized the plan we piloted last summer for helping teachers identify essential activities and organizing them into a plan for their first year in *DASH*. We have also piloted and written plans for facilitators to help schools articulate *DASH* from grade to grade, to align *DASH* with state standards or frameworks, and to articulate *DASH* with other subjects in the curriculum.

We are now editing and reformatting the K–3 *DASH* teacher guides, trying to have them ready for summer distribution. The *DASH Handbook for Administrators,* now in its final editing phase, should also be ready for summer. And we expect to have a new *DASH Instructor's Guide for Professional Development* ready for *DASH* summer institutes.

Assessment has been a major focus this past year. Dr. Pottenger has come up with two general rubrics for written work and for products or inventions. We are working to devise some *shells* for teachers to use in writing classroom rubrics. One example is a rubric shell for assessing working definitions. A teacher can use the shell to write a classroom rubric for a definition of, for example, plants. We have found that teachers must write their own rubrics, based on what happens in their own classes. We hope these shells will ease that process. As developers we can write rubrics only to assess the level of program implementation.

In the assessment arena we have also been collecting program effectiveness data. We are deep into analyzing a multitude of indicators, including teacher portfolios, teacher and student surveys, student test scores, case studies, and classroom videos. Much of this information was collected as a part of the just-completed STEP grant. So far, the findings look very favorable. We aim to publish a summary of evaluations in the near future.

We are receiving inquiries daily from new districts and schools interested in implementing DASH. The schedule of summer institutes is fast filling up. Much of this interest seems to stem from the mention of *DASH* in the Northwest Regional Laboratory's *Catalog of School Reform Models*, first edition, 1998. *DASH* was included in the Skill- and Content- Reform models section.

by Sandra Shimabukuro

The summer of '99 offers *DASH*ing opportunities on four Hawaiian islands. Pick an island and check below for dates of *DASH* institutes.

Join us too for something new—a five-day institute called School Team Planning. We urge teachers and a school administrator to attend as a team. The course guides the team in devising a plan for articulating *DASH* across subject areas and between grades, aligning *DASH* with state frameworks or standards, assessing students and the program, and establishing support networks of teachers, parents, and an administrator. Teachers at Mokapu Elementary School on O'ahu and *DASH* instructors are helping to shape the course.

O'ahu, famous for 20-foot waves, hosts Grades K to 6 during the weeks of June 21 to July 3, 1999. You have two choices for the School Team Planning Institute: July 6–10 or July 12–16, 1999.

Or be on Maui, voted the top vacation island, for grades K to 5 during the same weeks as O'ahu, June 21 to July 3. The School Team Planning Institute is July 12–16.

Go to Kaua'i, the Garden Isle, for grades K to 5 or to Hawai'i, home of the erupting volcano Kilauea, for grades K to 6 from July 19 to 31. School Team Planning on Kaua'i is August 2–6 and on Hawai'i August 9–13.

Be where the action is. *DASH* in Hawai'i.

Ruth Martin Receives Science Award

by John Pauls

Ruth Martin has been honored with a 1998 award for Excellence in Middle School Science Education, given by the Pacific Science Center and Ackerley Corporate Giving. Many readers know Ruth as a *FAST* Institute instructor and teacher at Alderwood Middle School in Lynnwood, Washington.

The award recognizes Ruth's role in encouraging and motivating students in studying science. According to the presentation, Ruth "incorporates science skills such as hypothesizing and measuring data into integrated educational projects." Her students have worked in a major interdisciplinary project to restore a stream to a salmon habitat, enhance a wetland, landscape a berm with native plant species, and preserve historic buildings at the Alderwood Demonstration Farm. Under Ruth's supervision, her students presented a session in Seattle at the NSTA's Northwest Regional Convention. One teacher commented, "This session made coming to this NSTA convention worthwhile." The origins of this project lay in the *FAST* Water Resource Management unit.

Ruth received a plaque and a $2,000 award at a ceremony at a meeting of the Edmonds School District board on November 4. She was selected from applicants throughout the state of Washington.

Innovative *FAST 2* Teacher Engages Students with Giant-Sized Manipulative Models

Carol Ann Kelly, teacher at Farnsworth Middle School in Guilderland, New York, spiced up *FAST 2* Literature on Simplest Formula of Gaseous Compounds by creating giant-sized manipulative models for students to work with. These huge creations, which mimicked the *FAST 2* symbols, allowed students to engage in the process by which molecular representation resulted in determining the simplest formula of some gaseous compounds. Mrs. Kelly had students come to the board to fill in data tables presented throughout the lab. She says, "It was phenomenal to see all the lights of understanding through inquiry go on in the face of each student as the formula was created." Students were engaged, excited, and eager to do this activity. As a facilitator of learning, Mrs. Kelly saw students actually correcting themselves. She relished the lesson that enticed her students to *inquire* and that led them right into the next investigations.

By using the giant models she met the needs of the learning styles in her class. Models were constructed from paper and cardboard. Deaf and hard-of-hearing students saw the represented formula development very clearly, students with individualized educational programs caught on to the concepts set out, and gifted students raised a host of inquiry questions.

Mrs. Kelly reported that the result of this activity was not merely a completed table, but a true understanding of the literature put forth in the labs. She is an advocate of the *FAST 2* approach to scientific thinking because, day after day, she sees her students grasping each concept put forth, enticing them to further questions, which in turn lead them on through the inquiry program. As an educator, she considers it a pleasure to facilitate the "circle of learning."

The Transition to Middle School

by Donna Schumacher
(Reprinted with permission from the ERIC/EECE Newsletter)

Students make many transitions during their years of schooling: from home to school, elementary to middle school, middle school to high school, and high school to college or work. These transitions are usually major events in the lives of students and parents. The stresses created by these transitions can be minimized when the new environment is responsive to each particular age group.

Transition Programs

Effective and comprehensive transition programs help (1) build a sense of community; (2) respond to the needs and concerns of the students; and (3) provide appropriate, faceted approaches to facilitate the transition process. The following guidelines are suggested for planning transition programs (Weldy, 1991):

- Provide several activities that will involve students, parents, teachers, and staff from both schools in the transition process.
- Establish a transition protocol that can be easily replicated and updated annually with little effort.
- Establish a timeline for the transition process.
- Schedule meetings between collaborative groups from sending and receiving schools and discussions for adults and students about the issues.
- Assess the human and financial resources available to support the transition process. Identify adult and student leaders from all schools and constituencies to help with the transition.
- Ask students, teachers, guidance counselors, parents, and others to evaluate the transition program.

Transition Activities

The following examples may be helpful in selecting or creating a transition plan to best suit your community:

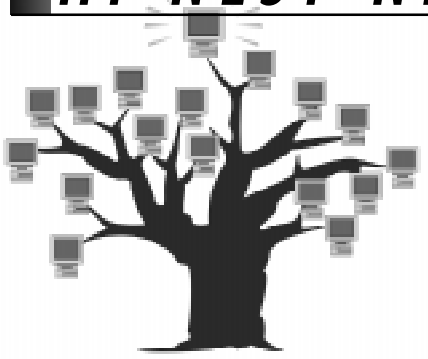
- The need for curriculum articulation for all teachers at all levels should be clearly understood. Teachers from sending and receiving schools can meet to discuss curriculum and instructional practices.
- Teachers from receiving schools can visit the sending schools to initiate personal contacts.
- Letters can be sent home welcoming students and families, and inviting them to school activities.
- Parent Teacher Association members can call each new family welcoming them to the school.
- Guidance counselors and special education teachers from each school can meet to share information.
- Students of the receiving school can become "ambassadors" of goodwill. Student-to-student contact, preceded by a discussion of what information might be useful to new students, can help establish personal links. Sending-school students can be paired with receiving-school students for visitation days.
- Letters between students in the sending and receiving schools can be exchanged.
- Programs new to entering students can be highlighted during student visitations.
- An unstructured open house can be held prior to the opening day of school; a structured evening open house can be held during the second week of school.
- A school handbook can be distributed to each family. Be sure to include phone numbers; school history; yearly schedules; teachers identified by grade level, team, and subject taught; bell schedules; lunch procedures; and other practical information.

Additional Resources

Anderman, Eric M., & Midgely, Carol. (1996, March). *Changes in achievement goal orientations after the transition to middle school*. Paper presented at the biennial meeting of the Society for Research on Adolescence, Boston, MA. ED 396 226.

Arowosafe, Donna Schumacher, & Irvin, Judith L. (1992). Transition to a middle level school: What kids say. *Middle School Journal*, 24(2), 15–20.

Weldy, Gilbert R. (1991). *Stronger school transitions improve student achievement: A final report on a three-year demonstration project "Strengthening School Transitions for Students K-13."* Reston, VA: National Association of Secondary School Principals. ED 338 985.



HI–NEST

North South East West

by John Southworth

More and more people have been signing on to our new HI–NEST Nicenet web site. See the fall newsletter for details. Enter http://www.nicenet.org to access the site. As a new user, click JOIN A CLASS and use 94780u47 as the CLASS KEY. Then sign in by making up a Username and a Password and completing the name and e-mail address blanks.

Monthly Weather Reports

Under HI–NEST Student Conference, look for the Weather Report message for the current month's announcement. You can get a blank copy of the report the Documents section. Copy, edit, and paste your report as a REPLY to the announced item.

Use this form in answering questions about monthly weather data.

For Subject list: /HI–NEST Student Conference/weather/(date)/(place)

Be sure to convert degrees Fahrenheit into degrees Celsius and vice versa. Enter *NA* for items that are *Not Available.*

The form posted on Nicenet asks for the following data:

Weather report for (date): e.g., Wednesday, 14 December 1998
Weather Report for (site):
Time measurements were taken, if known:
Average Temperature:
Maximum Temperature for the Day:
Minimum Temperature for the Day:
Cloud Cover:
Cloud Type:
Barometric Pressure:
High for Period:
Low for Period:
Tendency:
Dew Point:
Relative Humidity:
Wind Speed:
Precipitation:
Length of Day:
Sunrise:
Sunset:
Location of Observation:
Latitude and Longitude:
Elevation above Sea Level:
Urban, Suburban, or Rural:
Source of Data (student, newspaper, weather service, etc.):
Other information:

We hope to see your report on the Nicenet HI–NEST web site soon.

Information System Development

by Tom Speitel

The computer section of the Curriculum Research & Development Group has received a $970,000 contract from the U.S. Department of Defense for basic research on electronic books and on student electronic portfolio systems for classroom use. One of the many research questions is whether a student will be more forthcoming with a computer interviewer than with a live one. This question arises from preliminary observations at the Laboratory School.

This research is being done in collaboration with Mississippi State University and MountainTop Technologies of Pennsylvania. Mississippi State is researching intelligent computer-aided instructional design on the World Wide Web using portions of instructional materials already on the web. MountainTop Technologies is researching an elementary reading program delivered on the web. All these efforts will open up new vistas in distance education and authentic assessment. For further information, e-mail Tom Speitel at speitel@hawaii.edu.

Marine Educators Internet Discussion Group

by Mary Gullickson

SCUTTLEBUTT is the National Marine Educators' e-mail discussion and communications list. This list provides a forum for classroom and informal educators to post inquiries, share information, make announcements, ask questions about ocean science content, and keep current on events of interest to marine educators nationwide. Because SCUTTLEBUTT is an open, unmoderated list, subscription is open to any interested marine educator or researcher and subscribers post messages directly to the list without filtering or approval by a moderator or editor.
All messages sent to the list address (scuttlebutt@vims.edu) are automatically forwarded to all list subscribers.

SEA Education Summer Programs

by Mary Gullickson

Sea Education Association (SEA) summer programs are available for teachers again this year. Research at SEA is a six-week summer program that gives 21 middle and high school science teachers a unique opportunity to participate in a challenging oceanographic research experience. The Doherty Experience at SEA is a three-week summer program that offers teachers an exciting interdisciplinary study of the oceans. Curriculum development activities are the major focus of this program. For more information, write SEA Education Association, PO Box 6, Woods Hole, Massachusetts 02543 or call 508.540.3954.

Rainforest and Marine Biology Workshops

by Mary Gullickson

Rainforest and Reef Conservation Fund 501, a nonprofit group, is offering exciting workshops again this summer. Their 1998 workshops included participants from 40 American states and 4 Canadian provinces, plus England, South Africa, and Brazil. Forty-three universities were represented by faculty and students, along with science professionals, high school groups, and lay people interested in natural history and other topics. For 1999 they have groups coming from Penn State, Purdue, University of Maine, College of New Jersey, Muhlenberg College of Pennsylvania, Calvin College of Michigan, and a number of junior colleges and high schools.

This year their sites are Belize, Costa Rica, Honduras, Panama, Ecuador, Peru, and southeast Alaska. The workshops are field oriented, focusing on natural history, conservation, local cultures, archaeology and geology, rainforest and marine ecology, land management, and medicinal uses of native plants. Instruction features local biologists and naturalist guides. Proceeds go to sponsoring organizations that support valuable education or conservation projects in each country.

Three undergraduate or graduate credits in natural sciences or education are available for attending through Aquinas College of Grand Rapids, Michigan. For more information, phone Rainforest and Reef Conservation Fund 501 at 616.776.5928 or send e-mail to rainforest@mail.org.

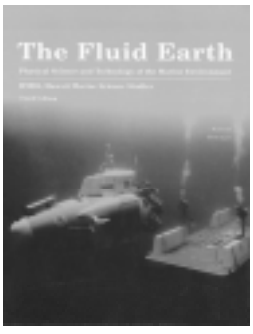
Fluid Earth / Living Ocean

Program Meets Texas Standards

by Mary Gullickson

The *Fluid Earth/Living Ocean* program has met the standards in the Texas Essential Knowledge and Skills (TEKS) list and is on the conforming list in aquatic science for textbook adoption in Texas. CRDG staff have been busy making awareness presentations for teachers and district staff in Texas, where the program has been enthusiastically received.

Plans are in the works for teachers institutes in Austin, Richardson, Houston, and Brownsville. Dates are yet to be announced.



1999 DASH Institute Schedule

- Hands on in-service teacher institutes conducted by a certified master teacher.
- Follow-up support for program use and management.
- Teacher institutes prepare participants to implement new teaching strategies in their classrooms.

Date	Location	Level
May 24–June 4	New Albany, MS	K–1, 2–3, 4
June 7–18	Ascenion Parish, LA	K–1, 2–3, 4
June 14–25	St. Louis, MO	K–1, 2–3, 4, 5
June 14–25	Harrisburg, PA	K–1, 2–3, 4, 5
June 21–25	O'ahu, HI	K
June 21–25	Maui, HI	K
June 21–26	O'ahu, HI	2
June 21–26	Maui, HI	2
June 21–July 2	Maui, HI	4, 5
June 21–July 2	O'ahu, HI	4, 5, 6
June 28–July 2	O'ahu, HI	1
June 28–July 2	Maui, HI	1
June 28–July 3	O'ahu, HI	3
June 28–July 3	Maui, HI	3
July 5–16	Pittsburgh, PA	K–1, 2–3, 4, 5, 6
July 6–16	Normal, IL	K–1, 2–3
July 6 –10	O'ahu, HI	School Team Planning
July 6–17	Syracuse, NY	K–1, 2–3, 4
July 12–16	O'ahu, HI	School Team Planning
July 12–16	Maui, HI	School Team Planning
July 12–23	Grafton, OH	2–3
July 12–23	Northeast Kingdom, VT	K–1, 2–3, 4, 5, 6
July 19–23	Kaua'i, HI	K
July 19–23	Waikoloa, HI	K
July 19–24	Kaua'i, HI	2
July 19–24	Waikoloa, HI	2
July 19–30	Kaua'i, HI	4, 5
July 19–30	Waikoloa, HI	4, 5, 6
July 19–30	Normal, IL	4, 5, 6
July 19–30	Beechwood, OH	2–3
July 19–30	Castleton, VT	K–1, 2–3, 4, 5
July 26–30	Kaua'i, HI	1
July 26 –30	Waikoloa, HI	1
July 26–31	Kaua'i, HI	3
July 26–31	Waikoloa, HI	3
July 28–August 4	Olathe, KS	K, 1, 2
August 2–6	Kaua'i, HI	School Team Planning
August 9–13	Waikoloa, HI	School Team Planning
August 9–20	Beavercreek, OH	K–1, 2–3

For further information, please contact:
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Check throughout the spring for updates at our website: http://www.hawaii.edu/crdg

CRDG Offers More Titles In The New Contemporary Fiction Series

by Don Buchholz

NEW CONTEMPORARY FICTION for ages 9 and up continues a series begun with *Chris's Story* and its back-to-back companion, *Bob and Paula's Story* (CRDG, 1994), offering present-day readers fast-paced, exciting, and meaningful stories with identifiable and likable characters. They're about kids today, their hopes and dreams, their concerns and fears. NEW CONTEMPORARY FICTION encompasses a broader world as well, including grownups as main, secondary, or ensemble characters—parents and teachers, school principals, bus drivers, paramedics, radio deejays and television reporters, politicians and police officers.

Living in Today's World

The stories in the series are about today, about making and losing friends, about belonging and being lonely, about dangers and drugs, family expectations and peer pressures, about the far-reaching consequences of a single violent act, about anger and prejudice and acceptance and trust. While most of the stories are grounded in reality, others touch on fantasy; some are whimsical, some dead serious, some wild slapstick.

Bring Contemporary Issues in the Classrooms

Books in the NEW CONTEMPORARY FICTION series are entertaining without being shallow, and educational without being pedantic. Teachers looking for ways to introduce contemporary social and health issues into the classroom and to provide a foundation for discussion will find in this series a wealth of ideas as well as stories that will draw kids in and hold them. The books can be used as individual or class readers, as read-alouds, for role-playing and class drama presentations.

Discussion Questions and Activity Suggestions

All books in the series come with outlines and chapter synopses, age- and grade-appropriate discussion questions, and suggestions for classroom springboard activities.

More Information

Contact the CRDG Dissemination office to request a brochure describing the NEW CONTEMPORARY FICTION series.

Call 1.800.799.8111 or e-mail crdg@hawaii.edu.

Announcing

S & S SCIENTIFIC UPDATED CONTACT INFORMATION

www.ssscientific.com
Phone or fax: 724.872.9383
E-mail: sssci@sgi.net

1999 FAST Institute Schedule

- Teacher institutes and follow-up support are provided by the University of Hawai'i.
- Helpful standards on marking and grading are provided.
- Materials include teacher guide, instructional guide, and evaluation guide.

FAST 1, THE LOCAL ENVIRONMENT

June 14–25	Honolulu, HI
June 14–25	West Seneca, NY
June 14–25	St. Louis, MO
June 21–July 2	Raleigh, NC
July 5–16	South Portland, ME
July 19–30	Manteca, CA
July 26–August 6	Mountlake, Terrace, WA
August 2–13	Beechwood, OH
TBA	Austin, TX

FAST 2, MATTER & ENERGY IN THE BIOSPHERE

June 14–25	St. Louis, MO
June 21–July 2	Raleigh, NC
June 28–July 9	Honolulu, HI
August 2–13	Beechwood, OH
August 2–13	Lake Arrowhead, CA
August 2–13	Manteca, CA
August 9–20	Reading, MA
August 9–20	Mountlake Terrace, WA

FAST 3, CHANGE OVER TIME

July 12–23	Honolulu, HI
July 12–23	Mountlake Terrace, WA
July 19–30	Raleigh, NC
August 9–20	Akron, OH

For further information, please contact:
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Fax: 808.956.6730
E-mail: crdg@hawaii.edu

Check throughout the spring for updates at our web site: http://www.hawaii.edu/crdg

1999 *Fluid Earth/Living Ocean* Institute Schedule

- A ten-day, hands on institute conducted by a certified master teacher is required for the teaching of HMSS.
- The institute covers both The Fluid Earth and The Living Ocean.
- Prospective teachers do sample investigations, review subject matter, and plan teaching strategies.

June 14–25	Honolulu, HI
Summer 1999–TBA	Boston, MA
Summer 1999–TBA	Austin, TX

For further information, please contact:
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Check throughout the spring for updates at our web site:
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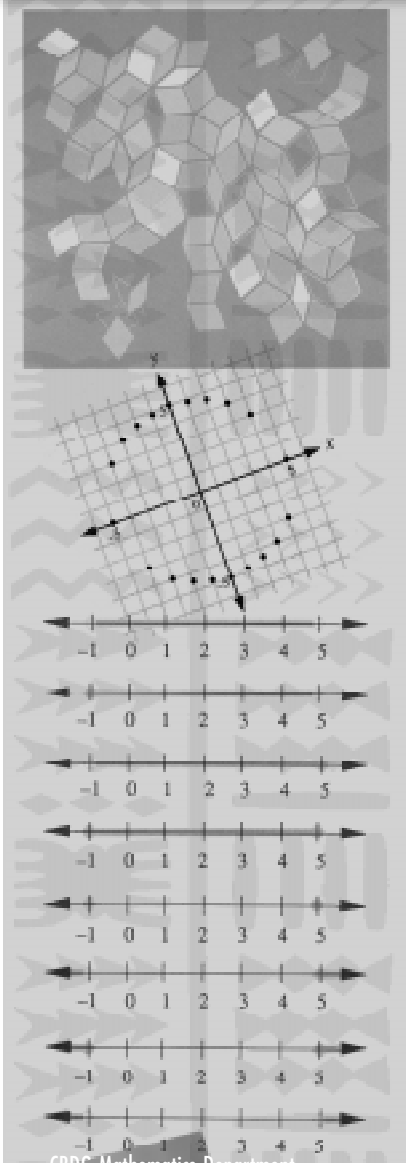
National Marine Educators Association (NMEA) Conference

by Mary Gullickson

Exploring Our Coastal Heritage: A Voyage Through Cultures, Lands, and Seas
August 6–11, 1999
Charleston, South Carolina

Explore our coastal heritage in southern style in historic Charleston by the sea! Expansive salt marshes, meandering tidal creeks, remote barrier islands, old cobblestone streets, former rice plantations, and Gullah-speaking sweetgrass basket weavers create a magnificent backdrop for this special NMEA annual conference. Hosted at the College of Charleston (est. 1770), the conference promises excellent concurrent sessions, dynamic guest speakers, field trips to unique ecological and historical locations, great southern cuisine, and the brand-new South Carolina Aquarium. For more information, write Wendy Allen at Baruch Field Station, USC, PO Box 1630, Georgetown, SC 29442, phone her at 843.546.3623, or send e-mail to wendy@belle.baruch.sc.edu. A call for presentations will be sent on request.

CRDG Mathematics Projects



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WELCOME BACK, DR. D!

by Annette Matsumoto

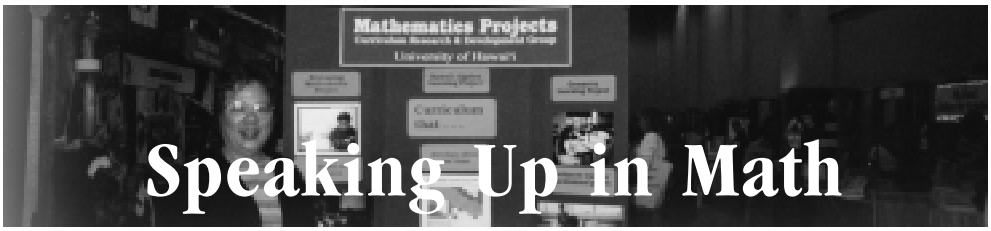
Dr. Barbara Dougherty has returned "home" to the mathematics section of the Curriculum Research & Development Group after a five-year absence. As an associate professor at the University of Mississippi, Barb directed the Mathematics Content Improvement Project (CIP). With a two-year grant from the U.S. Department of Education, this project developed teacher content knowledge (K–8) in the areas of number/algebra, geometry/measurement, and probability/statistics.

Barb was also the math supervisor for the Mississippi Teacher Corps, a graduate program at Ole Miss. She was on a committee charged with identifying a statewide exam for algebra and subsequent teacher training. She also developed training modules for the Mississippi curriculum framework in grades 3–4.

During the 1995–96 school year, she was site coordinator and teacher for a Hawai'i Algebra Learning Project (HALP) demonstration class at a Mississippi public high school. Visiting teachers and administrators were able to see a standards-based algebra class in action. [Coming up in the next issue: Dr. Dougherty discusses insights she gained during that exciting year.]

Returning to Hawai'i, Barb has been a senior program specialist in mathematics with the Pacific Mathematics and Science Consortium of PREL—Pacific Resources for Education and Learning. She has provided valuable service to teachers and students throughout the Pacific region. CRDG's partnership with PREL will enable Barb to continue work with educators in the region.

Although Barb collaborated with our math section even while she lived in Mississippi, having her back in person can't be beat. Welcome home!



Speaking Up in Math

by Hannah Slovin

Each year, members of the CRDG mathematics staff fly all over the United States presenting workshops at NCTM's national and regional conferences. Annette Matsumoto of the Hawai'i Algebra Learning Project, Cynthia Beppu of the Geometry Learning Project, and Hannah Slovin of the Reshaping Mathematics Project weave together their experience as curriculum researchers, developers, and teachers to present workshops that bridge the gap between theory and practice.

Participants in our sessions take on student roles in simulating a math class in which they work together to solve problems, present solutions to the group, and lead each other in discussing their solutions. We play teacher roles, modeling teacher behaviors, including instructional strategies for a setting that supports problem solving. We highlight those strategies through videos of our lab school classes.

Recent fall sessions featured our algebra and middle-grades programs. Annette Matsumoto presented two companion presentations—a one-hour general session entitled "Making Algebra Accessible for All Students" and a three-hour minicourse, "Teaching Algebra to All—the Pacific Way," at the 37th Northwest Regional Conference in Spokane, Washington, in October. The one-hour session overviewed the way the Hawai'i Algebra Learning Project crafted and sequenced mathematical tasks so as to help students gain a solid understanding of algebra.

Many participants came back for the minicourse, where they experienced algebra through a thought-provoking presentation of content and teaching strategies that empower all students mathematically. They saw evidence of student empowerment in videos of math classes. And they looked at assessment practices that were consistent with the instructional approach.

continued on page 11

Speaking Up in Math, continued from page 10

Also in October, Dr. Hannah Slovin spoke to teachers at a joint meeting of the NCTM–Central Region and the School Science and Mathematics Association held in Louisville, Kentucky. In a workshop titled "Reshaping Mathematics: How Motion Geometry Can Help You Transform What You Teach," Dr. Slovin introduced participants to CRDG's Reshaping Mathematics curriculum. Participants worked with sample problems from the program illustrating how a central idea unfolds over time in a multiyear curriculum. Then they watched a video in which sixth-graders made connections from familiar topics to new ones through their discussions of some of the same problems the participants had discussed.

Our presentations at the NCTM annual meeting in San Francisco in April highlighted ways to make mathematics accessible to all students. Cynthia Beppu's session, "Geometry for All: Changing What and How We Teach High School Geometry," gave participants an opportunity to gain insight into making geometry accessible to all students by exploring why students struggle. It included many ideas for supporting students in constructing geometric ideas by changing what we teach and how we teach it. Participants experienced and reflected upon a constructivist classroom through playing roles and watching a videotape.

Annette Matsumoto presented a session, "WANTED: Algebra for Everyone: HOW? Let's Recraft Our Questions," in which she shared ways of creating tasks to promote better understanding for all students and to help teachers make instructional decisions. By using more open-ended questions and letting students use a variety of solution methods, more students can grasp previously difficult concepts. Participants also had a chance to practice rewriting routine problems to create richer tasks.

In a presentation titled "Shaping the learning environment: Help your students start the year in a mathematical frame of mind," Dr. Hannah Slovin focused on the beginning of the school year, a crucial time for establishing a learning environment that enhances students' discourse and promotes critical thinking. The tasks used in this session were designed specifically to give participants the opportunity to develop and practice behaviors that promote mathematical problem solving and reasoning—among them using mathematical tools, making conjectures, explaining thinking, describing observations such as patterns, validating and justifying solutions, judging the reasonableness of answers, and working collaboratively.

This summer, Hawai'i will host the NCTM Western Regional Conference from July 27 to 30. CRDG presenters have planned a wide range of sessions that highlight many aspects of our project work, including sessions on curriculum design and development, instructional strategies, and professional development. In all our sessions, participants will engage in hands-on activities, get new ideas they can apply to their work, and have opportunities to reflect on and discuss those ideas.

Annette Matsumoto will present a session on how research with students at the University Laboratory School is used in designing and developing curriculum. Participants in this session will be able to practice some of the questioning strategies that help reveal students' thinking and ways to promote higher-order thinking. Dr. Barbara Dougherty and Cynthia Beppu will each present sessions focusing on instructional strategies that have proven successful in the Hawai'i Algebra Project and the Geometry Learning Project. These strategies aim to help students at all ability levels succeed in higher-level mathematics. Dr. Hannah Slovin and Melanie Ishihara will present the professional development program used in the Reshaping Mathematics Project as an example of a teacher enhancement program created to meet the needs of middle-grades math teachers who need to explore new topics. This program will also help teachers by providing experiences and support for sustained substantive enhancement of their teaching practice.

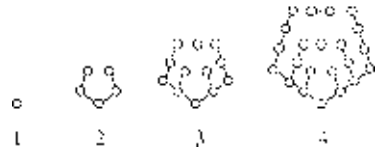
Student Corner

by Annette Matsumoto

Problem Set 1-6, #3a, b, and c, from page 32 of Algebra I: A Process Approach

3a. Use the diagrams to complete the table below:

Diagram number	Number of dots
1	1
2	5
3	
4	



3b. If we continued to draw diagrams, what would the fifth one look like?

3c. Without drawing, tell how many dots would be in the seventh and eighth diagrams.

Before reading on, take some time to solve this problem.

What methods did you use? What methods do you think your students would use? What patterns did you notice? What patterns might your students notice?

Sam is an eighth-grader at the University Laboratory School. His solutions to parts a and b are similar to other students' solutions. But to solve part c, Sam used a pattern that he found. See if you can explain why Sam's pattern works. Here is his write-up:

3a. I got this by counting the dots as told and got 12 for 3 and 22 for 4.

Diagram number	Number of dots
1	1
2	5
3	12
4	22

3b. The 5th one would look like this. (look below). All you have to do to get the fifth one is add 13 dots to the fourth diagram.

3c. The pattern for solving this problem is to multiply the # of the diagram (ex #4) times the diagram # below it (#3) that is 3 x 4 = 12. Then add to that sum all the number of diagrams within it. (ex. 12 + 4+ 3 + 2 + 1 = 22). Without drawing it out, I can figure that diagram 4 has 22 dots in total.

So a pentagon with seven dots to each side would be

(7 x 6) + 7 + 6 + 5 + 4 + 3 + 2 + 1 = 70

The eighth diagram would be

(8 x 7) + 8 + 7 + 6 + 5 + 4 + 3 + 2 + 1 = 92 which is your answer.

About This Newsletter

Aloha! This newsletter is intended to keep interested people informed of new developments and happenings in the science curriculum efforts of the Curriculum Research & Development Group.

The Curriculum Research & Development Group (CRDG) is an organized research unit of the University of Hawai'i. Established in 1966, CRDG conducts curriculum research and design, develops and evaluates educational materials, and provides training and follow-up services in selected areas of the curriculum. CRDG programs serve students at preschool, elementary, middle, and high school levels. Its programs are tested and used in the University Laboratory School, in Hawai'i, the Pacific, Europe, Asia, and the Mainland United States.

The science department of CRDG is currently engaged in the development and/or dissemination of the following programs: *Foundational Approaches in Science Teaching* (*FAST*), *Hawai'i Marine Science Studies* (*HMSS*), *Hawai'i Nature Study* (*HNS*), *Island Health Series, Physics, Physiology and Technology (PP&T), The Ocean Project, and Developmental Approaches in Science, Health and Technology* (*DASH*).

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