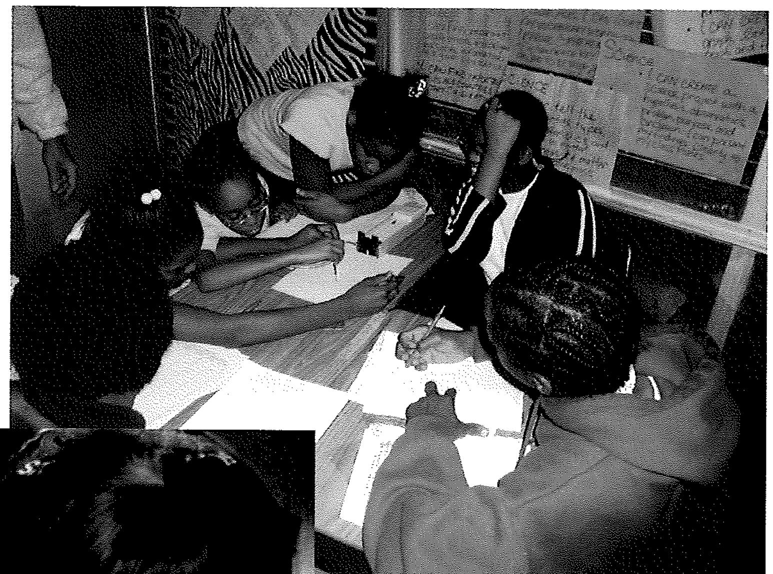
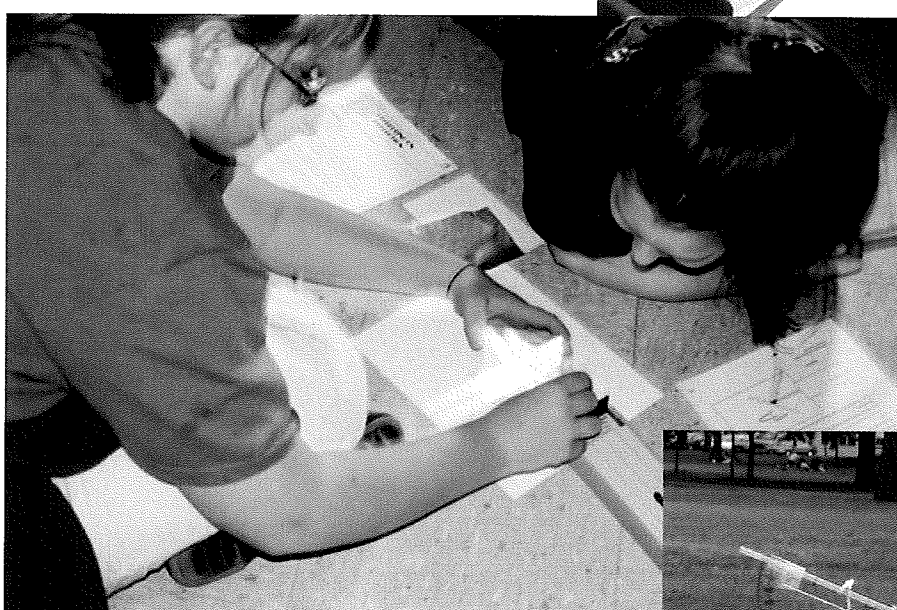
SPECTRUM

Spring 2005, Vol. 31, No. 1

The Journal of the Illinois Science Teachers Association



New in this Issue:
Teacher - to - Teacher



Look for:
NSTA Midwestern Area Conference Information

Spectrum

The Journal of the Illinois Science Teachers Association
Volume 31, Number 1

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Send submissions and inquiries to the editor. Articles should be directed to individual area focus editors (see next page and *write for the SPECTRUM information).*

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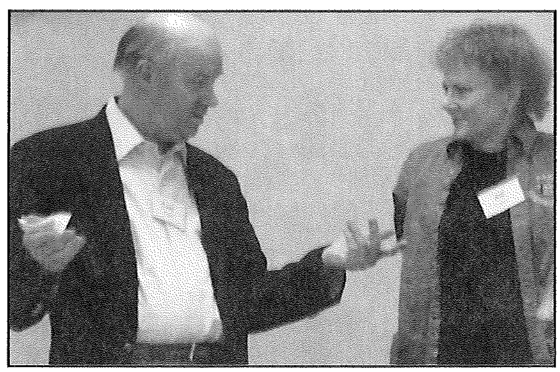

Treasurer Carl and President-elect Jill find some time for discourse at a board meeting.

The Illinois Science Teachers Association recognizes and strongly promotes the importance of safety in the classroom. However, the ultimate responsibility to follow established safety practices and guidelines rests with the individual teacher.
The views expressed by authors are not necessarily those of ISTA, the ISTA Board, or the *Spectrum*.

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SPECTRUM

The Journal of the Illinois Science Teachers Association

Spring 2005 Volume 31, Number 1

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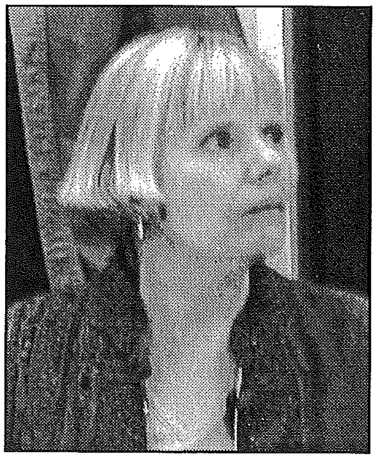

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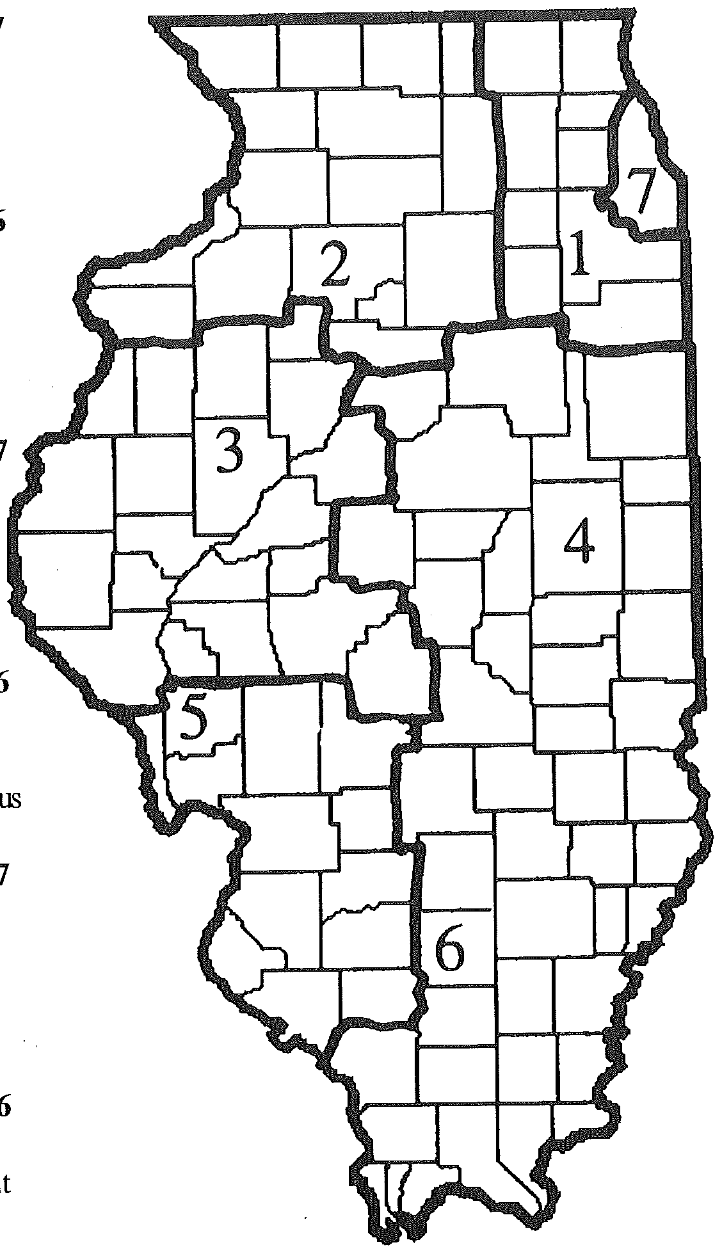

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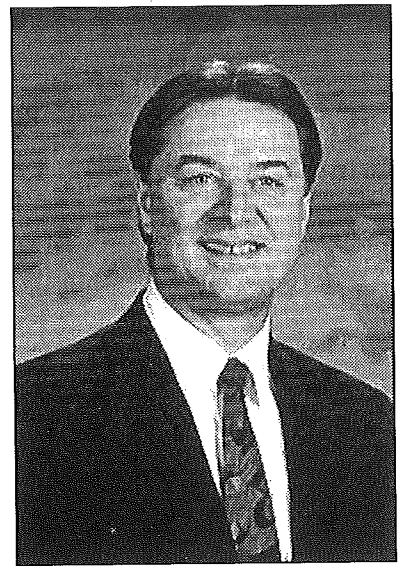
ISTA News

President's Corner

Raymond J. Dagenais, Ed.D.

Illinois Mathematics and Science Academy



Springtime is upon us and, just as in nature, it is a time of new beginnings for ISTA. First of all, I would like to thank all of the ISTA Board members and committee chairs who served faithfully over the past two years. Special appreciation is extended to Dr. Marylin Lisowski, our immediate past president, for her efforts in leading the organization, and to Diana Dummitt, who as ISTA's executive director, provided the professionalism and constancy that has established the Illinois Science Teachers Association as the largest and the oldest organization in Illinois devoted to excellence in science education.

This past March saw the 2005 ISTA board members assume their new roles. Every year one of the two ISTA regional directors in each of the seven regions completes their term of service and a new regional board member is elected to fill that role. Your regional directors appreciate the help and support that you can supply in assisting them as they promote quality science teaching and learning for all Illinois students. I welcome and look forward to working with the 2005 ISTA board to build upon the foundation that has been established.

Having served in the roles of ISTA vice president and president-elect over the past four years, and previously in the capacities as membership chair and ISTA annual conference program chair, I have had the chance to meet some wonderful people who are interested in quality science teaching and learning. These experiences have helped me formulate three goals that I lay out for ISTA. These goals are to:

1. Uncover the talents and experiences of Illinois science teachers to improve science education in Illinois;
2. Leverage the benefits of partnering with other professional educational organizations; and
3. Identify and promote ways to make the teaching and learning of science meaningful for Illinois science teachers and their students.

Achievement of these goals will require the commitment of not only the ISTA board but of the ISTA membership as well. When you think of the reasons that you choose to hold ISTA membership, I ask you to consider not just what you can take away for your own personal and professional use, but to recognize the premier benefit of ISTA membership as the opportunity to offer yourself to the profession. Whether you are a novice or a veteran, you have valuable experiences that can be shared for the greater good of science education.

Membership in ISTA can be the vehicle for life-long professional growth and I am eagerly anticipating the contributions that will come from our talented membership.

Yours truly,
Ray Dagenais

Announcements

The ISTA web site: www.ista-il.org is continually being updated. Don't forget to check for current conference and science news. *Remember to refresh your cached links to view the latest information.*

Thank You

The Illinois Science Teachers Association extends its appreciation to the Illinois Petroleum Resources Board for its sponsorship of the 2005-06 ISTA Student Awards Program. Each school year one student at a school can be honored with the ISTA Student Award. In order to be able to extend this honor, the ISTA medallion and certificate must be requested by a current ISTA member at that school.

Welcome Aboard

The following ISTA members have accepted positions as 2005-07 ISTA Committee Chairs:

Archives	Maurice Kellogg
Awards	Eeva Burns
Convention	Executive Director
Finance	Vice President – Deb Greaney
Membership	Donna Engel
Nominations and Elections	Past President – Marylin Lisowski
Public Relations	Tom Kearney
Professional Development/Building a Presence	Mary Lou Lipscomb
Publications Committee	Judith A. Scheppler

George Wagner, a long time member of NABT and IABT, a past president and treasurer for over 20 years, died in his sleeep of a pulmonary embolism on March 23. He will be missed by all who knew him. He was the gentle giant of IABT - stood 6'8" and was one of our big environmental advocates.

Congratulations, **Becky Jaramillo**
Presidential Awardee for Excellence in Science Teaching!

Congratulations to Becky Jaramillo, our new Presidential Awardee for Excellence in Science Teaching! More on Becky can be found on the ISTA homepage: www.ista-il.org.

National Science Teachers Association MIDWESTERN Area Conference

in Chicago, Illinois

World-Class Science

Nov. 10-12, 2005

www.nsta.org

Conference Room Rates:

Sheraton Chicago	**$169 single/double**
Holiday Inn Chicago City Centre	**$139 single/double**
Best Western Inn of Chicago	**$119 single/$128 double**

The Illinois Association of Biology Teachers Wants You!

Are you a new biology teacher? Or are you an experienced teacher, just looking for a few new biology tricks? Then IABT is for you! Find us at:

The web: www.iabt.net/
Email: iabtnews@earthlink.net
Executive secretary and state sponsor: Philip J. Mccrea
(mccreap@newtrier.k12.il.us)

NABT National Convention: Milwaukee, WI, October 5-8, 2005 (see page 45 for more information)

It's a Biology Thing!

ISTA

gratefully acknowledges

Diana Dummitt

For all of her hard work and committment to ISTA as its Executive Director, these past many years.

Many Thanks!

Good luck with your new position.

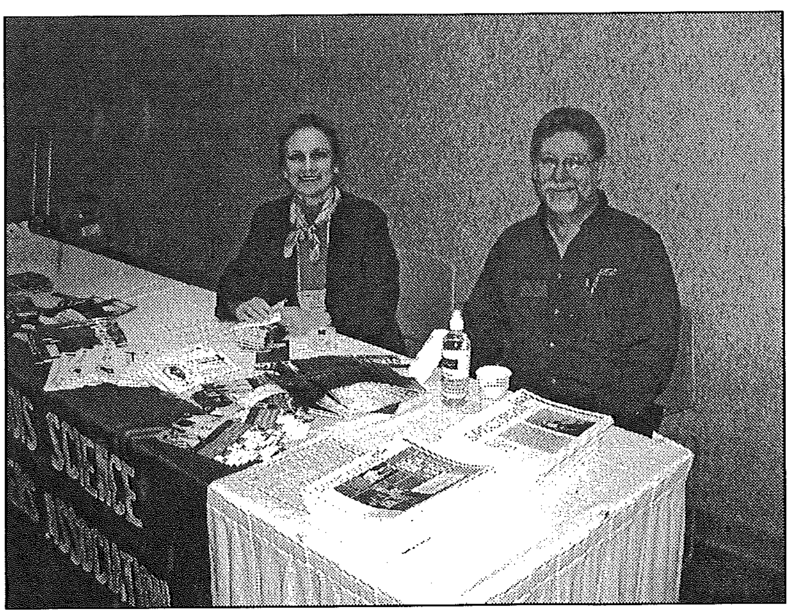
Another Science in the South Success!

More than 300 participants braved cold and blustery conditions to attend the 2005 *Science in the South* conference held on March 11, at Southern Illinois University in Carbondale, Illinois. Conference organizer Ken Robinson and his staff put together another outstanding offering of exhibits and presentations this year. Presentations included "Kids, Crops, and Critters in the Classroom," "Let's Have Fun with Archimedes principle,","Building and Investigating 'MacGuyver' Radios," and "Winding Your Way Around DNA and Biotechnology" across grade levels K – 12. Attendees enjoyed a wonderful lunch and an exciting door prize event before taking new ideas and materials home with them. Below is ISTA President Ray Dagenais's opening address for Science in the South:

The Process of Scientific Inquiry

Good Morning! My name is Ray Dagenais. As president of the Illinois Science Teachers Association, I welcome you to *Science in the South*, the ninth annual regional conference on science education held in southern Illinois.

The Illinois Science Teachers Association, established in 1967 as a State Chapter of the National Science Teachers Association, is the largest and oldest organization in the state devoted to excellence in science education. Its mission is to provide proactive leadership that will improve science education and achievement for all students by promoting effective classroom practices, supporting sustained professional development opportunities, facilitating communication, collaboration and networking opportunities, and advocating for the needs of science teachers. ISTA is proud to have been able to work with the organizers of this conference to offer quality professional development opportunities in a locale that is geographically convenient for science teachers in southern Illinois.



Diana Dummitt and Ken Robinson man the check-in table at *Science in the South*. Over 300 participants attended one of the premier events for science education held in Illinois.

These are trying times for education in general and science education in particular. Emphasis has recently been focused on the areas of reading and mathematics. Science teachers are uniquely positioned to offer contextual and meaningful reading and mathematical learning experiences through scientific exploration and inquiry. The process of science not only allows learners to increase their scientific knowledge base but also offers student-centered opportunities to analyze collected data using a variety of mathematical approaches and communication strategies involving reading and writing.

The goal is to move students along the path that leads them from simply waiting to be asked a question and responding with a memorized answer, to being able to carefully observe nature, formulate scientific questions of their own, and having the means by which to carry out investigations that provide evidence that can be used to answer their questions. This is the process of scientific inquiry. However, as teachers we know that the processes of scientific inquiry span a spectrum of teaching and learning approaches. There is no doubt that at one end of this spectrum lies *directed inquiry,* while at the other end lies *open inquiry.*

Directed inquiry approaches, or approaches where specific and detailed direction is provided to learners, are most effective when the material to be learned is factual or terminology based. Open inquiry, or the ability of learners to formulate their own scientific questions and to design investigations that lead to answers based upon scientific evidence, offers the greatest potential for increasing or deepening understanding.

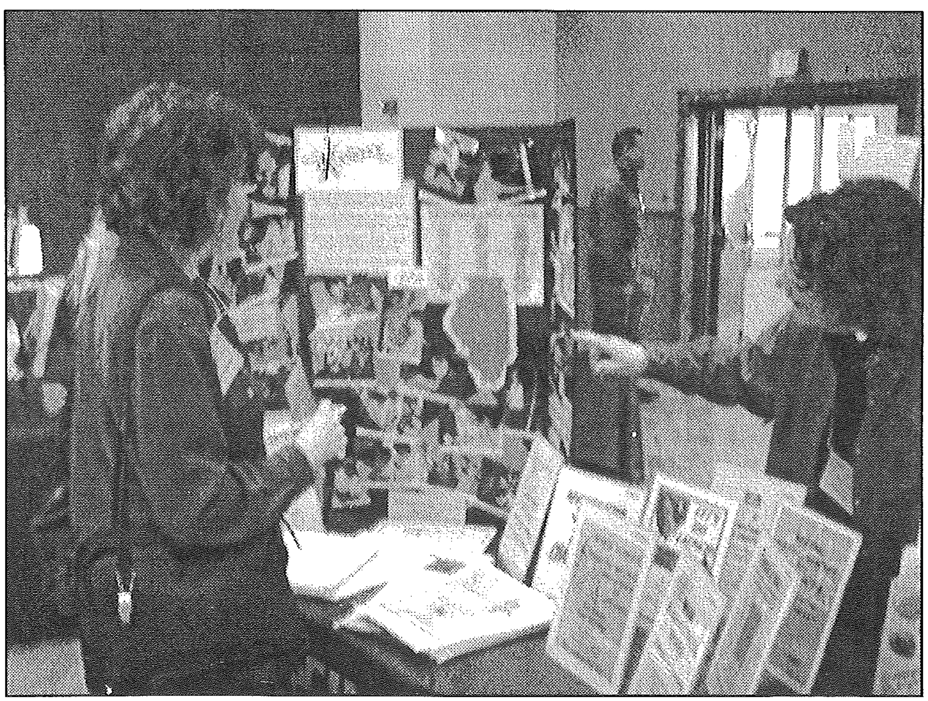
In between directed inquiry and open inquiry, lie *guided* and *suggested inquiry.* Guided inquiry approaches are best used when learners have some foundational base in the material and need teacher guidance in what and how to proceed. Suggested inquiry begins to move students toward open inquiry as teachers offer suggestions to questions and approaches that students have begun to come up with for themselves. Many mentoring experiences use this mode of teaching.

Part of high quality teaching is the ability to recognize which of the various teaching and learning approaches will be most effective for a class of students. As you participate in the different sessions today watch for the various inquiry-based approaches that may be used and consider how you might employ them with your students.

As members of the Illinois Science Teachers Association you have access to information related to science and science teaching through the ISTA journal, *Spectrum*, the ISTA web page, the ISTA list serve, the annual ISTA conference, regional conferences like *Science in the South*, and, this year the NSTA area conference, to be held in Chicago at Navy Pier, November 10 – 12, 2005. Please make some time to take advantage of these resources as you continue with your own professional development.

Science in the South organizers have put together a wonderful array of sessions. Enjoy your day and go back to work with the enthusiasm that collaborating with friends and colleagues can generate.

Have a great day!



Mary Lou Lipscomb discusses IMSA professional development programs for science teachers with Roberta Dagenais. Participants gained ideas and learned about new products and opportunites from the many exhibitors.

Illinois Science Teachers Association

2005 Membership Application

Please print or type and fill-out complete form

Name ____________________	Day Phone ____________________
Affiliation (School or Organization) ____________________	Home Phone ____________________
Address of Above Organization ____________________	Home Address ____________________
City, State, Zip Code ____________________	City, State, Zip Code ____________________
Email and/or Fax ____________________	County in Illinois ____________________

CHECK APPLICABLE CATEGORIES IN EACH COLUMN

O Elementary Level	O Elementary Sciences	O Teacher
O Middle Level	O Life Science/Biology	O Administrator
O Secondary Level	O Physical Sciences	O Coordinator
O Community College	O Environmental Science	O Librarian
O College/University	O Earth Science/Geology	O Student
O Industry/Business/ Government	O Chemistry	O Retired
O Other__________	O Physics	
	O General Science	
	O Integrated Science	
	O Other____________	

Send form and check or money order, made payable to Illinois Science Teachers Association, to: Sherry Duncan (email: sjduncan@uiuc.edu), ISTA Membership, College of Education, 51 Gerty Drive, Champaign, IL 61820

MEMBERSHIP OPTION (see below)_______ AMOUNT ENCLOSED __________

ISTA Membership Categories

Option 1: Full membership dues - $35.00. Full membership entitles individuals to the following benefits: a one year subscription to the SPECTRUM and ISTA ACTION; inclusion in the members-only ISTA-TALK listserv; notification of regional conferences and meetings; voting privileges; and the opportunity to hold an ISTA officer position.

Option 2: Two-year full membership dues - $60.00. Two-Year full membership entitles member to full membership benefits for two years.

Option 3: Five-year full membership dues - $125.00. Five-year full membership entitles member to full member benefits for five years.

Option 4: Associate membership dues - $15.00. For full-time students and individuals who are on retirement status. Entitles member to full menbership benefits, with the exception of the opportunity to run for office.

Opiton 5: Institutional membership - $75.00. Institutional membership entitles the member institution, for a period of one year, to two subscriptions to the *Spectrum* and *ISTA Action*; notification of regional conferences and meetings, and a reduced registration fee for the Annual ISTA Conference for a maximum of three members of the institution.

What Exactly is Building a Presence for Science?

Mary Lou Lipscomb

Building a Presence for Science Editor, Illinois Matheamtics and Science Academy

Illinois and ISTA are part of a large network called Building a Presence for Science (BaP). As science educators, or persons interested in science education, it is important for all of us to understand the goals and benefits of this network.

The Building a Presence web site (BaP Online—http://www.nsta.org/bap) describes the network as follows:

> Building a Presence for Science is the largest networking initiative of the National Science Teachers Association (NSTA). The award-winning program is designed to improve the teaching and learning of science from kindergarten through 12th grade. NSTA is the world's largest organization dedicated to the improvement of science teaching and learning.

The primary goal of BaP is to create communication and professional development networks of science educators and use these networks to facilitate standards-based teaching and learning. In addition to establishing state science teacher networks, BaP strives to help science teachers understand and implement state and national science education standards, and provide professional development opportunities for them.

National and state contacts electronically disseminate science education information to the network members. BaP Online offers state message boards, group email options, monthly E-blasts and other features facilitating electronic communications. Professional development workshops and BaP sessions are offered at NSTA and ISTA meetings.

Illinois is one of twenty-six states currently involved in the network. BaP initiated phase I of its state networks in 1996 with thirteen states and the District of Columbia. The phase II states, which includes Illinois, began their involvement in 2000.

In Illinois, ISTA is developing this network partnership with NSTA. Currently there are 188 identified *key leaders* who serve a specific geographic area of Illinois or an identified group of schools. The key leaders connect with *points of contact*—science colleagues who teach in schools that are within each key leader's area. Points of contact share information and resources with their school colleagues. There are currently 2315 identified points of contact in Illinois and the BaP network touches 5551 schools. Although that sounds like a large number, it is actually only 42% of the schools in Illinois!

Current key leaders and points of contact may go to BaP Online (http://www.nsta.org/bap) to edit their contact information, view and post to the exclusive state message board for Illinois, and check monthly E-blasts. If you are a key leader or point of contact, take some time this summer to check out BaP Online and update your contact information. If you are not a key leader or point of contact and would like to become one, you can also go to BaP Online and sign-up.

Participation in this network of science educators is an excellent opportunity to enhance your personal professional development by connecting you with others who are also striving to provide the best science education opportunities for their students.

Teacher - to - Teacher

Educators Share Information, Lessons, and Tips
Mary Lou Lipscomb, Editor

Teachers have a "bag of tricks" that they use on a regular basis or from time to time to spark or maintain interest, keep things moving, and/or help students understand a concept in a way that is unique or different. Also, from time to time teachers create and/or provide valuable professional development opportunities for one another. Thinking about and sharing these activities or ideas with colleagues provide professional development opportunities for all involved in the sharing. A sincere "Thank You" to those of you who have submitted ideas and information for this issue.

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Andy Apicella, a key leader in the Building a Presence for Science network, has shared a point of contact field trip that was held at Starved Rock State Park on April 16, in cooperation with the ROE in the Quad-Cities area. The field trip was open to all points of contact in Bureau, Stark, Warren, Henry, Henderson, Mercer, and Rock Island Counties.

Field trip participants joined Illinois Valley Community College geology professor, Mike Phillips, and ornithologist and current secretary/treasurer of the Illinois Audubon Society, John McKee, for an unforgettable learning and hiking experience. A lock and dam visit and lunch were included. Educational materials were also provided.

Andy teaches at Riverdale High School in Port Byron. Other key leaders involved in the planning of this event were Pam Byrne, Princeton High School; Carol Van De Walle, Audubon Elementary School; Karen Meyer, retired fourth grade teacher; and Jan Gustafson, C.R. Hanna Elementary School. In addition, Amy Sandgren at Regional Office of Education #49 in Moline worked with the key leaders to coordinate this professional development opportunity.

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Tom Kearney, another key leader and teacher at Andrew High School in Tinley Park, and one of the ISTA Region 1 directors, has suggested the following web sites:

Windows into Wonderland features a wide variety of online activities and "field trips" to Yellowstone National Park. Check out the "To Eat or Be Eaten" mystery, which can be found at: http://www.windowsintowonderland.org/index.htm

The *Electronic Naturalist* is a new on-line education program providing a weekly environmental education unit. Each unit has artwork, text, activities, additional web sites, plus online access to a professional naturalist. Two reading levels are available for grades K-3 (Quick Read) and 4-8 (Full Read). http://www.enaturalist.org/

Many times when watching movies we don't notice the way the movie might "abuse" science. Check out *Insultingly Stupid Movie Physics* at http://www.intuitor.com/moviephysics/ .
Included are suggestions for using "Movie Physics" in the high school physics classroom. Get a few of the different "movie clips" suggested and let your students try to "analyze" the physics principles shown.

Literacy is at the forefront of curriculum issues in most schools these days. It is important for children, throughout their schooling, to have a variety of opportunities to articulate their thoughts and ideas in both written and verbal formats.

The following journaling activity submitted by **Janet Kocis**, Math Department chair at Grant Middle School in Springfield, provides an opportunity for students to do just that. Although Janet uses this activity in her mathematics classes, the topics lend themselves to science classes as well

Janet says that to start class, "I always have a daily journal activity...either on the board or overhead."
❋ JOURNAL TOPICS:
Memory Monday: Explain how you used science (or math) over the weekend.
Teaching Tuesday: Explain something you remember from a lesson last week and how it relates to the real world.
Wacky Wednesday: Create a problem of your own. Explain how you would solve it (what you would do and why you would do it that way). Your problem must be connected to what we're studying in class.
Thesaurus Thursday: In writing, explain a vocabulary word to someone who might have been absent.
Flourishing Friday: What successes have you had this week? What are you still struggling with or need more time/practice to master?

+++++

In early March I attended the ISTA *Science in the South* conference at Southern Illinois University in Carbondale as an exhibitor for the Illinois Mathematics and Science Academy. During the down-time I checked out the other exhibitors.

Mary LeFaivre, Quality Assurance and Site Safety Coordinator, Office of the Chief, at the Illinois State Water Survey (ISWS), Department of Natural Resources, shared information on the **Rain Check Network**. Students who are part of this network collect rainfall data using a provided rain gauge and submit it to the Rain Check Network website along with students from around the United States. Submitted daily rainfall totals can be compared to others around the area. The website also contains an online database and links to other weather and climate websites; the address is http://www.sws.uiuc.edu/hilites/stfair/raingage/ .

The Rain Check Network is an initiative for the primary and secondary students of Illinois, although anyone can submit rain gauge measurements. It is designed to be an instructive tool, and is not to be used as a resource for definitive, quality-assured scientific data.

Testing the pH of Rain Water is another rainfall activity which students can conduct after they have collected and reported the amounts. It was designed jointly by the National Atmospheric Deposition Program (NADP) and ISWS staff members as an exercise for students to determine if their collected rain water is acidic. The activity, which is found on the NADP/ISWS sponsored web site http://nadp.sws.uiuc.edu/earthday/, was designed for Chemists Celebrate Earth Day, a program of the American Chemical Society (ACS). It includes background information, complete student instructions for the experiment, additional resources and activities, and provides the structure for reporting pH results and comparing them to the average observed pH for rainfall in their area.

Contact Mary at (217) 333-5902 or lefaivre@uius.edu for more information on the Rain Check Network or to request a classroom set of rain gauges.

Pam Breitberg, a teacher at Robert A. Black Magnet School in Chicago, suggests another literacy activity. Pam teaches seventh and eighth grade, but this activity can be successfully accomplished at most all grade levels. A great weekend assignment for students in science class is to have them find a science-related news article and report on it. It's a great way to include current science in the curriculum, as well as a variety of science topics not necessarily part of the adopted curriculum. Reading and discussing science topics found in the news covers a wide spectrum of science concepts in a manner relevant to the students' lives. A sample of the news article reporting form that Pam has used this year is shown.

Mrs. Breitberg – Science – Room 100

Science News Article

Name:____________________________ Date:____________________

News Article Title:____

Source (newspaper, magazine, TV station):____________________

Author/Reporter:____

Date of article/report (must be within 30 days):_______________

- **Who (Who is the article about?):**
- **Where (Where did this take place?):**
- **What (What is the article about?):**
- **When (When did the event/happening happen?):**
- **Why (Why is this news worthy?):**
- **How/what (Details of the article):**

How is this related to ______________________________ science?

Fill in science topic that was assigned for this homework.

My thoughts about this article:

***__ *extra credit -- I have attached the actual article to this report!*

YOU MAY USE THE BACK SIDE TO ADD MORE INFORMATION!!!!

No credit will be given unless you explicitly relate this article to science.

Mercury Safety and Reduction

Judith A. Scheppler and Raymond J. Dagenais

It has been known for many years that mercury can be dangerous if ingested. Illinois senate bill SB2551, passed this summer by Governor Blagojevich, creates the mercury reduction act, aiming to reduce mercury released into the environment from consumer product breakage and disposal. The bill, in part states: "Beginning July1, 2005, no person shall purchase or accept, for use in a primary or secondary school classroom, bulk elemental mercury, chemicals containing mercury compounds, or instructional equipment or materials containing mercury added during their manufacture. This subsection (a) does not apply to : (i) other products containing mercury added during their manufacture that are used in schools and (ii) measuring devices used as teaching aids, including, but not limited to, barometers, manometers, and thermometers, if no adequate mercury-free substitute exists." Schools need to review their use and storage of mercury and mercury-based products. For more information, go to: http://www.epa.state.il.us/environmental-progress/v30/n2/legislative-wrap.html

Hg Hg Hg Hg Hg

Write for the *Spectrum!*

The *Spectrum* is actively seeking articles, tips, announcements, and ideas that can be shared with other science teachers. Articles should be sent to the appropriate Area Focus Editor, listed below. Other submissions and inquiries should be addressed to the Editor, Judy Scheppler, at quella@imsa.edu. Please send all submissions electronically. Further information about writing for the *Spectrum* can be found at: www.ista-il.org/spectrum.htm

Elementary School Education:
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Middle School Education:
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Eastern Illinois University

Secondary School Education:
Gary Ketterling (gketterling@ben.edu)
Benedictine University

Higher Education:
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University of Illinois at Chicago

Building a Presence for Science Program:
Mary Lou Lipscomb (lipscomb@imsa.edu)
Illinois Mathematics and Science Academy

Editor:
Judith A. Scheppler (quella@imsa.edu)
Illinois Mathematics and Science Academy

Articles

Planning for Good Museum Trips with Preschool and Elementary Age Children

Jean Paine Mendoza

College of Education, University of Illinois

Who knew that in the animatronic insect exhibit, Raisa would quietly stick by her second-grade teacher as if glued to the woman's skirt, averting her eyes from the gigantic roaches and spiders. But her classmates found the bugs "awesome" and "cool."

Who knew that Miss Rothman's kindergarteners would arrive at the science and technology museum on one of the busiest days in museum history? Now her tired, hungry, cranky group has a 25-minute wait to get seats in the museum's popular lunchroom. Even with two parent chaperones, Miss Rothman wonders how they're going to avoid mass meltdown.

Who knew that three-year-old Micah would burst into tears when he realized that the lion cubs in the exhibit case were dead? "This is a dead circus!" he sobbed inconsolably. "I want to go home!"

As the anecdotes above suggest, museum trips may turn out to be anything but the fun, educational outings teachers hope for. Museums can be excellent science resources for preschool or early elementary age children. In the exhibit halls, on the walls, and in the resource centers, teachers and children can find the stuff of which children's scientific investigations are made. Contemporary children's museums are tailored to the needs of families and classrooms in the preschool and early elementary years, and many older institutions have now set aside parts of their buildings where children can have hands-on interaction with museum materials. The "hands-off" parts of a museum have a lot to offer younger students, too.

This is a dead circus!
I want to go home!

But sometimes things can go wrong in unexpected ways. Here are some ideas to help make a museum trip memorable – positively!

A museum can be overwhelming to children: large (even cavernous), full of strangers and echoes and unfamiliar, sometimes scary-looking things. Some teachers suggest planning specifically to reduce anxiety. In addition to organizing chaperones and transportation, get some visual information together to share with the class about the museum you will be visiting. Share brochures or find a Web site about the museum so the children will have an idea of what to expect. Try to find photographs of the exterior and interior to show the class. Read aloud some children's literature about museums. Borrow items from the museum's resource center and talk with the children about how specimens are stored and displayed.

One or two days before your trip, encourage the children to draw pictures and ask questions about the museum. Invite them to predict what they might see and hear there. Listen carefully to what children are saying about the trip, so you can calm any anxiety or correct misconceptions they have about the museum *before* your group walks through those museum doors. For example: "Some of you are talking about the giant bugs. Some of those insect models are bigger than you or me. But they are like big toys. They move but they can't see or hear or feel anything. They're not alive. They're not going to hurt us. What else do you wonder about those insect models?"

Some early childhood teachers recommend that a preschool group should stay in a museum no longer than an hour. (Longer trips might work better for them in a children's museum rather than in a more traditional space.) Older children will probably do best on longer museum visits if you plan breaks for lunch, snacks, or a couple of games or stories. You might also limit your visit to one or two rooms or floors, depending on the size of the museum and the age and tolerance of your class.

Though many museums now are geared toward the hands-on interests and needs of children, some interesting parts of a museum may be "look, don't touch" environments. Children from preschool and early elementary classrooms can visit those areas and keep their hands and eyes busy recording data. Some teachers ask each child ahead of time to write down specific things he or she wants to find out during the visit. (Children who don't write yet can express their "wonderings" in drawings, and an adult can write their questions as captions for the drawings.) These prepared questions can be given to each child at the museum, along with a pencil and a sheet of paper clipped to a sturdy piece of cardboard to record answers. If you have enough adult accompaniment on the trip, you might assign each adult to a small group of children who asked similar questions. The adult can help them look for answers and record what they find out.

One way children can record data is to make observational drawings. When the class is inside a gallery, invite each child to choose something that interests them, find a place to sit, and carefully draw the object. An adult can circulate among the children and ask questions to help them focus on details. (For tips on having children make observational drawings, see http://ceep.crc.uiuc.edu/eecearchive/books/projcat2/chard2.html or http://teacher.scholastic.com/products/ect/observational_drawings.htm.)

If the museum you are visiting allows photography, bring one or more cameras and let children take turns photographing something that interests them. It will help if an adult keeps a list of who photographs what; it's easy for a child to forget what her subject was.

Teachers might want to keep in mind that children are likely to get more out of a museum trip that is related to what they are working on in class, than if it's a general-interest trip.

Sometimes you just can't foresee the challenges that might arise on a museum trip. Traffic jams, tornado warnings, and bus breakdowns are just a few of the unexpected circumstances teachers have faced. Be sure to bring along two or more books to share with the children *just in case*. Or be ready to tell a few good stories, lead some chants, sing some songs, and play several rounds of *I Spy* to keep children engaged if your group gets stuck waiting for something. Some teachers carry a reminder list of good *sitting still* activities. Don't expect children to be ready to reflect on their museum trip while they are thirsty, tired, or hungry. Wait until they have had lunch and some down time to ask them to talk about what they learned.

Teachers might want to keep in mind that children are likely to get more out of a museum trip that is related to what they are working on in class, than if it's a general-interest trip. If they aren't studying something that the museum's resources can help them with, you might consider having the group study the museum itself. Proceed as you would for any inquiry with the children. Share some information about the place, then ask them what they would like to find out about it. They may have questions about the building itself, or the people who work there. Ask them to think about how they could find answers. What are some things they might count? How could they find out what materials the building is made of? Which of the employees could they talk to? If possible, contact museum personnel who can meet with them during the trip to respond to some of the questions. Again, be sure to take along materials for observational drawings.

Finally, it's good to keep in mind that sometimes a child discovers unwelcome knowledge in a museum. For many young children, as for 3-year-old Micah, it may be the realization that the animals in a natural history museum are dead. In particular, preschoolers who are fond of animals may be upset when they realize that the furred, feathered, and scaled specimens they can see so closely were once alive. Individual teachers – and parents, for that matter – have their own comfort zones about the subject of death, and about the fact that some specimens may have been put to death in the interest of science.

It's a good idea to consider how you will talk with children about these topics before they come up. If a child is surprised by unwelcome information while on a museum trip, listen to the child's concern and talk about it with him or her in an empathetic way. Everybody has times when they find out things they didn't want to know. That's true for parents, teachers, and scientists, as well as for children! And sometimes it takes awhile to feel better about those things.

Museum trips with preschoolers or elementary age children can be difficult. But children can see and do things first-hand in museums that may not be available anywhere else. If a teacher and the students are well-prepared, visiting a museum can be a rich and rewarding experience, a great resource for science learning, and a source of good memories.

The Illinois Science Teachers Association would like to thank

Marylin Lisowski

for her excellent service to ISTA in her role as President, these past two years.

Many Thanks!

Your duties as past-president are just beginning!

Are Student Perceptions of Teaching an Important Variable that Influences Student Achievement?*

Richard A. NeSmith

Eastern Illinois Unviersity

You are better able to accomodate students, and to promote and facilitate learning if you will seek to determine students' perceptions about learning.

For the longest time teaching was so didactic that we seldom, if ever, considered the perceptions of our students. It just did not seem important. We all have stories about how misperceptions ended with funny stories that cause us to chuckle. I remember one I read many years ago from an elementary school teacher. The teacher led the class with the Pledge of Allegiance, and instructed them to put their right hands over their hearts and repeat after him. He looked around the room as he started the recitation, "I pledge allegiance to the flag..." When his eyes fell on Little Johnny, he noticed his hand over the right cheek of his buttocks. "Johnny, you need put your hand over your heart." Little Johnny replied, "It is over my heart." After several attempts to get Little Johnny to put his hand over his heart he gave up. Afterwards the teacher asked Johnny, "Why do you think that is your heart?" "Because, every time my Grandma comes to visit, she picks me up, pats me here, and says, 'Bless your little heart,' and my Grandma wouldn't lie." Now, our middle school students might not be quite so naïve or have such perceptions...or do they? Maybe not, but they have perceptions about you and how you run your classroom. These perceptions will, and do, have an impact on their success, or lack of it, in your class. Research is revealing that you are better able to accommodate students and to promote and facilitate learning if you will seek to determine student perceptions about learning.

Introduction

This study sought to determine whether the perceptual relationship between middle level teacher and student had any influence on the students' academic achievement, in this case, science achievement as determined by the term grade, which typically is issued after a six or nine week grading period. The study utilized the 48-item short form Questionnaire on Teacher Interactions (QTI) which has been shown to be valid and reliable.[1] The survey instrument used in this study is available at: http://bioscience.tripod.com/QTI.pdf. This study of students' and teachers' perceptions was conducted in a mid-western state in 2003 with a random sampling of middle school/junior high schools with students (n=433) in grades 5 through 9. Schools from rural, suburban, and urban settings were represented, as well as from affluent and underprivileged school districts.

The research design incorporated triangulation as a means of rigor, as well as the practice of random sampling of middle level students and their science teachers (quantitative) and one-on-one student and teacher interviews (qualitative). The Questionnaire on Teacher Interactions is designed to evaluate classroom perceptions in four domains, each containing two dichotomous scales or sectors. These are as follows:

1) Dominance, encompassing: a) leadership and b) strictness; 2) Submission, encompassing: a) student responsibility/freedom behavior and b) uncertain behavior; 3) Cooperation, encompassing: a) understanding and b) helpful/friendly; 4) Opposition, encompassing: a) dissatisfied and b) admonishing (see Table 1.1 and Figure 1.1). As students work through the questionnaire they are providing data that indicates their perception of their teacher in the four domains (1-4), as well as illuminating more specifically within the domains the sectors (a and b of each domain). Random one-on-one interviews were conducted which gave those participating in the survey the opportunity to clarifying their perceptions of the four domains by way of commenting eight pre-established questions, each addressing a scale. The same survey taken by students to reveal their perceptions of their teachers' pedagogy was also completed by each respective science teacher to determine their own perceptions of their teaching demeanor: classroom practices, teaching styles, classroom environment, and so forth. Results were grouped and statistically analyzed first, according to each respective class, and secondly, as a whole and then compare to their respective science (9 to 12 week) grade issued by their respective teacher.

Table 1.1 Description of scale and sample items for each scale of the QTI

Scale name	**Description of scale (The extent to which the teacher…)**	**Sample item**
Leadership	…leads, organizes, gives orders, determines procedure and structures the classroom situation.	This teacher talks enthusiastically about his/her subject.
Helping/Friendly	…shows interest, behaves in a friendly or considerate manner and inspires confidence and trust.	This teacher helps us with our work.
Understanding	…listens with interest, empathizes, shows confidence and understanding and is open with students.	This teacher trusts us.
Student Responsibility/ Freedom	…gives opportunity for independent work, gives freedom and responsibility to students.	We can decide some things in this teacher's class.
Uncertain	…behaves in an uncertain manner and keeps a low profile.	This teacher seems uncertain.
Dissatisfied	…expresses dissatisfaction, looks unhappy, criticizes and waits for silence.	This teacher thinks that we cheat.
Admonishing	…gets angry, express irritation and anger, forbids and punishes.	This teacher gets angry unexpectedly.
Strict	…checks, maintains silence and strictly enforces the rules.	This teacher is strict.

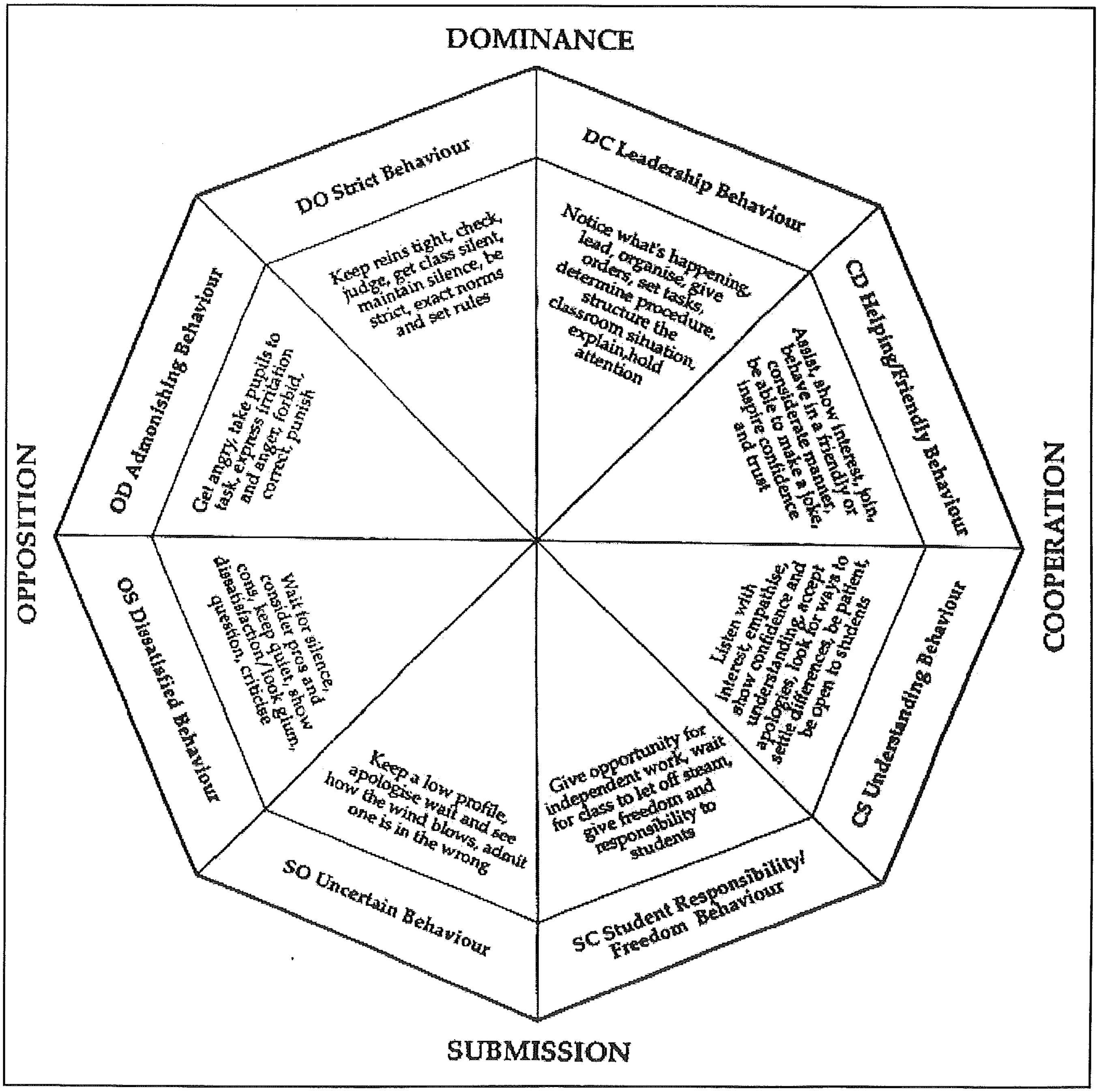

Figure 1.1 Diagram of the eight sectors within the four dimensions being examined using the Questionnaire on Teacher Interaction (QTI).

Qualitative Results

Qualitative measures provided an opportunity for clearing up misunderstandings, using an interview protocol, as well as a means of providing a measure of confidence that those interviewed were actually answering the questionnaire as they intended to answer. The interviews also provided evidence that the QTI was a sufficient instrument in recording the participants' perceptions; both valid and reliable.

A few anomalies surfaced during this study. It appears that from the qualitative standpoint students are far more resilient than we might presuppose. From personal observation, along with that of several associates, we discovered that while observing classrooms the observer came away with a very poor opinion of some teachers' demeanor, attitude, and teaching disposition. To state it bluntly, there were teachers who one would not consider very effective in their manner of teaching and one would expect to be very disliked by students. They were often crude in their mannerisms or methods. Sometimes the ineffectiveness was considered their pedagogical routine, which often amounted to less than that of students being active in learning. The dilemma became obvious upon examination of the QTI data from students and comparing it with that of their interviews...it was found that in almost every case, students not only liked these teachers, but respected them, as well. This is not to say that they did not suffer academically but affectively they were accepting of their teacher. It was as if the students as a class had an affective range of acceptance. As long as the teacher did not cross those invisible parameters (we will identify these parameters in the next section) the students were accepting of the teacher. This proved to be a significant lesson for the observers who expected students to strongly dislike these teachers, and yet their QTI data stated otherwise. The dualism of qualitative and quantitative methods of research was useful in revealing this, otherwise, undetected incongruity.

Quantitative Results

In what ways do differences in student perceptions and teacher perceptions of effective teaching and learning have on student achievement? This is an important question and one that provided the impetus for this study. It is the difference between these two variables (student and teacher perceptions) that may provide a clue as to whether a student's

Table 1.2 Internal consistency (Cronbach Alpha Coefficient) and ability to differentiate between classrooms for the QTI.

Scale	Unit of Analysis	Alpha Reliability	ANOVA Results eta^2
Leadership	Individual	.74	.10*
Helping/friendly	Individual	.80	.48**
Understanding	Individual	.77	.07*
Student responsibility/ freedom	Individual	.63	.14**
Uncertain	Individual	.60	.07
Dissatisfied	Individual	.71	.16**
Admonishing	Individual	.74	.22**
Strict	Individual	.64	.14**

*p<.001, ** p<.005, n = 433 students in 21 classes academic achievement (as measured by a class grade) has any relationship to how closely the student's concept of effective teaching is in comparison with his or her science teacher's perception

Before addressing the statistical analysis it seems appropriate here to note that the internal validity of the QTI is reported to be between Cronbach's alpha coefficients .62 to .88 (Rickards and Fisher, 1996). The analysis of variance for this particular study revealed further evidence of internal validity with results ranging from .60 to .80. The QTI, in fact, is able to differentiate between the perceptions of student in different classes (that is, students within the same class should perceive it relatively similarly, while mean with-class perceptions should vary from class to class).

Table 1.3 Association between QTI Scales and Students' Achievement Outcomes in terms of Simple Correlations (r) and Standardized Regression Coefficients (*B*)

QTI Scale	Strength of Environment - Outcome of Association Attitude to Class	
	r	*B*
Leadership	0.13**	0.06
Helping/friendly	0.9	0.03
Understanding	0.06*	0.01
Student responsibility/ freedom	-0.08	-0.05
Uncertain	-0.21**	-0.06
Dissatisfied	-0.29**	-0.27**
Admonishing	-0.16**	-0.04
Strict	-0.15**	-0.04
Multiple Correlation	*R = 0.31***	R^2 *= 0.10*
*p<.05 **p<.01	n=405	

Table 1.2 indicates the scale means for teachers and their respective science students' scores on the eight scales of the QTI. Tables 1.3 and 1.4 provide the data analysis and association between QTI scales and student achievement outcomes for the middle level students and their respective teachers. There is a striking similarity between the perception of teachers and their students which reinforced the qualitative results obtained from the interviews. Emergent themes from the qualitative data include students' desire for teachers who are helpful and friendly. Middle school students do not want teachers who are *uncertain* in their demeanor or who are *dissatisfied* in their position. This seems to be that invisible line. These characteristics are at the opposite ends of the spectrum and appear to give students the most problems in learning environments. Contrary to this, teachers rate themselves more helpful/friendly than did the students. And, they rated themselves less uncertain and/or dissatisfied than did their students. It would seem fair to assume that as a student moves further along in the developmental stages, a greater dislike for a learning environment where either of these demeanors becomes exaggerated. Even more intolerant (by students) is when the attitude of *dissatisfied* is combined with over strictness or excessive admonition (that is, reprimanding). This seems to be where the students draw the line.

Table 1.4 Correlates of the sector, admonition: (a) positive correlations, (b) negative correlations

strict and dissatisfied	-0.933**
admonition and uncertainty	-0.930*
admonition and helpful/friendly	-0.870*

**Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Associations between Achievement and Perceptions

An examination of the simple correlation *(r)* figures indicates that there were five statistically *significant* relationships ($p < .05$) out of eight possible sectors, influencing student-teacher interactions and student achievement (see Table 1.3). Statistically speaking, that is 20 times that expected by chance alone. In classes where the students perceived greater leadership in their teachers, their achievement was higher. The leadership scale appears to be a very important factor that provides a very significant positive effect on student achievement, followed only by understanding. Statistically speaking, students in a classroom where they *perceive* that the teacher is a leader have higher achievement than those who do not have this perception.

Conversely, teachers perceived as very strict and dissatisfied, strict and uncertain, or admonishing or uncertain, tended to affect student achievement. The beta weights show that only one of these associations, however, actually retains its significance in a more conservative test with all the other QTI scales controlled. The statistically *significant* relationship most affecting middle level student achievement between a teacher and student was the students' perception of the teacher being dissatisfied with his or her profession. Classes where students perceived their teacher as expressing more dissatisfaction had significantly poorer achievement than their counterparts. Combinations including a perception of dissatisfaction do hinder student achievement.

When simple and multiple correlation analyses were used to investigate associations of teacher-student interactions with students' achievement, a significant positive relationship emerged for the leadership scale on the right side of the model (refer back to Figure 1.1). Negative associations were found for all of the scales on the left side of the model. Ten percent of students' achievement could be attributed to their teacher's interpersonal behavior.

General issues regarding, and affecting middle level education, include the concept of developmental appropriateness. This concept recognizes that middle level students are different due to the transitional nature of development. The middle school model attempts to provide students with a more personalized experience. With the emphasis on inquiry and hands-on active learning (constructivism) the teacher must find out what the students already know. This implies teachers becoming acquainted with their students...a more "helpful/friendly" demeanor, if you will. Statistically speaking, students are inclined to respond positively in an academic manner when their teacher sees them as a human being, respects them, and shows a friendly interest in them, but in an environment where the teacher is truly a leader in helping students learn. It appears that the greatest harm, or at least the greatest effect, on student achievement is from a teacher that is dissatisfied-strict, dissatisfied-admonition, or uncertain in their actions. It appears that statistically, students in such a classroom environment will achieve much lower than other classes. This sector proved to have a greater negative effect on student achievement than did any of the others (see Table 1.4). Even greater is the impact if these sectors combine. Strict and dissatisfied is very significant (-0.933), followed by the combination of admonition and uncertainty (-0.930). It appears that admonition, however, can be, to some extent, minimized if combined with helpful/friendly (-0.870). It at least becomes less significant.

Conclusion

Little Johnny, in your class, has grown up. He, hopefully, now knows where his heart is located while stating the pledge. But remember, as he continues to mature as a learner he continues to construct knowledge; to make sense of his world, and such perceptions are very real and do have an effect on his academic success. In closing, we need to recognize that our classroom environment does have a significant influence on student achievement, perceptions have changed. In essence, it is an experiment. You can tweak your teaching mannerisms like a formula one driver might do to their car. In practice, you might find a few things you did not realize beforehand and, who knows, you might find you are even able to reach a few more of those who have *been left behind*, or those who need to feel like their perceptions count for something. You may also find that as you adjust and accommodate that student achievement rises.

References

Rickards, T. W., and Fisher, D. L. (1996). Associations between teacher-student interpersonal behaviour, gender, cultural background and achievement. *Proceedings Western Australian Institute for Educational Research Forum 1996.* Retrieved April 23, 2001, from http://educatin.curtin,edu.au/waier/forums/1996/rickards.html

Endnote

1) .63 to .88 when used with individual students and .78 to .96 when used with class mean as the unit of analysis.

* The following studies were seminal in providing the impetus for this study.

NeSmith, R. A. (2003). *Students' and Teachers' Perceptions of Effective Teaching and Learning in the Middle Level Science Classroom: The Effects on Students' Achievement.* Unpublished dissertation for D.Sc.Ed. Curtin University of Technology, Perth, Australia.

NeSmith, R. A. (1997). *How middle grade students perceive effective teaching and learning*. Unpublished educational specialist thesis, Augusta State University, Augusta, Georgia.

GIS in Problem-Based Curriculum

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Geographic information systems is one of the most powerful pedagogical tools in a teacher's arsenal.

GIS (geographic information systems) is one of the most powerful pedagogical tools in a teacher's arsenal. Unlike most classroom technology where the computer is merely a presentation tool, GIS allows students to interpret data and generate solutions to problems. Students are attracted to the operation, graphics, and immediate feedback this technology presents. Depending upon the time constraints of the curriculum, students can begin using GIS lessons after as little as one or two tutorials.

How quickly students can begin using GIS depends upon the "comprehensiveness" of lesson preparation and the extent to which students will apply GIS operations. Students exploring a previously created ArcView project, a GIS limited lesson, may only need to measure, identify, reorder themes, or adjust a legend in order to solve a problem or learn a concept. GIS advanced lessons, student projects that require data entry and theme creation, will require more training.

Although it can be beneficial to study the science of GIS, that is database operation, topology, and so forth, it's more important for students to actually use the tool. GIS can't be used effectively without some training but maintaining a focus on the curriculum concept should be paramount. GIS limited lessons are often centered around fully completed ArcView projects with limited numbers of shapefile themes. In these projects, students often reorder the table of contents, alter legends such as making polygons semitransparent, measure lengths or areas, identify attributes, or view hot-linked information. Hot-linking is an excellent feature to incorporate into GIS limited lessons. It allows the explanation of facts and concepts via attached documents as well as the insertion of tabular data or graphics, such as photos or drawings.

GIS limited lessons are often linked to worksheets that provide supporting information and guide students in their map explorations. To encourage all students to succeed, it's important to strike a balance between higher order and lower order operations in Bloom's taxonomy. Lower order operations, such as rote memory and limited comprehension, are balanced against higher order operations, such as evaluation and synthesis, by gauging the aptitude of students. For example, two-thirds to three-quarters of worksheet questions for average freshman are simple recall, the paraphrasing of information, or elementary calculation. There are limited numbers of questions devoted to simple analysis or evaluation and fewer yet, if any, devoted to the synthesis of new information.

It is important to note that the difficulty of the questions is randomized. Placing easy questions throughout the document encourages less confident students to "read on" and to think about the scenario. Determining whether or not a question is answerable is a valuable skill in and of its self. Often after reading the more difficult questions and then answering the simple ones, students are able to solve upper order problems.

Although it seems counterintuitive, higher order questions are best worth fewer points. In this way, average students can receive average grades. This method challenges more gifted students and encourages average students who come to realize that for them greater success can often be achieved through greater efforts. A word of caution is in order here. A great many students who have never demonstrated interest in after school help often seek it and time demands upon the teacher increase. There are few things, however, more satisfying than watching average students become progressively better thinkers.

"Quake" (appendix A) is an example of a GIS limited lesson. Quake is designed to teach earthquake wave properties and triangulation using a problem-based approach. It is built around a completed ArcView project and students need only limited proficiency with ArcView, such as using the hot link tool and drawing graphics. A brief introduction provides background information and a statement of the problem. Bare bones instructions supply necessary information such as the path to the ArcView project and which software tools will be most helpful. Instead of direct instruction, a table with labeled fields guides initial student data collection. Information hot linked to the project consists of: tabular records for clock times for each of three seismic detector sites; a graph of P- wave vs. S-wave distances with respect to times; and a text document partly explaining triangulation.

Using only the given information challenges even the most adept problem solvers. Struggling students are encouraged to seek additional resources, which can be found in the classroom text or on the Web. At no time should the teacher provide feedback on the correctness of answers. Instead, teachers should assist students by providing sound problem solving techniques. Teachers should direct students to:

- Summarize the lesson topic. In this case, how the different types of energy waves released from an earthquake move through the crust.
- Write down what they know and what they don't know based on the given information. Students should be encouraged to interpret the information to the best of their ability.
- Read all questions and answer those that they can in the order that suits them. Answering one question may provide insight into solving another.
- Seek additional resources based upon keywords or specialized vocabulary in the given information.
- Visualize the action taking place in the scenario.
- Seek after school help but warn them that help does not mean providing answers.

Worksheet questions from Quake test skills from all levels of Bloom's taxonomy. Five questions test knowledge or comprehension and are rated "easy." Five questions involve analyses or application and are rated "medium." Two questions involve evaluation or synthesis and are rated "difficult." Questions devoted to lower order processes receive more points than those devoted to higher order skills (appendix B).

GIS advanced lessons are more demanding of students and require more training. GIS advanced lessons are often best utilized by incorporating them into thematic units. Instead of using GIS to present data to students, GIS advanced lessons require students to use GIS to analyze information and present findings. It's important to be judicious when using GIS in this way. Younger students tend to focus more on the beauty of the map than on sound reasoning. If the completed assignment isn't carefully scrutinized, students may come to believe that it is more important for a project to be visually

To encourage all students to succeed, it's important to strike a balance between higher order and lower order operations in Bloom's taxonomy.

pleasing than to be accurate. GIS advanced lessons have been incorporated into a variety of thematic units. Students have mapped the distribution of endangered species, colonized Mars based upon prerequisite conditions, and mapped aquatic conditions such as dissolved oxygen and temperature.

GIS advanced lessons almost always involve higher order thinking skills, so certain aspects of the project should be amended in such a way as to provide points for less gifted students. This could mean giving points for a paper's length, the correct inclusion of a figure or table, proper resource citation, and so forth. Evaluating students' higher order skills is difficult at best. Certainly the accuracy of their analyses and presented information must be paramount. The depth of their analyses and resultant findings must be gauged against national or state benchmarks. The logic of the presented argument or the degree of abstraction between components provides some measure of critical thinking, which should be normalized by age. When in doubt, err on the side of rewarding positive growth.

The application of GIS technology to the teaching of social studies and physical geography is obvious. With creativity, GIS promises to be a powerful tool for teaching many other subjects as well. From the creation of an Elizabethan town during a study of Shakespeare to the modeling of countercurrent blood circulation in a duck's leg, GIS is the tool of choice for conveying information having spatial attributes.

About the Author

Conrad Stanley possesses a bachelor of arts in science education from Olivet Nazarene University and is certified to teach both science and mathematics in Illinois. Mr. Stanley earned a master of science in environmental biology from Governors State University and has been a GIS user since 1999. The recognition that GIS would be a central component of modern I. T. came during his initial exposure to it in a graduate course where it was applied to landscape analyses. As such, GIS, at various depths of proficiency, has been an essential component of his high school science curriculum.

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Secondary Education Editor, Gary Ketterling, Note: Other resources that might be helpful in getting started using GIS are *GIS in Schools* by Richard Audet and Gail Ludwig, ESRI Press. ISBN 1-879102-85-4 and the following websites: http://www.ilgisa.org/spring%2005/plan/announcement.pdf and http://www.ilgisa.org

Name________________

Appedix A Quake

Date______________________Period__________

Introduction:
Although Mars is theorized to be geologically dead, seismic instruments placed to assist in colony construction have detected" Earth -- like" Marsquake waves. The epicenter of this event must be located before future space station construction can begin. Answer questions below and fill in the table to solve the mystery. When you're finished, feel free to look around the surface. It really is Mars! (Mars.tif courtesy USGS Astrogeology Research Program PIGWAD server)

Instructions:
With ARCserve connected and ArcView running, open ***quake*** at Path:
ARCserve/projects/quake/quake.APR.
Activate the seismic departments theme and then click on a site to get more information using the lightning bolt tool. Use drawing tools as necessary in your investigation.

Data table

	Data Table 1	
Sites	P-Wave/S-Wave time lag, minutes	Radial Distance to Epicenter

Questions

1. What type earthquake wave travels the fastest?

2. What wave is also a transverse wave?

3. What earthquake wave travels the slowest?

4. What are the approximate coordinates of the epicenter in latitude/longitude?
   Latitude_______________ longitude_____________

5. How is an earthquake's focus different from its epicenter?

6. Which site recorded seismic activity first?

7. What is the approximate circumference of Mars in kilometers according to this map?

Measure along the northern edge of the map and answer the next two questions.

8. What is the horizontal distance from the edge of the map to the center of the map?

9. Why does this measurement differ from the equatorial measurement?

Create a point-theme shapefile representing your epicenter and store it for grade in a separate folder at Path: ARCserve/stdntsvs/"your teacher"/"your new folder"/"descriptive name eight characters or less".

Appedix B

Quake Rubrik

Introduction:
Although Mars is theorized to be geologically dead, seismic instruments placed to assist in colony construction have detected" Earth -- like" Marsquake waves. The epicenter of this event must be located before future space station construction can begin. Answer questions below and fill in the table to solve the mystery. When you're finished, feel free to look around the surface. It really is Mars! (Mars.tif courtesy USGS Astrogeology Research Program PIGWAD server)

Instructions:
With ARCserve connected and ArcView running, open *quake* at Path:
ARCserve/projects/quake/quake.APR.
Activate the seismic departments theme and then click on a site to get more information using the lightning bolt tool. Use drawing tools as necessary in your investigation.

Data table

	Data Table 1	
Sites	P-Wave/S-Wave time lag, minutes (Easy---8 Pts/cell)	Radial Distance to Epicenter (Medium---4 Pts/cell)
1	3--3.5	1800--2600
2	5.5--6.5	4000--5000
3	2--3	1000--1800

Questions

1) What type earthquake wave travels the fastest?
   (Easy---8 Pts) P-Wave
2) What wave is also a transverse wave?
   (Easy---8 Pts) S-Wave
3) What earthquake wave travels the slowest?
   (Easy---8 Pts) L--Wave or Surface wave
4) What are the approximate coordinates of the epicenter in latitude/longitude?
   Latitude_29--36.5 N__________ longitude_____12--18.5 E____
   (Hard---2 Pts)
5) How is an earthquake's focus different from its epicenter?
   (Medium---4 Pts) The epicenter lies directly above the focus, the center of energy release.
6) Which site recorded seismic activity first?
   (Medium---4 Pts) Site 3
7) What is the approximate circumference of Mars in kilometers according to this map?
   (Easy---8 Pts) 38,000---41,000 km OR 21,330 km if looked up true measure.
   1. Values differ due to error in my projection!!

Measure along the northern edge of the map and answer the next two questions.

8) What is the horizontal distance from the edge of the map to the center of the map?
   (Easy---8 Pts) 45--550 km
9) Why does this measurement differ from the equatorial measurement?
   (Hard---2 Pts) Mars is a sphere so no distance is covered as you move longitudinally around the pole. Longitudinal distance exists at equator and tapers to 0 at pole.

Create a point-theme shapefile representing your epicenter and store it for grade in a separate folder at Path: ARCserve/stdntsvs/"your teacher"/"your new folder"/"descriptive name eight characters or less".

University-School Collaborations: Can They Work?

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Inquiry, Context, and Nature of Science (ICAN) is a five year teacher enhancement grant which focuses on nature of science and scientific inquiry.

The education literature (research and theoretical) is filled with discussions about the importance of collaborations between schools and universities. For many years there has been a large gap between the goals and values of university educators and the needs of classroom teachers. The longevity of this gap is only surpassed by the many years of failed professional development efforts. The lack of a productive working relationship or partnership between schools and universities has often been cited as one of the reasons why little has changed in schools relative to the visions of reform documents. There are numerous examples of what has not worked. The purpose of this paper is to illustrate what a university/school collaboration can be and how it can significantly impact curriculum and learning in a systemic manner. The paper will describe the structure, content, and dynamics of a close collaboration between a university and a K-8 Chicago school.

Project ICAN

The context of the collaboration is an externally funded project and a brief description of the project and its goals will serve to provide a context for the collaboration between university and K-8 school. Inquiry, Context, and Nature of Science (ICAN) is a five year teacher enhancement grant which focuses on nature of science and scientific inquiry. The project resides at the Illinois Institute of Technology (IIT). Students' understandings of science and its processes beyond knowledge of scientific concepts have been emphasized in the current reform efforts in science education (AAAS, 1993; NRC, 1996; NSTA, 1989). In particular, the *National Science Education Standards* (1996) state that students should understand and be able to conduct a scientific investigation. The *Benchmarks for Science Literacy* (AAAS, 1993) advocates an in-depth understanding of scientific inquiry (SI) and the assumptions inherent to the process. Both reform documents consistently support the importance of students' possessing adequate understandings of nature of science (NOS). Research, however, has shown that teachers do not possess adequate views of NOS and SI that are consistent with those advocated in reforms. Moreover, it is difficult for teachers to create classroom environments that help students develop adequate understandings of NOS and SI (Lederman, 1992; McComas, 1998; Minstrell & van Zee, 2000) without explicit instruction and assessment.

The aspects of NOS stressed in Project ICAN are that all scientific knowledge is subject to change, scientific knowledge is partly a function of human creativity and subjectivity, all scientific knowledge is a combination of observation and inference, scientific knowledge is at least partially empirically-based, and scientific knowledge is culturally embedded. Additionally, emphasis is placed on the differences between theories and laws, with laws being defined as identified relationships among observable phenomena and theories being inferred explanations for observable phenomena. In short, theories do not change into laws with more evidence. The two are different types of knowledge with neither transforming into the other. In terms of SI, the project stressed the doing of inquiry (process skills) as well as understandings about inquiry. These understandings include, but are not limited to: there is no single set or sequence of steps that all scientific investigations follow, the distinction between evidence and data, the idea that multiple scientists viewing the same data can come to different valid conclusions, and research designs influence findings. These aspects of NOS and SI are consistent with those found in the *National Science Education Standards*. For more detailed descriptions of these ideas, the reader is referred to the National Standards and Lederman's (1992) review of the research on NOS.

Research has shown that through explicit/reflective instruction of NOS aspects and connections of aspects within the context of science activities, students are able to understand aspects of NOS (Abd-El-Khalick & Lederman, 2000; Khishfe & Abd-El-Khalick, 2002; Smith, Maclin, Houghton, & Hennessey, 2000). An explicit/reflective approach draws learners' attention to relevant aspects of NOS and SI in the context of inquiry-based activities or historical examples. These considerations of effective teacher development and classroom guided the design of Project ICAN.

Project ICAN is an NSF Teacher Enhancement grant that focuses on the development and implementation of a professional development model to enhance middle and high school science teachers' disciplinary and pedagogical knowledge related to the unifying concepts, SI and NOS. The goal of the project was to enhance teachers' abilities to improve students' understanding of NOS and students' understanding of, and ability to perform, SI within a context of a standards-based science curriculum. Previous efforts have focused on either teacher knowledge or student achievement relative to SI and NOS. Project ICAN represents a first attempt to couple teachers' professional development relative to NOS and SI with an extended focus on teachers' classroom practice and student achievement. Project ICAN is comprised of three phases: an introductory summer institute, monthly workshops during the academic year, and a two-week capstone summer institute.

Phase One: Introductory Summer Institute

During the two summer weeks, teachers participated in ten, six-hour sessions that focused on NOS, SI, and unified concepts through a series of explicit/reflective activities, readings, and discussions. NOS and SI were contextualized within standards-based science subject matter. The primary goal of this institute was to develop teachers' understandings of NOS and SI. In addition, the process of helping teachers use their knowledge to enhance their students' understandings was begun.

Phase Two: Academic Year Activities

During the academic year, teachers participated in ten full-day monthly workshops. These workshops included NOS and SI instruction, reflective review of participants' instructional experiences videos, and curriculum revision. Teachers actively engaged in SI activities and NOS activities. Teachers videotaped at least one lesson for the project staff to review and provide feedback prior to the workshops. A selection of videotaped lessons was chosen to view as a group at the monthly workshops. Monthly workshops also addressed NOS and SI instruction in the context of science subject matter, curriculum revision, and viewing/debriefing teachers' videotaped lessons. Teachers shared lessons and reported outcomes during the workshops.

Teachers focused on revising lessons to teach about NOS and SI in an explicit manner within the context of traditional science subject matter. All lessons were followed by group debriefings to discuss successes, challenges, and extensions to the activities.

During the year teachers also engaged in research experiences, the purpose of which was to provide a "reality check" for the ideas expressed in grant activities about NOS and SI and to provide teachers with additional subject matter experiences that they could incorporate into their classroom instruction. These research experiences included working with entomologists at the Field Museum, participating in genetic research at IIT, working with scientists at the Art Institute on preservation of artwork, biomedical research on thrombosis at IIT, and participating in research related to crystal formation for "packaging" of medical drugs.

Phase Three: Summer Capstone Institute

The primary focus of this capstone institute was on assessment of NOS and SI and continued work on curriculum revision. Whenever possible there was an emphasis on performance-based assessments. In addition, teachers were encouraged to develop action research projects that they could complete in their classes during the following year.

Participating Teachers

The number of teachers participating in Project ICAN is 50-60 each year with some teachers being asked to help plan and implement the project in the following year. As with most NSF grants, there is an attempt to recruit teams of teachers from individual schools. This is viewed as a way to have systemic impact within a school or district. However, recruitment efforts usually settle for whoever applies. In the case of Project ICAN, one school (that is, Ancona School) enrolled a group of teachers during the first year and then continued to enroll groups of teachers in each of the following years.

The Ancona Story

The Ancona School is an independent Pre-K through eighth grade elementary school situated in Hyde Park in Chicago. Ancona is a diverse community of approximately 260 students and thirty plus teachers, administrators and staff. Ancona has both Montessori and Progressive roots; its foundation is child-centered, hands-on and inquiry-based. Teachers are expected to develop their own innovative curricula across all subject areas. Indeed, autonomy and creative license is the reason many of them choose to work at Ancona.

At Ancona teachers create units of study around big ideas and essential questions of their own choosing, select primary and secondary resources that they will use to develop their own as well as their students' knowledge bases, design instructional activities based on student interest and ability, and develop assessment tools unique to each subject area and project. For students, most units of study begin with a K-W-L (What do you Know? What do you Want to know? What have you Learned?), but for teachers, the work of developing a unit begins with a combination of their own passion for the subject, their own deep understanding of child development, their knowledge of pedagogy and learning styles, and a little imagination and clairvoyance as they look for the hook that will draw the students in, inspire their students' questions and ignite their passions. But developing curriculum is not the hard part about working at Ancona. Developing curriculum that is part of a cohesive and comprehensive school-wide program in any given subject area is, however, a challenge.

"The students own the questions and the teachers don't have to have all the answers. I am learning right along with my students."

Ongoing professional development is crucial in an educational setting like Ancona's if curriculum is to be dynamic and current. But professional development that informs and inspires individual teachers is not enough. An Ancona education is designed to provide students with a big picture in any and all subject areas. Continuity and cohesion across grade levels is essential if students are going to graduate from Ancona with knowledge and skills that deepen with each subsequent year. Common themes and a consistent focus on process over product provide the framework that ensures students will be engaged in learning that emphasizes *how* they know and *why* they know over *what* they know. Professional development that enables teachers to collaborate and truly become a community of learners lays the groundwork for optimal curriculum development and individual professional growth. Project ICAN provided such an opportunity.

In 2003, a group of teachers consisting of a primary grade teacher, two middle school science/ math teachers, a third-fourth grade teacher, and an art teacher joined Project ICAN. All of these teachers have a passion for opening up the world of science to students; all of them are committed to expanding their own knowledge of science. At the time, Ancona was in the beginning stages of writing a science curriculum that would outline the skills, concepts and topics that should be taught at each grade level. These teachers participated in the two week introductory summer institute and came back to school that September enthusiastic to try some new things with their students and eager to look at the science curriculum through a different lens: Nature of Science. As the year progressed, they met with other ICAN teachers from across the city sharing ideas, comparing and critiquing lessons, and challenging their notions of how to teach science. It was clear this cadre of teachers had evolved into a true support group whose pedagogy was on the line and whose intellectual grasp of science was expanding dramatically. They began to challenge the work that had been done on the science curriculum as they examined it for authentic opportunities for Scientific Inquiry. What was the curriculum communicating to students about Nature of Science? They took on the time-honored Science Fair. Instead of discrete projects mostly done at home by individual students, why not encourage collaboration and let the work evolve right there in the classroom? Instead of "setting up an experiment," why not begin with a true question based on classroom scientific investigations, shared data, and information collected using the Internet? They wanted to expand the role of observation, rethink the role of hypotheses generation, introduce the idea of iteration, and begin to create a true community of scientists in their classrooms who share their ideas and their data and collaborate to push their questions and expand their knowledge. Ambitious, scary, exhilarating, groundbreaking—it was all that and more.

They invited one of their mentors, Judith Lederman, to talk with the rest of the faculty about Nature of Science and what true Scientific Inquiry looks like when it comes from the students. Their enthusiasm and Judy's provocative ideas inspired a new group of teachers to join Project ICAN the following summer as the original group participated in their Summer Capstone Institute. The following year another group joined ICAN and today all of the Ancona teachers who teach science have participated. Their own reflections on the impact of this program on their teaching tell a powerful story of personal and professional growth, the result of many "aha" moments.

Several of the teachers use the word, "empowered" to describe themselves since joining Project ICAN. Before ICAN these teachers were intimidated by the idea of teaching science. Now they are confident and excited about teaching science and feel like they are learning along with their students. Jane Paha, a preprimary teacher, commented, "The students own the questions and the teachers don't have to have all the answers. I am learning right along with my students." Myriam Guillen, another preprimary teacher feels participating in Project ICAN has changed her in fundamental ways saying, "I am more imaginative and creative in all aspects of my life, not just in teaching." Jenny Hempel spoke for several teachers when she explained the difference between two different practices: setting up an experiment aimed at achieving one known outcome, versus eliciting questions based on student observations, designing experiments to answer those questions and asking new questions as a result of those experiments. Her first graders are learning how to name and categorize their thoughts and comments: Are they questions, guesses, observations, facts or opinions?

Nancy Willis has been taking classes to the Field Museum for years as a part of her unit on the evolution of life on Earth and dinosaurs. Students always went armed with a clipboard and a list of questions from the teacher meant to guide their observations in the museum. As a result of an ICAN field trip to a museum, Nancy now asks her students to do their own careful observations of bird, reptile and dinosaur skeletons and come up with their own questions and hypotheses about the scientific classification of dinosaurs—Are they the ancestors of birds or reptiles? In short, prior to ICAN Nancy was conducting her field trips in a traditional manner. That is, students were basically looking at exhibits for information to answer provided questions. ICAN's emphasis on inquiry changed Nancy's approach into a more open-ended investigation. Students were asked to search for similarities and differences among animals of their choice and then asked to develop questions of their own that could guide data collection from other exhibits.

Since joining Project ICAN three years ago, Janet Musich, Ancona's art teacher, has tracked the daily appearance of a small rainbow on the ceiling or wall of the art center as sunlight shines through a prism that sits on the window sill. Pushpins mark the daily location of the rainbow at the exact same time of day as children wonder why the rainbow seems to move in a regular path across the ceiling and down the wall over the course of the year. Why does the rainbow disappear altogether for weeks at a time, even when the sun is shining? Why isn't the rainbow following the same pattern year after year? One student hypothesized that the Earth had temporarily jumped off of its orbital path. Hmmm...how likely is that to happen? What have other scientists discovered about light and the Earth's rotation?

Zeus Preckwinkle asks his seventh and eighth grade students to imagine they are Galileo. Given the time and state of scientific knowledge, they learn to appreciate his attempts at answering his questions and the bold hypotheses he offered as he pushed the envelope of "current scientific thinking" of his day.

Peg Pavelec's fifth and sixth grade students decided to plant a butterfly garden as a part of their unit on biodiversity. They watched as soil formed in two liter bottles filled with compost, then analyzed the soil in several areas around the school assessing its life sustaining potential. Once they found a suitable spot for the garden, they tested the soil many times over the course of several weeks, adjusting the amounts of compost, humus, mulch and decomposers being added to compensate for what was lacking in the soil. At the same time, they tested a variety of plants for their ability to thrive in Ancona's soil. Finally, they planted the garden, recorded their plantings on a grid, and collected data on their growth, viability, and appeal to butterflies. Armed with data from last year, this year's class will adjust their garden plan to improve the growth of the identified plants. These plants were impatiens, day lilies, and pansies.

When asked about the impact of ICAN on their students' understanding of Nature of Science, all of the teachers point to the tentative nature of scientific knowledge. All scientific knowledge must be seen in the cultural and temporal context in which it was created. Although science is driven by data and conclusions must be empirically based, data interpretation is just that—interpretation and it is subjective by virtue of the lens through which it was gathered and analyzed. Science units are messy now; they are questions that may be unanswerable, investigations without conclusions, and lots of conversations that end with, "yes, but..." Science work at Ancona doesn't necessarily produce science stars these days, but a true collaborative effort that is creating a scientific community that shares ideas and inspires the participants to new levels of excellence.

The impact of Project ICAN on Ancona School is clear. However, the relationship between the Illinois Institute of Technology and Ancona School has blossomed into other collaborative efforts. Judith Lederman and Jenny Hempel are currently working on the development of assessments of nature of science and scientific inquiry for students who are too young to read and write. A mathematics educator from IIT and staff at Ancona are now planning the revision of the mathematics curriculum and mathematics teaching at Ancona. In short, Project ICAN served to introduce the teachers at Ancona School to faculty at Illinois Institute of Technology. As a result of project activities a mutual trust developed among individuals. A personal relationship developed as a consequence of a shared vision for the improvement of science teaching and learning. And, it was this trust that has lead to numerous projects between the two institutions, with both serving as equal partners with one goal in mind: improving the quality of science and mathematics education.

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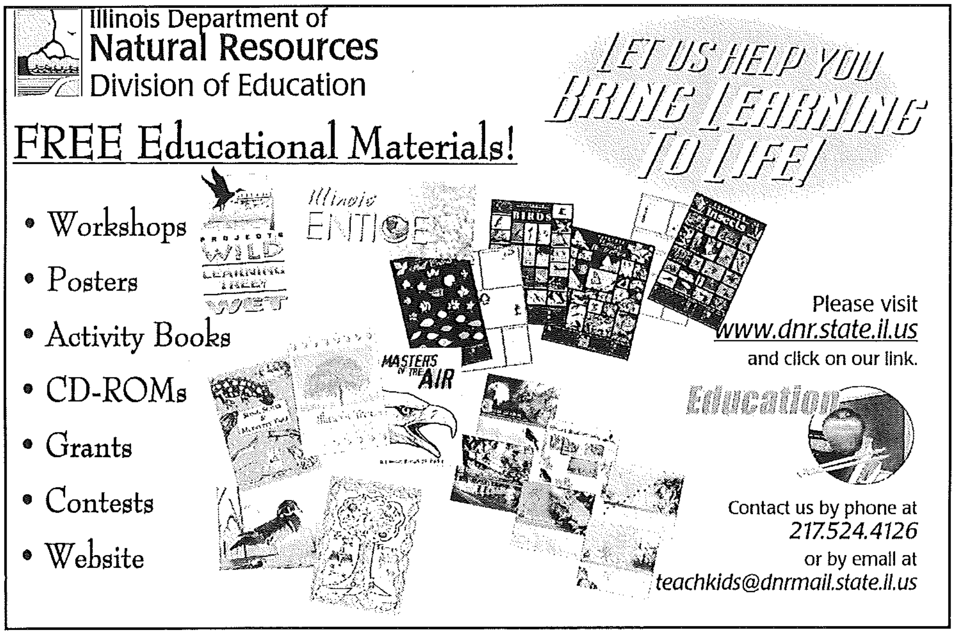

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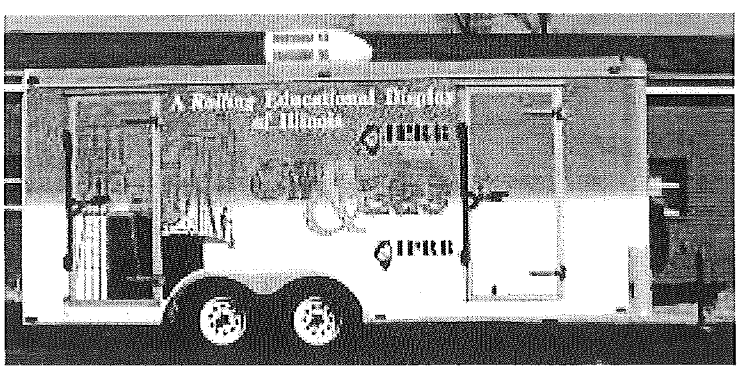

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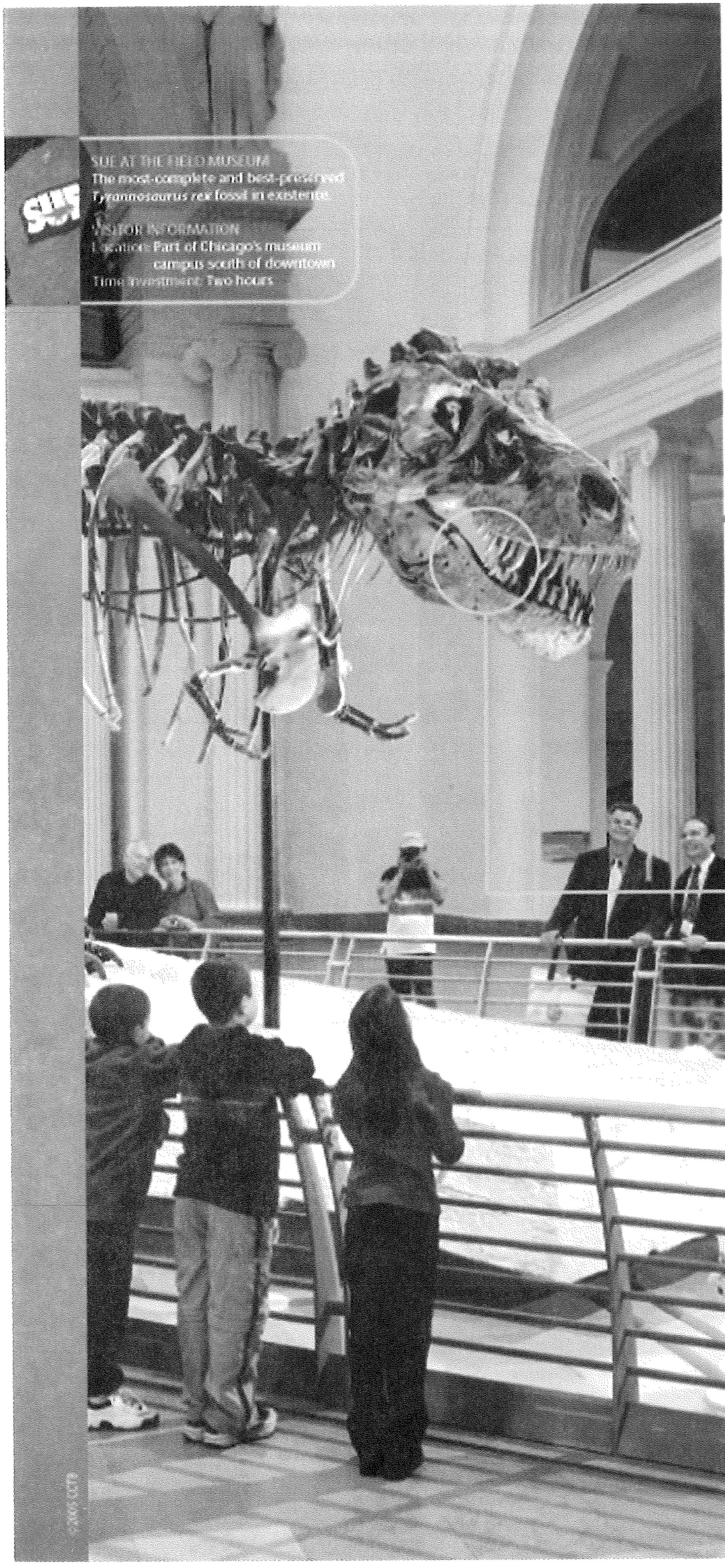
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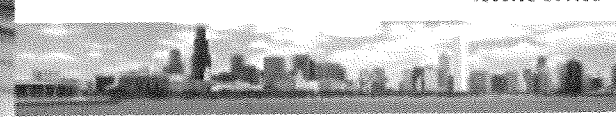

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