SPECTRUM

Spring 2002

"Creating Communities of Learners"

Illinois Science Teachers Association Annual Convention

November 6-9, 2002

Pheasant Run Resort, St. Charles

Advance Registration

Pages 18-19

- Reflections of Washington D.C.
- Bringing New Science Teachers Onboard
- Scientific Inquiry, Simplified
- An Interview with Bill Rathje, Garbologist

SPECTRUM

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Volume 28, Number 1

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The Illinois Science Teachers Association recognizes and strongly promotes the importance of safety in the classroom. However, the ultimate responsibility to follow established safety procedures and guidelines rests with the individual teacher.

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Spectrum

The Journal of the Illinois Science Teachers Association
Volume 28, Number 1

Spring 2002

Articles

Departments

President's Corner

Edee Norman Wiziecki

National Center for Supercomputing Applications
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The Age of Accountability

The implementation of standards for teaching and learning has created changes in science classrooms around the country. The overall goal of the standards-led initiative is to increase learning for all students, but we also recognize that this is not easily measured. In order to increase student learning in science, we must provide appropriate opportunities for students to experience science facilitated by teachers who are well prepared to teach science. While there is ample evidence that shows sound assessment practices can increase student learning, one problem associated with assessment remains — it is often used for the wrong purpose.

As important as are our standards for learning, is the need to implement an appropriate assessment system to determine the level of learning in multiple and accurate ways. The increased pressure on teacher accountability and student achievement requires having a system of assessment that is both proven and regular. Too much emphasis is placed on standardized tests as a single measure of achievement. To truly assess student learning, we have to learn how to balance standardized tests with local and classroom assessments. Developing an appropriate assessment system is a major challenge for teachers, administrators and policy makers.

Because we believe that the work before us means taking a stand on this important issue, the ISTA Board of Directors has written a "position paper" on assessment that is published in this issue of the *Spectrum.* It begins with the following statement:

The Illinois Science Teachers Association endorses high standards for all students and endorses to hold its members to be accountable to those high standards. The ISTA also endorses the following eight principles that describe how science assessment systems should be implemented in the state of Illinois.

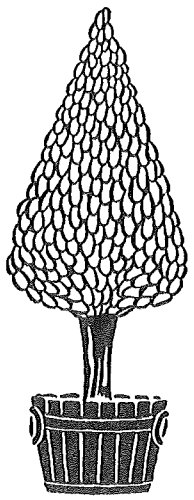
I urge you, as a member of the ISTA to read the position paper and offer feedback. The paper will again be published in the Fall *Spectrum* and is available our website. The position paper will be acted upon by our membership at the November conference. At that time, all members will be asked to approve or reject the position paper. If approved, the document will be widely distributed to teachers, administrators, policy makers, and legislators, and will help guide the activities of the ISTA.

I would like to thank all of the board members, past and present, for spending many hours preparing this significant document and I thank them for moving our association forward for the purpose of improving science education. Special thanks goes to former board member Michael Lach who never let us forget our responsibility to the teachers and students of Illinois.

Edee Norman Wiziecki

Edee Norman Wiziecki

President



Illinois Science Teachers Association Position on the Matter of Assessment

Assessment has always been an essential part of schooling. It has been used for a variety of purposes such as program review, evaluation of individual student learning, graduation decisions, higher education admission decisions, scholarship qualification, and prediction of future academic success. Information has been gathered in a variety of ways including forced choice formats such as multiple choice, matching, and fill-in-the-blank prompts as well as constructed response formats such as analytical or quantitative problem solving, written narratives, physical product creations or modifications, and interviews. Each of these information-gathering approaches has its benefits and drawbacks.

The dilemma we find ourselves in today results from the complexity of the problem and our desire to offer the best science education possible to students in Illinois' schools. In an age that asks for accountability, the challenge is to find ways to communicate to others the degree to which our educational purposes are being achieved. As indicated previously, there exist a number of approaches that can be used to collect information through the assessment process. However, some approaches offer information and strategies for analyzing that information that help us better determine how well a given purpose has been achieved.

Much of the consternation over current assessment efforts results from the fact that information gathered for one purpose is inappropriately used for other purposes. For example, information gathered to determine breadth and depth of a given science program may not be a valid measure of individual student achievement. In order to be able to apply appropriate assessment strategies, it is imperative that the purpose of the assessment is clearly and explicitly stated. Then, taking physical and temporal constraints into consideration, assessment information gathering approaches, analyses techniques, and reporting mechanisms can be chosen that will provide reasonable measures of the stated outcome. Forced choice items can be written that require critical thinking and understanding rather than simply memorization and that better meet stated purposes and existing constraints Under other conditions, constructed response approaches may be required to provide valid measures of intended outcomes.

The National Science Teachers Association (NSTA) has produced a statement on assessment that the Illinois Science Teachers Association endorses. Building upon the NSTA statement, the Illinois Science Teachers Association has developed an assessment position specifically related to Illinois schools.

Overview

The Illinois Science Teachers Association endorses high standards for all students and endorses to hold its members to be accountable to those high standards. The ISTA also endorses the following eight principles that describe how science assessment systems should be implemented in the state of Illinois.

1. **The primary purpose of science assessment is to improve student learning in science.**
2. **Science assessment for other purposes supports student learning in science.**
3. **Science assessment systems are fair to all students.**
4. **Professional collaboration and development support assessment in science.**
5. **The broad community participates in science assessment development.**
6. **Communication about science assessment is regular and clear.**
7. **Science assessment systems are regularly reviewed and improved.**
8. **Science assessment systems use clear standards and good science.**

These eight principles describe the assessment system that best enables students to learn and teachers to teach. Students are assessed with multiple academic measures, in a wide variety of forms, and those results are collected together when making high-stakes decisions. All students are treated fairly and equally. The assessment system is clearly communicated to all interested parties, with full disclosure of items, rubrics, and exemplars. Shaping the assessment system is a process of continual improvement, driven by data and research, with input from both school and district practitioners as well as the educational and scientific personnel. The assessment system is aligned with Illinois Learning Goals, and measures the ability of learners to (1) know and understand scientific concepts, theories, and ideas; (2) design and conduct experiments; (3) make and defend arguments based on evidence; and (4) communicate scientific information.

Preamble

The Illinois Science Teachers Association endorses high standards for all students and endorses to hold its members to be accountable to those high standards. The ISTA also endorses the following principles that describe how assessment systems should be implemented.

Principle 1: The primary purpose of science assessment is to improve student learning in science.

Assessment systems in science, including classroom and large-scale assessment, are organized around the primary purpose of improving student learning. Assessment systems provide useful information about whether students have reached important learning goals and about the progress of each student. Practices and methods are utilized that are consistent with learning goals, curriculum, instruction, and current knowledge of how students learn. Classroom assessment that is integrated with curriculum and instruction is the primary means of assessment. Science educators assess student learning through such methods as structured and informal observations and interviews, projects and tasks, tests, quizzes, laboratory experiments, performances and exhibitions, audio and videotapes, experiments, portfolios, and journals. The educational consequences of assessment are evaluated to ensure that the effects are beneficial.

Principle 2: Science assessment for other purposes supports student learning in science.

Assessment systems report on and certify student learning and provide information for school improvement and accountability by using practices that support important learning. Teachers, schools and education systems make important decisions, such as high school graduation, or future academic course selection, on the basis of academic information gathered over time, not a single assessment. Information for accountability and improvement comes from regular, continuing work and assessment of students in schools and from large-scale assessments. Accountability assessments often use sampling procedures. Rigorous technical standards for assessment are developed and used to ensure high quality assessments and to monitor the actual educational consequences of assessment use.

Principle 3: Science assessment systems are fair to all students.

Assessment systems in science, including instruments, policies, practices and uses, are fair to all students. Assessment systems in science ensure that all students receive fair treatment in order not to limit students' present and future opportunities. They allow for multiple methods to assess student progress and for multiple but equivalent ways for students to express knowledge and understanding. Science assessments are unbiased and reflect a student's actual knowledge and skills. They are created or appropriately adapted and accommodations are made to meet the specific needs of particular populations, such as English language learners and students with disabilities. Science educators provide students with instruction in the assessment methods that are used. Bias review committees study and approve each large-scale assessment.

Principle 4: Professional collaboration and development support assessment.

Knowledgeable and fair science educators are essential for high quality assessment. Science assessment systems depend on science educators who understand the full range of assessment purposes, use appropriately a variety of suitable methods, work collaboratively, and engage in ongoing professional development to improve their capability as assessors. Schools of Education prepare science teachers and other educators well for assessing a diverse student population. Educators determine and participate in professional development and work together to improve their craft. Their competence is strengthened by groups of teachers scoring student work at the district or state levels. Schools, districts, and states provide needed resources for professional development.

Principle 5: The broad community participates in science assessment development.

Science assessment systems draw on the community's knowledge and ensure support by including parents, community members, scientists, and students, together with educators and professionals with particular expertise, in the development of the system. Discussion of assessment purposes and methods involves a wide range of people interested in education. Parents, students, and members of the public join a variety of experts, teachers, and other educators in shaping the assessment system.

Principle 6: Communication about science assessment is regular and clear.

Educators, schools, districts, and states clearly and regularly discuss assessment system practices and student and program progress with students, families, and the community. Educators and institutions communicate the purposes, methods, and results of assessment. They focus reporting on what students know and are able to do, what they need to learn to do, and what will be done to facilitate improvement. They report achievement data in terms of agreed-upon learning goals. Translations are provided as needed. Examples of assessments and student work are made available to parents and the community so they know what high quality performance and local students' work looks like. Assessment results are reported together with contextual information such as education programs, social data, resource availability, and other student outcomes.

Principle 7: Assessment systems are regularly reviewed and improved.

Assessment systems are regularly reviewed and improved to ensure that the systems are educationally beneficial to all students. Assessment systems must evolve and improve. Even well designed systems must adapt to changing conditions and increased knowledge. Reviews are the basis for making decisions to alter all or part of the assessment system. Reviewers include stakeholders in the education system and independent expert analysts. A cost-benefit analysis of the system focuses on the effects of assessment on learning. These principles, provide the basis for evaluating the system.

Principle 8: Assessment systems use clear standards and good science.

Any formal science assessment used by schools, districts, and states must be aligned to the Illinois Learning Goals for Science. Schools, districts and states provide needed resources for science teachers to engage in professional development that will make clear the specific standards that are addressed by each assessment. In science, a complete assessment system should measure the ability of learners to (1) know and understand scientific concepts, theories, and ideas; (2) design and conduct experiments; (3) make and defend arguments based on evidence; and (4) communicate scientific information.

The Illinois Science Teachers Association believes that the task ahead of us requires us to step forward and decide what it is that is important to know about science education in Illinois and then create and implement appropriate approaches that allow us to communicate how well we are achieving our stated purposes. If the Illinois science education community does not find a way to address the issue for itself, others will do it for us.

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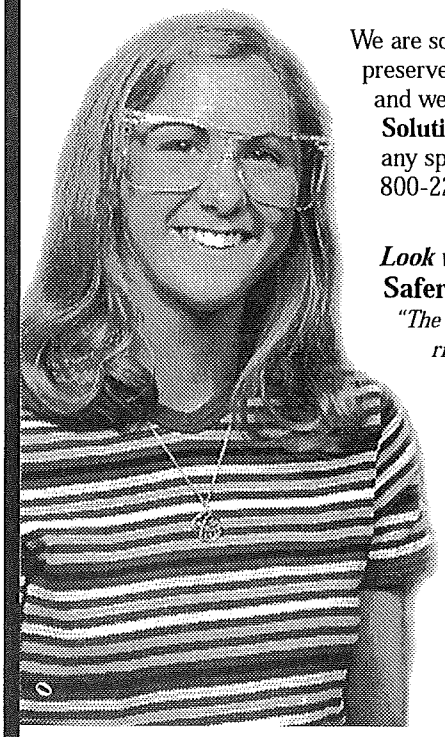

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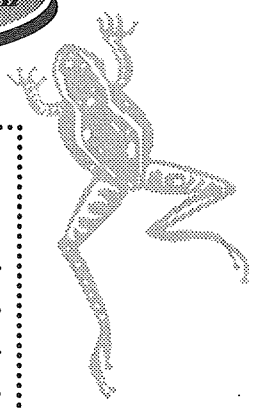

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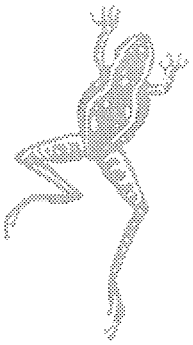

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June 19, 2002

Governor George H. Ryan
Office of the Governor
207 Statehouse
Springfield, IL 62706

RE: The De-Emphasis of Science Education in Illinois

Dear Governor Ryan:

Our nation is facing a critical shortage of science and mathematics teachers, scientists, and engineers—a fact that is recognized by our leadership in Washington, D.C. We look to foreign countries to fill many technology-related positions because our current work force cannot fill them. We are now facing a critical situation with the prospect of having a generation of Illinois students left behind in terms of developing its understanding of the natural world and their ability to function as effective citizens.

The Illinois Science Teachers Association is extremely concerned about the loss of targeted funding and support of science education in Illinois, particularly the targeted loss of funding for the Scientific Literacy Program of the state board of education. Evidence is mounting that suggests block grant funding is not being used to support the kind of science instruction that is most effective in helping Illinois students learn science and in providing professional development opportunities to help teachers learn new teaching strategies, and the best way in which to assess student success.

The Illinois Science Teachers Association is committed to promoting excellence and innovation in science teaching and learning for all. ISTA's current membership of more than 3,000 includes science teachers, science supervisors, administrators, scientists, business and industry representatives, and other who understand the importance of quality science education

The Illinois Science Teachers Association believes that unless targeted funding and support for quality science education in Illinois is re-established to levels that meet or exceed previous levels, Illinois students will not have the opportunity to achieve the levels of understanding that are expected for all students. ISTA hopes that you and our state and national decision makers understand that these decisions will leave a generation of Illinois students behind the nation/world. We strongly urge you to find ways to give Illinois students the opportunity to understand their natural world and how they can affect its continued development in order to become productive citizens by reinstating the funds that promote science literacy for all students.

Sincerely,

Edee Norman Wiziecki
President
On behalf of our 3,000 members

Ray Dagenais
Vice President

A Reality Check: The De-Emphasis of Science Education in Illinois
Please contact your legislators immediately to voice your concern.

Dear Members:
A generation of Illinois students will be left behind in terms of developing its understanding of the natural world and their ability to function as effective citizens.

The impetus for improving science education in this country was initiated in 1985 by the report "A Nation at Risk." Over the following decade this work was moved forward by such critical resources as the National Science Foundation's, "National Science Education Standards," the American Association for the Advancement of Science's, "Science for All Americans," the "Benchmarks for Scientific Literacy," and the "Atlas of Science Literacy," and the Illinois State Board of Education's "Illinois Science Learning Standards."

The progress has been slow, but steady, as understanding on the part of educators, parents, and others has improved in terms of how students learn science and how researched-based strategies help students learn science. Alternative assessments approaches have been further developed that have helped teachers determine what their students have learned. All of these initiatives have been made possible by federal, state, and local financial support.

Recent decisions at the state level have eliminated the financial support needed to continue the research on teaching and learning, the creation of materials and resources that align with the information that research has produced, and the professional development that permits educators to learn the most effective teaching and learning strategies with the best resource materials available that will lead directly to improved student learning.

The Illinois Science Teachers Association is extremely concerned about the loss of targeted funding and support of science education in Illinois and in particular the loss of the Scientific Literacy Program of the state board of education (See letter at left, sent earlier this month). *Evidence is mounting that suggests block grant funding is not being used to support the kind of science instruction that is most effective in helping Illinois students learn science and in providing professional development opportunities to help teachers learn new content and strategies. Illinois Science Teachers Association believes that unless targeted funding and support for quality science education in Illinois is re-established to levels that meet or exceed previous levels, Illinois students will not have the opportunity to achieve the levels of understanding that are expected for all students.*

The Illinois Science Teachers Association hopes that our state and national policy makers understand that their decisions will leave a generation of Illinois students behind and strongly urges them to find ways to give Illinois students the chance to be a part of the burgeoning need to understand their natural world and how they can affect its continued development.

The future of our children is in their hands.

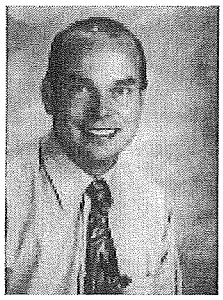
Sincerely,

The Board of Directors

Around the State

Regional Directors' Reports

Region 1



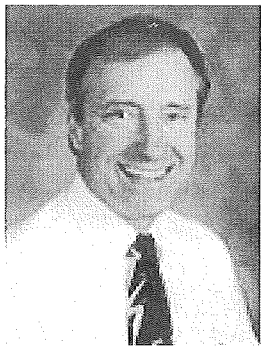
Walter Glogowski

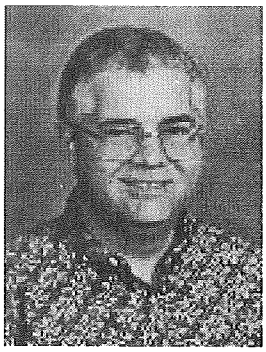
I sent out 26 invitations to local middle school and Jr High school teachers to attend "Astronomy Night" at Ridgewood High School on May 28, 2002. I had ISTA information at the event and asked local teachers to join. All of the teachers that I have invited are from the feeder school to our HS Dist so I hope the "personal" appeal will work.

Anna Zuccarini

Marjorie Cave, Science Literacy Coordinator for the Regional Office of Education, held a meeting for Key Leaders in the DuPage County. Seven people were in attendance and discussion of the Building a Presence vision followed. She reiterated Key Leader responsibilities and noted the areas where Key Leader representation was lacking. Over the next several months, our objectives are to try to establish a point of contact for the districts lacking a Key Leader, communicate with school principals, and try to connect with private schools. Additional meetings will occur in the next school year.

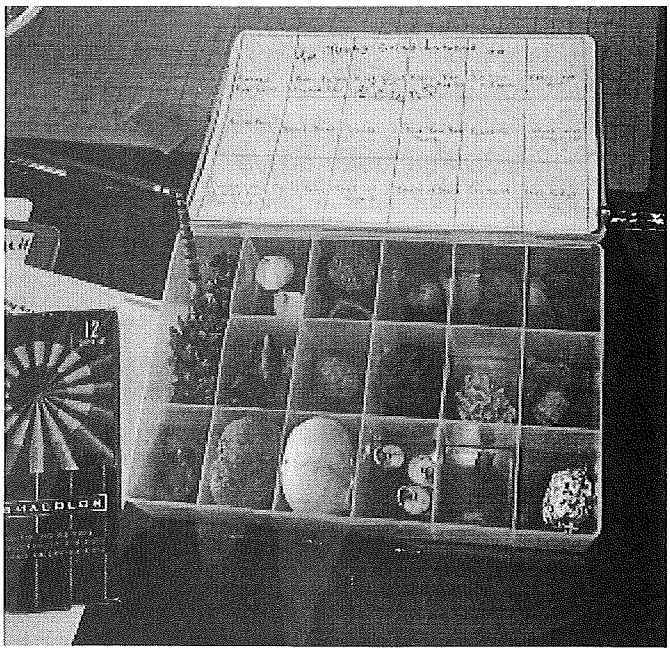
Region 2





Dennis Moore **Andy Apicella**

Andy and Denny are working on a fieldtrip for teachers that would include the new IMAX and Putman Museum in Davenport. Included will be a behind-the-scenes tour, a look at the projector, and more. We might also tour the fine museum. Refreshments will be included. Watch the website and Region 2 mailings for further information.



Collection from ISTA Region 4/Allerton Park Art & Science Workshop.

Region 4

Rebecca Hall **Kevin Seymour**

In the fall of 2001, Barbara Short, then Region 4 Director and Kevin Seymour met to discuss holding a meeting for ISTA members ini the region. It was the wish of the two directors that the meeting be held at Allerton in the late fall. Diana Dummitt, Barb, Kevin, and Jerrold Soesbe, Director of Allerton Park and Conference Center met on September 11 for planning purposes. Due to the events of that day, the workshop was postponed and held in April and May. ISTA sponsored a series of Science and the Arts inservices at Allerton under the direction of Michael Jeffords from the Illinois Natural History Survey. Those who attended the workshop had a wonderful experience. See photo taken at left of a sample project.

Newly elected Rebecca Hall met with Kevin Seymour twice this spring to discuss BaP issues and hosting another Region 4 meeting. The plan is to invite ISTA members from Region 4 to attend a session in late September or early October. We will hold the event at Allerton or at a school south of Champaign. We are hoping to have Ed Keiser, meteorologist for WILL AM-580 for a keynote. After the keynote, we will present information about ISTA and facilitate a group discussion about the services the membership would like to see

Not sure of your region? Check the inside back cover for a county listing. Contact your Regional Director from the information on the back cover.

Region 5

Pam Abbott

So far this Spring, I have discussed ISTA at a graduate class at SIUE with 20 local HS and Middle School teachers nd three professors; also talked about the ISTA Award Certificate and medallion, talked about PSAE Award and I have copies of the Exxon Mobil Exemplary HS Science Teacher Award to hand out next week at class. I have also told teachers about the fall conference and encouraged them to attend.

I am on the the ACS Society Committee on Education (ACS SOC) and have been asked to be on an joint ACS/NSTA task force concerning state requirments for HS Chemistry teachers. At the ACS SOC mtg. in Orlando two weeks ago, the discussion concerned being able to get information from the ACS to chemistry teachers directly concerning workshops, training sessions and publications available for their use. It was apparent that sending information to the district alone was not sufficient to make sure it was received by the correct teachers. I informed them about the BaP venture/website and told them to research it through NSTA. JChemEd also presented a proposal to make their resources aligned with the ACS resources and available on-line. I also informed the JChemED spokesperson about BaP.

Congratulations to

Longtime member and supporter of ISTA

MEL WOJTULEWICZ

on her retirement from the Chicago Public Schools

Region 6

Outgoing Director, Kevin Wise

The "Science in the South" Conference has become a continuing special project for Region 6 of the Illinois Science Teachers Association. This is the sixth year in a row for the conference which is co-sponsored by the Illinois Science Teachers Association, Southern Illinois University at Carbondale, and some one dozen Regional Superintendents of Schools. This year's conference took place on March 9th in and around the facilities of the Student Center at Southern Illinois University at Carbondale. The conference is facilitated by the professional staff of Continuing Education at SIUC.

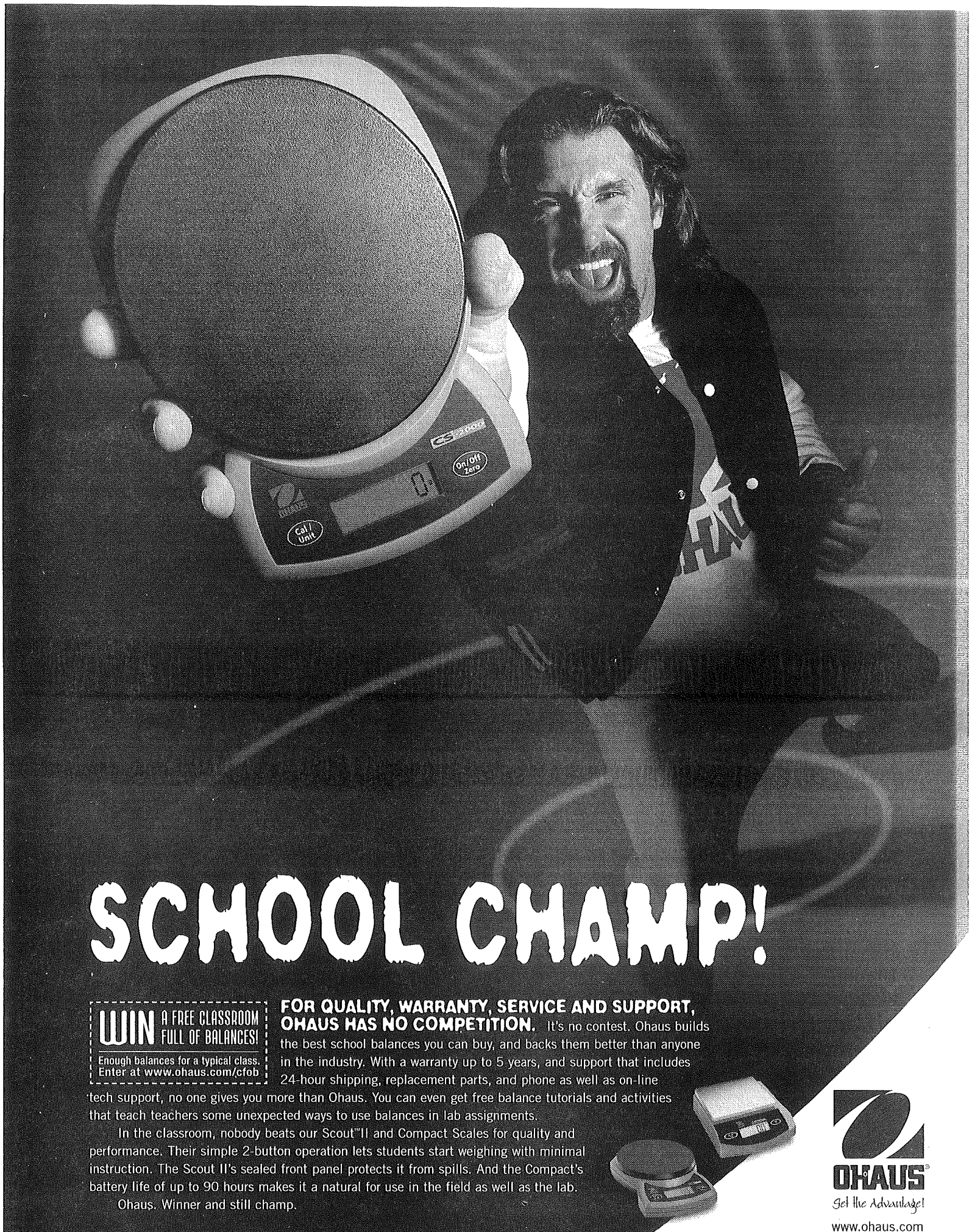
Science in the South was initiated in part to bring a science education conference within reasonable driving distance for teachers in the southern part of Illinois. There was and remains a great need for professional development opportunities related to science teaching strategies and resources for teachers in our area. A further goal of the conference was to inform teachers of and involve them in professional organizations such as ISTA. Membership dues for ISTA were included in the registration fee so that all attendees become ISTA members for one year.

The conference has been increasingly successful each year in getting area teachers involved. Participant numbers have risen from the low two hundreds to more than 320 this year. Speakers and vendors have been attracted from across the state to provide opportunities to learn first hand what is new in science education. Several agencies also had mobile display units on site. Area teachers have started to join the program as presenters. Attendance at the conference by undergraduate students in teacher education at SIUC has also increased substantially.

ISTA members and staff have played keys roles in planning and conducting the "Science in the South" conference. ISTA has always had a centrally located display table at the conference. ISTA involvement at the conference also resulted in an increase in membership from the region. We trust that many of these new members continue to be associated with ISTA in future years. Our additional goal for next year for Science in the South is to continue to involve more teachers and ISTA members as presenters at the conference. This year we had an earlier and more widely distributed "Call for Papers" which really helped to get the word out. We are studying feedback both from participants and program committee members to have an even bigger and better "Science in the South" conference on Friday, March 7, 2003.

From your ISTA Website Coordinator, Tracy Trimpe

Visit the ISTA website at http://www.ista-il.org/ for information about award opportunities, workshops, convention information, and more! What would you like to see on the site? Send your suggestions, site recommendations, and notices of workshops to me at: ttrimpe@sciencespot.net



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Meet your ISTA Committee Chairs: Awards

Ann Linenfelser

Ann Linenfelser and Nancy Nega are the current co-chairs for the ISTA Awards.The awards committee oversees the application process for the ExxonMobil Award, The ExxonMobil Internship and the awards considered for the Recognition Luncheon. As of this year, ISTA will be the coordinating state agency for the Presidential Awards for Mathematics and Science.

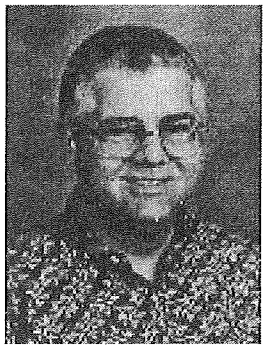
Ann is the current Recycling Education Coordinator for Madison County. In this capacity, she launches various recycling programs in the schools - from the collection of everyday paper to tennis shoes to pencil shavings to 6-pack rings to soda tabs. She teaches recycling lessons to students in grades K-12 in 120 county schools. Prior to this 12 year experience, she taught HS Biology for 16 years.

Nancy Nega

Nancy is an 8th grade science teacher in Elmhurst, and has taught there for 16 years, after subbing for 5 years. Nancy also is the Master Teacher for the Pre Service Teacher Program for the Department of Energy at Argonne, and is also involved with other programs at Argonne. She is a National Board Certified Teacher and a Presidential Awardee in Secondary Science.

My First Year on the Board

Andy Apicella



Since joining the Board in March, 2001 I have been active in ISTA activities. I attended the NSTA convention in St. Louis and attended the Building a Presence breakfast as a representative for Illinois. Through the summer, I also served on the planning committee for the 2001 ISTA Convention that was held in Peoria. I headed up the Building a Presence preconference workshop and with help from Diana Dummitt, Tracy Trimpe, and Gwen Pollock was able to organize the day as an introduction to the BaP program.

In early June I attended the NSTA Region 12 meeting in Galena with fellow ISTA members Diana Dummitt, Barb Sandall, Nancy Grim and Deb Greaney. We met with the representatives from WSST and WEST from Wisconsin and the Iowa Academy of Sciences as well as Wendell Moehling, Associate Executive Director of NSTA. Over the two day meeting the participants discussed how each state was working on the BaP program and how they handled their state conventions. I attended the June Board meeting in Urbana and joined in the Friday night discussion of the Exxon-Mobil exemplary high school science teacher award program.

Last June I was invited by Pam Stanko of ISBE to serve on the panel to determine the cut scores for the science test portion of the Prairie State Achievement Exams.

We did not have a September Board meeting due to the stress of the events of September 11. Through many phone calls and

e-mails I was able to work with Tracy Trimpe to get the schedule for the pre-conference organized and ready for the convention.

At the ISTA convention I served as facilitator for the Building a Presence Program preconference workshop and throughout the last two days of the convention I assisted Tracy and Stacy Baker with the details of the convention.

After the convention I was asked to join Nancy Grim on her work with the Membership committee. As part of my assignment I looked for candidates to run for the ISTA Board for the Region 2 Director position that was held by Dennis Moore. Dennis was finishing his second year on the Board and was eligible for a second elected term. Dennis did offer to run and was elected to a second term.

In November I was invited by Pam Stanko to review questions for future Prairie State Achievement Exams in the area of Science. We met at MetroTech in Champaign.

Throughout the year I have been working with Amy Sandgren at the Rock Island County ROE on the Building a Presence program

At the December meeting I brought up the question of the role of the PSAE in student assessment and how ISTA members can use the results of the PSAE to improve curriculum to work towards continued improvement in PSAE scores. This led to Ann Reichel surveying the membership through the ISTA listserv to determine how others felt about the PSAE. The results of this survey were presented to the ISTA Board at the March, 2002 meeting.

Prior to the Board meeting Ann Linenfelser sent me some drafts of the application for the Exxon-Mobil awards and I made comments and sent those to Ann.

At the March Board meeting I was asked to assist Katie Kendall ISTA liason for Business and Industry, to determine the method of selection for the ComEd recognition of outstanding science students in northern Illinois. We met with Cheryl Hyman of ComEd in early April.

I was also asked to help with this year's Building a Presence Committee in planning the preconference workshop for the 2002 ISTA Convention at St. Charles.

I offered to work with Mike Lach, Ray Degenais and Walter Golgowski on writing a white paper on the ISTA position on student assessment.

I distributed forms to high school teachers in the Rock Island ROE area about the ISTA recognition of an outstanding science student who is graduating from an Illinois school this year.

Over the Spring break I attended a meeting of the ComEd committee to discuss the application process for the 2002 ComEd 100-ISTA awards. We met at Jumers in Bloomington and worked out the plans for the applications. ISTA members Tracy Trimpe, Diana Dummitt, Katie Kendall, and Cheryl Hyman (ComEd) attended. Through e-mail communication the applications were proofed before being released to the students and posted at the ISTA web site.

This summer I am continuing to work with Amy Sandgren of the Rock Island ROE to build a cadre of Key Leaders and Points of Contact for the Building a Presence Initiative in Region 2.

Feel Powerless as a Teacher?

Take an active role in shaping the future of science education in Illinois by running for ISTA Regional Director. Contact your current Regional Director (listed on inside back cover) then contact Donald Nelson, ISTA Past-President for information about getting on the ballot. See inside front cover for Don's contact information.

ISTA Board Buzzzz...

ISTA Spring Board Meeting Minutes March 9, 2002

In Attendance:

President	Edee Wiziecki
Vice President	Ray Dagenias
Secretary	Debra Greaney
Treasurer	Carl Koch
Executive Director	Diana Dummitt
Directors:	
Region I	Anna Zuccarini
	Walter Glogowski
Region II	Andy Apicella
	Denny Moore
Region III	Don Powers
	Jill Carter
Region IV	Rebecca Hall
	Kevin Seymour
Region V	Pam Abbott
	Liza Basden
Region VI	Wesley Heyduck
	Marsha Lee
Action Editor	Kevin Seymour
Business/Industry	Katie Kendall
Awards Co-Chairs	Ann Linenfelser
	Nancy Nega
Web Coordinator	Tracy Trimpe

The meeting was called to order at 8:32 AM by President Edee Wiziecki. President Wiziecki welcomed the new members to the board and explained the consent agenda procedures. Denny Moore shared a promotional video he produced for ISTA.

The minutes of the December meeting were approved with the following corrections: Spelling of Carl Koch's name and adding Katie Kendall to those in attendance.

Vice President Ray Dagenais reported on the progress made by the finance committee in revamping the budget to better reflect past income and expenses. He acknowledged the assistance of past treasurer Barbara Sandall.

President Elect Marylin Lisowski was unable to stay, but left a list of issues to be discussed as appropriate.

Executive Director Diana Dummitt reported that NSTA has requested a return of funds for BaP from ISBE for nonperformance of contractual responsibilities. She has documents available for review from NSTA outlining the process that led to her being made the state coordinator and a new contract being developed with ISTA serving as the fiscal agent. She is now in control of the database and encourages those who wish to be Key Leaders to contact her to be added to the database. She will also be contacting those who expressed an interest earlier, but who were never confirmed. Diana also outlined the July 17-18 Key Leader training.

President Edee Wiziecki reminded the outgoing regional directors that they should submit a report outlining the activities in their region for the past year.

Executive Director Diana Dummitt informed the board of the success of Science in the South. Kevin Wise, former Region 6 Director, will continue to be involved in that effort. Region 3 has a conference coming up on April 12. Region 4 has a workshop Using Art to Teach Science. Mike Lach reported on some features of the listserv housed in Region 7. He again reminded people to join if they are not currently taking advantage of it.

Ann Linenfelser questioned if there are policies or guidelines regarding what can be put on the ISTA Calendar of Events web page. At this point, Web Coordinator, Tracy Trimpe, will continue to act as filter. President Wiziecki reminded the board to send current information to her to keep our site up-to-date. The strategic plan page needs to be updated. Diana informed us that our current webmaster is graduating and we will need to find someone else.

Region 2 Director Andy Apicella reported on information on the Prairie State Achievement test gleaned from a question put on ISTA Talk. There were 19 responses, none of which were positive. Pam Abbott has worked on development of the test. She explained that there are not enough items to do area analysis and the test would have to be extended to 2-3 hours just for science to do that. A discussion followed on several issues. Mike Lach said there are major misconceptions about the test and use of the data it provides. Andy expressed frustration at trying to find someone at ISBE to answer the question of how this data can be used to improve curriculum.

Walter Glogowski wants ISTA to finish and publish a white paper on assessment because of the abuses of the test data. A lengthy discussion followed about how to best proceed in this process. A committee was formed to facilitate this process: Members are Andy Apicella, Walter Glogowski, Katie Kendall, Ray Dagenais, Jill Carter, Kevin Seymour, Pam Abbott, and Anna Zuccarini. This committee will develop a clear statement of purpose and an action plan of strategies addressing getting feedback.

1. The Key Leaders will be involved at their July training.
2. An initial draft of principles due at June board.
3. That draft will be placed on line at the end of June.
4. These principles approved at convention (town hall meeting).
5. A date to review with ISBE the current state of science testing will then be scheduled.
6. Release state review.

Our Faithful ISTA Secretary Deb Greaney

Walter will send out current draft of Mike's paper and NSTA statement on assessment to all board members this week.

Vice President, Ray Dagenais, reviewed the procedure that organizations must follow to receive seed money from ISTA. He has received a request for funding from WIU. They have filled out all the required forms. A motion was made by Ray that ISTA support WIU with $500 as requested for their conference. Denny Moore 2nd the motion. Motion carried. Ray will write a letter to inform them of the board's decision.

A final report and the modified budget were presented to the board. Edee pointed out the areas of deficit in income. Discussion followed on certain line items. A motion to accept the December treasurer's report was made by Andy Apicella. Wesley Heyduck 2nd the motion. Motion carried.

A motion was made by Andy Apicella: ISTA will reimburse the qualified travel expenses for regional directors, committee chairs, and board officers only upon receipt via email by the President and Executive Director of their reports. Wesley Heyduck made the 2nd. Motion carried. Pam Abbott made a motion to approve the revised budget for FY 2002. Walter Golgowski made the 2nd.

Discussion: Denny Moore questioned the procedure for dealing with items that would cause an overage in a line item. It was decided that the treasurer would make the Executive Board aware of the shortage and they would deal with the issue. A question was posed about the procedure for approving overages; Is it done by a certain amount or a percentage of the line item? A discussion about the possibility of using accounting software rather than an accounting firm ensued. The accounting firm offers many other valuable services.

Edee also pointed out that a six month CD in the amount of $64,000 has been bought as a temporary measure until the board can decide what to do with it long term. The accountant suggested that perhaps we purchase 2 smaller short term CDs with staggered renewal rates. Katie Kendall also suggested that we investigate the possibility of placing these funds in a higher interest bearing vehicle such as a money market account. Nancy Nega also questioned a rainy day fund of $50,000 since the greatest shortage we have had to date has been $25,000.

Edee outlined the current agreement with Pheasant Run. It was entered into 5 years ago and the commitment was made to 700 sleeping nights. In 2000 we only filled approx 360 rooms. The question is, "What kinds of things we can do to insure that people stay there?" The BaP program will possibly pay for the rooms of the Key Leaders on Wednesday night which will fill about 200 rooms. Other ideas include showing your room key to get into a special event or speaker, having a shuttle to take people staying into the city for free to some place or event. A long list was generated and Diana will take it to the convention planning team which she is meeting with in April. She asked everyone to email ideas to her.

Convention 2003 is scheduled to be held in Peoria on October 16-18. Diana asked everyone to investigate alternative sites for future ceonventions and get information and ideas to her by April 15th.

Executive Director Diana Dummitt, gave the board an update on Building a Presence for Science. There are currently 70 Key Leaders in the state and we need to have 172 by November. There needs to be one for every 25 schools. Current key leaders need to log on and check the database for their county. They can then go to their ROE for help in finding Points of Contact. Chicago needs 39 Key Leaders. Diana will contact the Golden Apple teachers and all national board certified teachers in the Chicago area to be Key Leaders. Mike Lach offered to help with the selection.

The Key Leaders will be trained in July on the website and on leadership, standards based instruction, and assessment. The Wednesday night hotel and pre-conference registration at the ISTA conference will be paid for the Key Leaders by BaP. Members of the BaP planning committee are Andy Apicella, Marylin Lisowski, and Deb Greaney.

A discussion pertaining to the request submitted by Marylin on behalf of an emeritus member was held and Kevin Seymour made a motion . It stated, "I move that all retired members be able to vote." Nancy Nega made the 2nd. Discussion followed and it was determined that we didn't have enough information to decide. The motion was withdrawn. Diana will contact Marylin to get more information.

Motion made to adjourn at 2:00 pm by Walter Glogowski with a 2nd by Pam Abbott.

The mission of the Illinois Science Teachers Association 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.

"Creating Communities of Learners"
Illinois Science Teachers Association
Annual Convention

November 6-9, 2002

Pheasant Run Resort, St. Charles

Teachers, principals, supervisors, and others concerned with effective science education are invited to attend the annual conference of the Illinois Science Teachers Association at Pheasant Run Resort.

PRECONFERENCE

The convention begins Wednesday evening November 6th with a special reception for all participants in the NSTA/ExxonMobil sponsored Building a Presence Program. On Thursday, November 7th two special leadership strands will be offered. One will be a preconference for participants of the Building a Presence Program. This full day of training and networking will include a variety of sessions on leadership, effective standards-based teaching, and communication. NSTA staff will be on hand to provide information and updates on the national scene. The second strand will include leadership training of a more general nature and is open to all teachers and administrators. The day will conclude with an after-school wine and cheese preview of the exhibits in the Megacenter open to all teachers registered for the convention.

FRIDAY EVENTS

Over 100 one-hour sessions will be presented all day Friday November 8th on a wide variety of topics for teachers at all grade levels. Over 100 vendors will be exhibiting in the MegaCenter all day, offering the latest information on new science teaching equipment, textbooks, audiovisual aids, lab equipment, computer programs, supplementary materials, and other services and facilities. In addition, more than thirty Illinois state agencies have organized a fantastic room full of free materials. The Exhibit Hall and State Agency room will close at 4:00 pm. They are not open on Saturday. Honor your outstanding colleagues at the fabulous buffet during the ISTA Awards luncheon, generously sponsored by Prentice-Hall. Later in the day get acquainted with your ISTA Regional Director and others from your ISTA Region at the Town Meeting. End the day with friends old and new by taking advantage of several special dinner options. **ISTA convention attendees who are registered to stay at Pheasant Run Resort Friday night will be ISTA's very special guests on a deluxe bus tour into the city of Chicago. Several options will be offered to experience Chicago at Night.**

SATURDAY EVENTS

Saturday, November 9th begins at 7:30 am with the ISTA Membership meeting including a continental breakfast and an outstanding array of door prizes once again made available by our generous exhibitors. The rest of the day is dedicated to 3 to 5-hour strands on specific topics for elementary and secondary teachers. Sessions will feature engaging workshops on optics, radiation, cutting edge technology, environmental education, agriculture, and much more! In addition, ISTA is co-sponsoring the ComEd 100 program - stop by and meet these top 100 students and see how their projects have impacted their communities. **The Exhibit Hall will not be open on Saturday.**

CONVENTION LOCATION

Convention registration, sessions and exhibits will be at Pheasant Run Resort, 3 miles east of St. Charles, Illinois. St. Charles is located on Route 64 approximately 45 miles west of Chicago. Pheasant Run Resort has been newly remodeled and is a beautiful, full-service resort. Relax at the award-winning dinner theatre and Zanies Comedy Club (contact the Resort for tickets). Join your colleagues and dance the night away to live jazz and swing music or enjoy the big-screen T.V. in one of several lounges. Unwind at the Mario Tricoci Day Spa and stay over until Sunday for the fantastic Sunday brunch in the beautiful Atrium.

Reservations should be made directly with Pheasant Run Resort. Call 630-584-6300. Be sure to mention that you are a participant in the Illinois Science Teachers Association Convention to receive the discount rate of $119.00. Parking is free. Remember that you qualify for the FREE Chicago at Night trip if you are a **registered guest** at Pheasant Run Friday night, November 8, 2002. Don't miss this event - There will be several educational and educational options offered.

For more information and current updates, go to the ISTA website at www.ista-il.org

2002 Illinois Science Teachers Association Annual Convention

Pheasant Run Resort

November 6-9, 2002

PRE-REGISTRATION FORM

New this Year! If you are a current ISTA member, you can register a Fellow Teacher or Administrator to come with you and receive a Discount on BOTH Registrations.
Simply attach both registrations with payment for the discounted rate.

FILL OUT FORM COMPLETELY (PRINT CLEARLY: INFORMATION WILL BE USED FOR OUR RECORDS)

Name: _____ Spouse's Name (if attending): _____

Home Address: _____ Home Phone: (___)_____

City/State/Zip: _____ County where you work_____

Affiliation (school, college or organization): _____

Business Address: _____ Business Phone: (___)_____

City/State/Zip: _____ E-mail_____

_____ CHECK HERE IF YOU NEED SPECIAL ASSISTANCE DUE TO HANDICAP.
_____ CHECK HERE IF YOU WOULD LIKE TO BE A PRESIDER FOR A SESSION.

REGISTRATION FOR THURSDAY PRECONFERENCE (EXHIBIT PREVIEW 4:00-7:00PM)

_____ Registration for One	$75.00 _____
_____ Registration for Two	$125.00 _____

REGISTRATION FOR FRIDAY AND SATURDAY

_____ Current Member Registration	$100.00 _____
_____ Registration for ISTA Member and fellow teacher or administrator	$150.00 _____
_____ NON-Member Registration	$135.00 _____
_____ Full Time College Student (includes Membership)	$15.00 _____
_____ Non-teaching Spouse	$10.00 _____
_____ SIGN ME UP FOR THE FREE CHICAGO BUS TOUR FRIDAY NIGHT! (Must be a registered FRIDAY overnight guest at Pheasant Run Resort to qualify. See hotel registration information at right)	$00.00 _____

ONE-DAY REGISTRATION FRIDAY (EXHIBIT HALL OPEN 9:00AM-4:00PM)

_____ Current Member Registration	$75.00 _____
_____ Registration for ISTA Member and fellow teacher or administrator	$125.00 _____
_____ NON-Member Registration	$135.00. _____
_____ Full Time College Student (includes Membership)	$15.00 _____
_____ Non-teaching Spouse	$10.00 _____

ONE-DAY REGISTRATION SATURDAY 5-HOUR WORKSHOPS (EXHIBIT HALL NOT OPEN)

_____ Current Member Registration	$75.00 _____
_____ Registration for ISTA Member and fellow teacher or administrator	$125.00 _____
_____ Full Time College Student (includes Membership)	$15.00 _____
_____ Non-teaching Spouse	$10.00 _____

PRENTICE HALL LUNCHEON ON FRIDAY—ALL ARE ENCOURAGED TO ATTEND $10.00 _____

_____ **I have included my 2002 membership dues** $35.00 _____

REGISTRATION TOTAL: _____

Make checks payable to: **Illinois Science Teachers Association. BY ACTION OF THE ISTA BOARD OF DIRECTORS, REGISTRATION IS REQUIRED FOR PARTICIPATION IN ALL ACTIVITIES OF THE CONVENTION. THE BADGE ISSUED TO EACH REGISTRANT IS THE TICKET OF ADMISSION TO ALL SESSIONS, EXHIBITS AND OTHER ACTIVITIES.**

NSTA
ExxonMobil

Are you part of

the Illinois Building a Presence for Science Program Yet?

You need to be!

Time is Running Out — Become the Point of Contact for your School Today.

Our goal is to have all participants in place by Spring 2003. Creating a comprehensive network of leaders in science education, the Illinois Building a Presence for Science Program (BaP) is administered by the National Science Teachers Association and funded by the Exxon Mobil Foundation. The Illinois Science Teachers Association is engaged in an ambitious effort to create a network among Illinois teachers who share a special enthusiasm for science education. This program is an exciting opportunity for educators to become part of a network of dynamic teachers who will take the lead in implementing standards-based science teaching and learning. The goal of this program is to create a comprehensive communications and professional development network of outstanding science educators.

Objectives:

- Create a state network of science and mathematics teachers to share resources about effective teaching and learning.
- Lessen teacher isolation and enhance collaboration.
- Assist teachers to implement the Illinois Learning Standards in their schools.
- Provide quality professional development opportunities and standards-based resources to help all students learn science.

Don't Miss this Great Opportunity!

For more information, go to the ISTA website: www.ista-il.org

Articles

Reflections of Washington D.C.

Elaine Modine

Presidential Awardee 2001

I am so proud to be a teacher – to be able to touch the lives and give direction to our youth in science.

The whirlwind of activity began with the official e-mail at 6:30 p.m. on Friday, March 15 confirming the selection of Presidential awardees. Within four days I was standing in the beautiful lobby of the Capitol Hilton in Washington D.C., part of an all-expense-paid trip for my husband and myself to honor and celebrate science and math teachers from across the United States. Rowena Douglas of the National Science Foundation, our constant e-mail contact and director of all, greeted us on Tuesday evening. In reference to the short notice we had to make our plans because President Bush had to sign the memo releasing our names, she said, "By now you really realize this award comes from the President of the United States." We were told to sit back and enjoy and be appreciated for all we do. It was an exciting five nights and six days of activity that I wish every teacher could experience.

On Capitol Hill we experienced a congressional hearing before the House committee on Science chaired by the Honorable Sherwood Boehlert. Representative Judy Biggert of Illinois, whom I met, sits on that committee and I was able to share some of the advanced biotechnology experienced in my classroom. Four teachers from Arizona, Michigan, Oklahoma and New York presented testimony before the House committee and pleaded educations' case against funding cuts like the Eisenhower funds and how cutbacks are greatly impacting science education. Vice-President Chaney greeted us on the steps outside the White House.

We received several children's books that were signed by the authors whom we met including, *Meet the Octopus*, and *Who Lives in the Sea?* by Sylvia M. James. One of the main cave explorers, Nancy Aulenbach in the IMAX theater show we saw "Journey into Amazing Caves", also gave us a copy of the companion book *Caves*, by Michael Taylor. Visits to the National Air and Space Museum, an elegant dinner and reception of pheasant and caviar at the State Department followed by an address by Nobel Laureate Dr. Carl Wieman, the National Aquarium in Baltimore and Maryland Science Center and a fun evening aboard the Odyssey for a Dinner Dance cruise down the Potomac were also on our weeklong agenda. Gwen Pollock of ISBE supplied me with pins, business cards and mementos to share with teachers from around the nation. I now have quite a collection!

Flags of 50 states adorned the Kennedy Center stage where Dr. Rita Colwell, Director of the National Science Foundation and John Marburger III, Director of the Office of Science and Technology Policy of the White House, gave us our awards. Marilyn Weaver, principal of Waubonsie and Dr. Sher Renken my district science coordinator, flew out to DC to share this special evening with me. The eloquence of those who addressed us made me feel so very proud to be a teacher. From Dr. Rita Colwell, to Dr. Judith Ramaley Assistant Director of the NSF who quoted Parker A. Palmer's "The Courage to Teach" to Harold Pratt, NSTA President and John Lott of NCTM — what wonderful words were shared.

One of my most memorable speeches included the metaphor of the chain of inspiration: "We are inspired so we must be inspiring. We are part of a chain. Through time, teachers, as links in our past, have inspired us, and those teachers are links to those before them who also inspired. In turn we teachers are linked to our students whom we inspire and who will continue the chain to inspire others." I returned with a sense of patriotism and renewed commitment to help teachers strive for excellence.

I returned with a sense of patriotism and renewed commitment to help teachers strive for excellence.

I'd like to share the closing words from my journal: "I am so proud to be a teacher – to be able to touch the lives and give direction to our youth in science. It is a great responsibility but it has renewed my sense of purpose and the importance our nation puts on us teachers to offer experiences to our youth in science and math that will inspire them. They are the future of our nation and our nation depends on them. I will share that with them when I get back. Teachers are highly regarded in Washington DC. Our job is vital to the well being of this great land of ours! I return with a renewed passion for the importance of our profession."

I am thankful for the opportunities and support that have enabled me to pursue my passion and dream of providing the very best experiences in the high school classroom for our students. I will continue to strive to offer that caliber of teaching and congratulate all my colleagues who join with me in so worthwhile a mission.

It Could Happen to You!

Applications for the 2003 Presidential Awards for Excellence in Math and Science Teaching (PAEMST)will be available in November and sent to all ISTA members. You can check out PAEMST by going to www.ehr.nsf.gov/pres_awards/

Bringing New Science Teachers Onboard

Raymond J. Dagenais, Ed. D.

The challenge of keeping competent, caring, and qualified teachers in Illinois science classrooms is growing as teachers continue to leave the profession in greater numbers for a variety of reasons. One time-tested approach in helping induct new teachers into the profession is that of mentoring. Recently, I was interviewed by *Education World* writer, Michele Israel, for an article she is composing for the on-line journal. What follows are her questions, and my responses.

How long has peer mentoring for teachers been around?
This is a difficult question to answer. One might argue that mentoring has been around for thousands of years if you consider that the teacher Plato had as his mentor Socrates and Plato took on as his protégé the teacher Aristotle. In more recent times mentoring most likely became a well-established strategy for teacher growth and development during the establishment of the common school movement of the early to middle 1800's. The demands of educating ever-greater numbers of students increased the challenge of training greater numbers of teachers. It is a reasonable assumption that teachers helped one another as the size of schools grew.

What is the value of mentoring? Who benefits?
The value of mentoring is manifested in the human developmental relationship that is established between the mentor and the protégé. A person new to the profession has someone they can turn to for guidance and support. In addition, the veteran teacher who is a storehouse of information and insights has a means through which these treasures can be passed on to other generations. Ultimately it is the learners influenced by competent, caring, and qualified teachers that benefit.

What are the deficits of mentoring? When does mentoring not work and why?
Mentoring relationships have a life cycle of their own. They have a beginning, a growth period, and an end. The termination of mentoring experiences can end in a number of different ways. The saddest scenario sees the mentor and the protégé parting ways because of significant differences of opinion. Oftentimes, these disagreements arise because of power or control issues. Regardless of whether the relationship is formally arranged or informally developed, it is essential that both individuals see the value of the relationship and are willing to accept the responsibility to make it work. Without this commitment no program, no matter how well designed and financed will produce satisfying mentoring experiences.

What makes a mentoring relationship work? What are the barriers to effectiveness?
The critical component of a successful mentoring experience is the mutual commitment of the mentor and the protégé. Some research I have done on the subject suggests that having a mentor that is in the same field of study or discipline, that has some knowledge, expertise, talent, or connections that the protégé finds worthwhile and desirable, and that is located in relatively close proximity to the protégé are factors that are positively correlated to successful mentoring experiences. One other factor that has the potential to positively influence a successful mentoring experience but has not yet been verified through research is the cognitive flexibility of the protégé. The premise is that if proteges are willing to suspend judgement and tolerate ambiguity, they stand to gain more from the experience than proteges who do not demonstrate those attributes.

How must a mentoring program be structured? Could peer mentoring/evaluation become an entire new field of study in education?

Mentoring programs serving large numbers of mentor/protégé pairs must be well thought out and purposefully implemented if the programs are to be successful. The mentoring relationship is an integral part of the mentoring experience and researchers have investigated the characteristics of mentoring experiences. Unfortunately, a variety of related approaches have been termed "mentoring" when they are actually training, peer-tutoring, or peer-coaching experiences. One research study (*Mentoring Program Standards* – Dagenais, 1996) has identified dimensions of successful mentoring programs. These dimensions led to the formulation of mentoring program standards outlined in the report.
The dimensions are:

1. Program Scope
2. Mentoring Incentives
3. Mentor Training
4. Mentor Selection and Matching
5. Assessment and Evaluation of the Mentoring Experience

What we know about mentoring could certainly form the basis of a serious academic study leading to even greater insights into this special human developmental experience.

Mentoring seems to have increased as teacher attrition rates rise. Is mentoring the best approach to attrition? How should mentoring be viewed in a more comprehensive fashion?

Attrition is an outcome related to the way teachers deal with the challenges and opportunities for growth they encounter during their professional careers. Teachers face different dilemmas and satisfying moments as they progress from apprentice, to novice, to professional, possibly to distinguished and even emeritus stages of teaching. The value of mentoring for individuals early in their careers lies in what they can learn from someone who is recognized for their experience and expertise and is willing to help the newcomer. The value for those teachers later in their careers is derived from the satisfaction of being able to help another grow in the profession. Progression through the phases depends upon the reflection-renewal-growth cycle as described in the *Life Cycle of the Career Teacher* (Corwin Press, 2000). Mentoring can play a significant role throughout the professional teacher's career.

What are the best mentoring models? Practices? Programs?

The best mentoring models incorporate mentoring relationships that are founded upon mutual respect, high levels of trust, and an intrinsic desire on the part of the mentor to "take the protégé under a wing" to help the newcomer grow. The best programs do not have to depend upon extrinsic incentives to entice people to be mentors. These programs also understand that formally arranged mentoring relationships do not always have the same character as informal relationships established through the mutual desire on the part of both the mentor and the protégé to work together.

Who are mentoring opponents? What are their arguments?

Almost no one is opposed to the idea of mentoring. Opposition arises in the form of support that the variety of helping approaches receives. The level of support in terms of fundamental understanding of the mentoring experience and the financial resources required to establish a solid program does not usually keep pace with mandates for mentoring. The argument is that mentoring is good but we don't have the resources to support it.

Mentoring can play a significant role throughout the professional teacher's career.

On what do mentors work? What are typical needs of "mentees"?

Mentors work on knowing how to meet protégé needs as the protégé grows. In the early phases of a new situation people are very often willing to accept advice "carte blanche", frequently imploring a mentor to "tell me what I need to do (to survive this situation) and I'll do it. As proteges grow more confident, they are less willing to be told what to do, preferring to listen to the advice and reflect on how it fits with their experiences and intentions. Ultimately, the protégé may achieve levels that equal or even surpass those of the mentor. The relationship has now become a collegial relationship where the pair works with each other on a common level. The mentor must be acutely aware of these changes if the mentoring relationship is to survive and flourish.

If you had to recommend to a school district or school ways to establish a mentoring program, what would your recommendations be?

One organization that has used the report, *Mentoring Program Standards* (Dagenais, 1996) to help design its New Teacher Mentor and Induction Program is Nevada's Washoe County School District. This program has achieved remarkable success in retaining teachers new to the district.

Scientific Inquiry, Simplified

Bob Brazzle

Illinois Mathematics and Science Academy

The motivation for this article (and for the classroom activity on which it is based) has come from my professional development work on scientific literacy issues. On many occasions, I've heard teachers make casual references to "the five step scientific method," usually in the sense that they teach this to their students. I remember hearing about this during my own secondary education, and then again when I entered the education profession about five years ago. In between, I was off being a scientist, and during that time never once heard about a five step scientific method. Nor did I ever hear any colleagues philosophize about how scientists conduct their work. My chosen scientific field was "Meteoritics" (the study of meteorites). This field is tremendously diverse, and therefore I was exposed to a wide range of scientific work. Now as an educator, I've had the opportunity to reflect on the work of scientists, and to engage in discussions about this with my colleagues. So with this backdrop, I present my thoughts on the matter.

First let me explicitly state one of the main points of this article. The overall work of science is extremely complex, and therefore any representation involving five (or any other number) cookbook-like steps is a gross oversimplification to the point of being simply inaccurate. In a recent editorial, Norman Lederman and Lawrence Flick (SSMA's *School Science and Mathematics* vol. 102, #2 Feb. 2002) talk about the negative impact this representation has had on science education.

I begin my course with a unit intended to engage students with some of the complexities associated with scientific inquiry. I call this unit "The Sun Angle Project", and I have conducted this project three times (twice with IMSA students, and once in my online Astrophysics course through the Illinois Virtual High School – IVHS). I give students the following instructions:

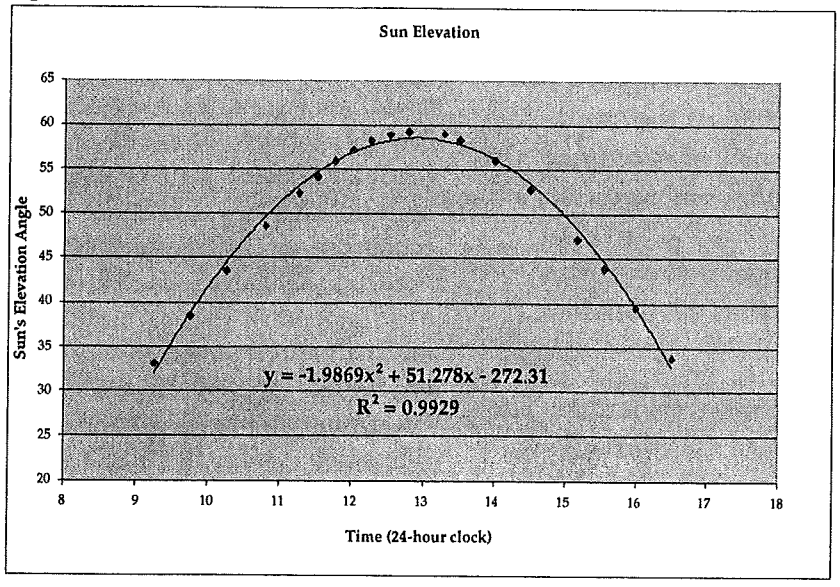
> I want your group to construct a device with which you can measure the Sun's elevation angle above the horizon. Then use that device to conduct at least eight measurements in a single day (but you're welcome to do more than eight). You then need to interpret your data – try to impress me with your conclusions. Your group then needs to write up your work; it must fit on a single sheet of paper. Finally, your group will present its work orally in class, in a short (~8 minute) presentation.

My instructions differ slightly for the online version of the unit. Also, I tell students that I will reimburse them up to $1 for any expenditures (with receipts). This gives them the idea that they should use simple materials. I have seen some pretty clever designs, and have not yet been asked to reimburse anyone. I conducted the experiment myself, using a 24-inch orange plastic level. I used the level to find a horizontal sidewalk block, stood the level on end, and measured the length of the resulting shadow. On 8/24/2000, I made 19 measurements of the Sun's elevation angle. Figure 1 shows my data. I wrote a short paper about my work, and I give this to students when they turn their papers in. I wrote a second paper about a follow-up experiment. Students are given 2_ weeks to complete the assignment, and then we spend another two weeks discussing my papers and their work. You can see all of my materials for this unit on my Web site at:

http://www.imsa.edu/~brazzle/IVHSastro/SunAngle/SunAngMain.html

Immediately after giving students their assignment, I present them with two representations of the "scientific method." One is a concept web I created, entitled "Scientific Inquiry, Simplified" (see above URL); the other is an example of a five-step scientific method, which I got from http://emporium.turnpike.net/C/cs/t_sci_me.htm The title of my concept web (and this article) is slightly tongue-in-cheek, as it appears much more complex than "the five-step scientific method," but I intended it to be a reasonably general model of how science advances in an overall sense. I ask the students to keep both of these representations in mind as they do their work, and evaluate the extent to which these accurately represent their work. In my limited experience looking at examples of the five-step method, I've seen that some are worse than others. The one I present to students is as follows:

Figure 1



1) State the question
2) Form a hypothesis
3) Do experiments
4) Interpret data and draw conclusions
5) Revise theory (back to step 2)

My goal is for students (and the teachers with whom I facilitate professional development) to come to see this as an inaccurate representation of the process of scientific inquiry. Here are some of the ideas students learn through this unit. The ideas I present below are very consistent with the view described in the seminal book *Science for All Americans* (AAAS, 1989). The reader is also referred to the book *How We Know: An Exploration of the Scientific Process* (Goldstein and Goldstein, 1978) for review.

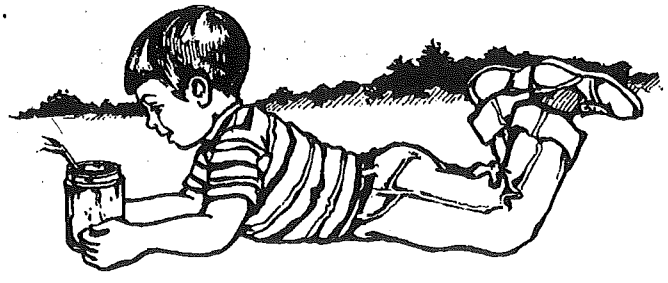
Do scientists always start with a question? Definitely not! In constructing my concept web, I tried to think of the ways that scientific inquiry can actually begin. I came up with four major ways: a question, an observation, an assumption (e.g. about how the world works), and a model. If you try to shoehorn students into always starting with a question, some of their questions can sound very contrived.

As used in this five-step method (and in some classrooms), a hypothesis seems to be an uninformed guess about the outcome of an experiment. I've even seen a worksheet that said "**My hypothesis.** I think _____". I tell my students that Mother Nature

doesn't care what you think – experiments will come out the way they come out. Our job as scientists is to metaphorically unlock the secrets of nature in an *unbiased* manner, i.e. conduct experiments and investigations without a preconceived notion of their outcome. Scientists generally don't seem to use the word "hypothesis" in a heading in a scientific article. I recently skimmed several dozen journal articles (from Science, Nature, and other journals), and didn't once see "hypothesis" used this way. Nor did I see the word used at all. Scientists possibly prefer the word "model" over "hypothesis" in this context. Some scientific work does involve directly testing specific models. Another type of scientific work involves distinguishing between two competing models. Yet another type involves observing or collecting with no reference to, or reliance on any models of how nature works.

Some teachers seem to enjoy setting up some demonstration, maybe talking about some concept as they go. Then, dramatically — just as they're about to combine the contents of the two test tubes — they stop and ask "okay, what is your prediction?" Unfortunately, this is not necessarily the correct scientific connotation of the word "prediction." Often, when a new scientific model is developed, scientists will explore its consequences (predictions) under various conditions, and then evaluate these against previously made observations. In other words, scientific predictions are often made in the past tense. Hypotheses, models and predictions are all intertwined, but if nothing else these are firmly *grounded* in quantitative observation. In no case can they spring simply from a question (nor from a single observation or assumption, for that matter). To be fair, this and other five-step representations at least allude to the iterative nature of science (step 5's "go back to step 2").

Which brings us to experimentation. Not all scientific work is experimental in nature. Some is "theoretical." Theory is a word which simply has a different meaning for scientists, compared to its standard usage in everyday language. You might hear a person say "well, that's just a theory," meaning one guess equal in value to any other guess. But scientific theory represents whole bodies of work that explain seemingly-disparate phenomena. Scientific theory is developed slowly, using the scaffold of self-consistency between quantitative observation and mathematical modeling. Within the realm of current experience, scientific theory generates precise predictions and consistent explanations. What's more, these predictions and explanations will *always* be viable within set parameters.



Our job as scientists is to metaphorically unlock the secrets of nature in an unbiased manner.

For example, for more than two centuries, Newtonian Mechanics could successfully describe the generalized motion of a particle, and predict changes in that motion. Twentieth-century physicists demonstrated that Newtonian theory doesn't apply in cases where the particle of interest is very small, or moving very rapidly, or moving in a very large gravity field. But quantum theory and relativity theory (which handle these extreme cases) are fully consistent with Newtonian theory when the particle's parameters of size and speed take on less extreme values. 5,000 years from now, physics students will still have to learn Newtonian Mechanics. Every scientific theory is robust. Four of the arguably most important society-changing inventions of our time (the car, the refrigerator, the elevator and the television), rely solely on so-called classical (or Newtonian) physics, i.e. they don't require relativity or quantum mechanics.

The above five-step method says nothing about assumptions. But every scientific investigation (and every model) relies on many assumptions. Assumptions are often used to simplify the situation so that analysis becomes more tenable. There's the joke about the physicist who declares a simple solution to a long-standing problem of inventing a mechanical chicken plucker. He says, "first assume the chicken is spherical...." For my analysis (figure 1), the quadratic fit function is such a simplifying assumption. It is also a mathematical model. It permitted me (very simply) to determine the time of "local noon," that is, when the Sun is due south. According to my data, that time was 12:54:14 CDT.

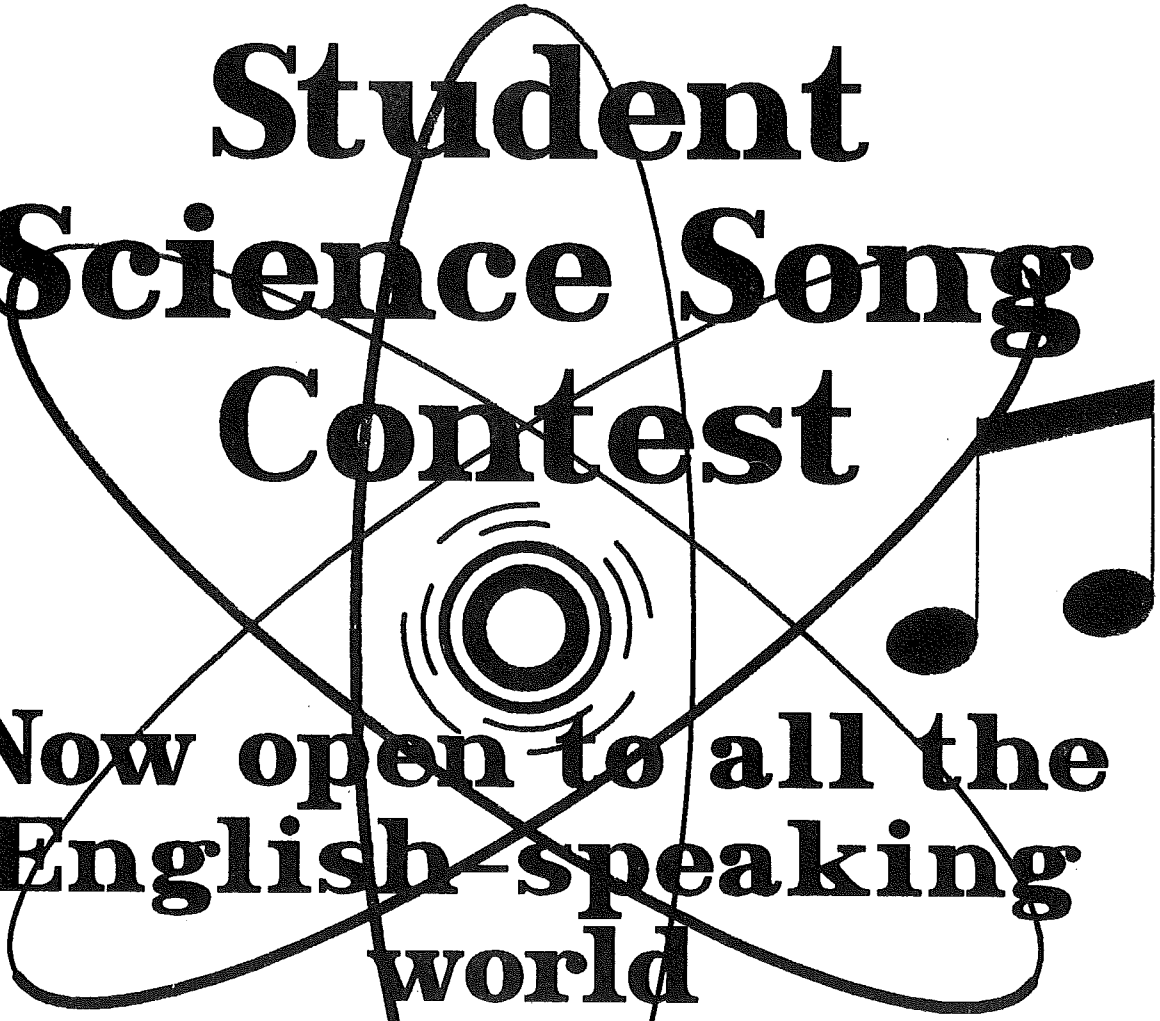
Although the time of local noon was gleaned through *analysis* of data, I still think of it as an *observation*. Some might call that an "indirect observation," but I think the distinction between direct and indirect observation is artificial. We now need to explain this observation. Had I asked students to predict the outcome before beginning, they would probably have guessed that local noon would be at 12:00. Their data is generally not very precise (and they invariably completely botch a few data points). So, if they come up with a time other than 12:00, they would probably chalk it up to bad data and be done with it. But we have to carefully explain the observation even if it makes intuitive sense to us. When a result is consistent with some model, scientists play Devil's advocate. They methodically eliminate other effects which might accidentally generate the same result. The above five-step method says nothing of that.

To explain this observation, we need to develop a model. The model I present in my first paper is that local noon is not 12:00 (or 1:00 CDT) because I was not on the "reference line" of my time zone, which is at 90 degrees west longitude. The model is physical in nature – I can say that since local noon *precedes* 1:00, my location must be *east* of the reference meridian. The model is also mathematical – I can use Earth's constant spin rate (which is another simplifying assumption, in fact this is not exactly true) to calculate my longitude. Thus, by assumption and observation, 12:54:14 becomes 88.56 degrees west longitude, according to the model (this is therefore a prediction of the model, and it is easily tested). Some of my students have the misconception that my model is nothing more than the level itself – they apparently think a model must be a tangible thing.

The above five-step method is also silent on the issue of measurement uncertainty. But this is a crucial part of experimentation. In my analysis, the overall measurement uncertainty is quite complex. In fact, neither I nor my colleagues could come up with a convincing method, and therefore I tried to approximate this using a brute force method (see my Web site). Based on the model, my observed longitude differed from my actual longitude by 12 minutes of arc. However, my approximate overall measurement uncertainty was only about 0.5 minutes of arc. This is a convincing demonstration that the model is inadequate.

In a forthcoming paper, I present a follow-up investigation in which I uncover additional factors that influence this result (Earth's obliquity and the eccentricity of its orbit). By taking these into account, I show how the revised model is consistent with observation, within the limits set by measurement uncertainty. I also present information on effects that influence the time of local noon to a much smaller degree (small amplitude rotational wobbling of our planet). One of the main points of this unit is that we can learn a great deal about the various motions of our planet through precise astronomical observations. Another goal is to have students understand how scientific models evolve in light of additional information. Though my first model was insufficient, it is nevertheless accurate "to first order." Rather than abandoning it, I simply added on the smaller effects from other sources. I will continue to revise this unit, and very much welcome comments from the science education community.

4th Annual Student Science Song Contest



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An Interview with Bill Rathje, Garbologist*

*Jim Albracht***

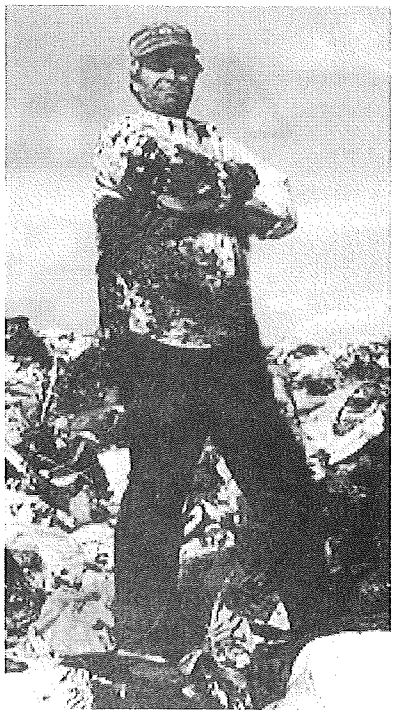
Jim: If said, "that's garbage" to my next guest this morning you'd actually be paying him a compliment. Bill Rathje is the archeologist who decided to dig into what you and I throw away and what he finds tells us not only a lot about ourselves but the future of our planet. He joins us with the most unique job in the world. Bill, you are a garbologist. Can you briefly describe how you got into this business because as all archeologist do, you were digging into the ruins, but why garbage?

Bill: Well Jim, I figured that if an archeologist could learn some important things about ancient societies by digging up and sorting through old garbage then maybe archeologists should be able to learn something important about us by looking through our garbage.

Jim: What we think landfills contain and what they really have inside them can be two different things. The misconception list is endless when it comes to what we throw away. What are some of the biggest misconceptions about what people set out on their curb and what happens to it afterwards?

Bill: I think the three biggest areas where we found misconceptions what we found and what people said they thought was filling up land fills in interviews were: 1) Styrofoam, which many people felt was 20 to 30% of what was filling up the land fill; 2) Fast food packaging, again they thought 20-30% was fast food packaging; and 3) Disposable diapers, which they thought comprised 35-45%. Now it doesn't take a mathematical wiz to figure out that we've dealt with almost 100% of what is in the landfill with just those three objects. So it has to be wrong and it is. When you dig up the garbage, separate it, and measure the volume you find that Styrofoam is less than 1%. The fast food packaging is only one half of 1% and disposable diapers, all together 1.2%. That does not mean that it is insignificant because it is 1.2% of 180 million tons, which is what we throw away every year into land fills. But there are a lot more important items in landfills than those.

Jim: Many people just assume that things are biodegradable. When we let it go out of our sight we just assume it's going to go away at some point. But from your studies you find that is not the case at all. You found grass clippings from 1970?

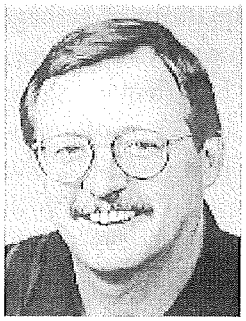


* Prof. William L. (Bill) Rathje is the Founder and Director of The Garbage Project, which conducts archaeological studies of modern refuse. Rathje received a B.A. from the University of Arizona, a Ph.D. from Harvard, and is currently Professor Emeritus at the University of Arizona and a Research Professor at Stanford. Since 1973 the Garbage Project has studied fresh refuse to document household-level food waste, diet and nutrition, recycling, and discard of hazardous wastes. Since 1987 the Project has excavated 21 landfills across North America to record the quantities of various types of buried refuse and what happens to these materials over time. Rathje has published widely in academic journals and in *National Geographic, The Atlantic Monthly*, and *Smithsonian*. Awards include the prestigious AAAS/ Westinghouse Award for Public Understanding of Science and Technology and in 1992 the APAA Solon T. Kimball Award for Public and Applied Anthropology. He has authored *Rubbish! the Archaeology of Garbage* (co-authored with Cullen Murphy) and *USE LESS STUFF: Environmental Solutions for Who We Really Are* (co-authored by Robert M. Lilienfeld). Dr. Rathje is host of the computer-interactive video "Our Garbage Dilemma," a permanent exhibit in the Smithsonian.

Bill: We found grass clippings from 1950's through the 1980's. In what we call a dry land fill, the garbage seems to get mummified. Now you lose about half of it to biodegradation, half of what we call raw organics, which is food waste and yard, waste. About one half of that will biodegrade, the other half won't and as near as we can tell practically nothing else in the land fill changes. So the end result is that you throw away a newspaper today and if an archeologist digs it up in 50 years or 100 years you will be able to open it up and read it.

Jim: What does that mean to the average person who sets out the garbage every Tuesday or Wednesday morning? They might be saying, "So What", but there is always a price to pay. Is it just real estate, is it space, is it health, what is it when these landfills get to enormous sizes and quantities?

Bill: I think first and foremost in a very pragmatic sense, it is space. There is only so much space out there for garbage. So we are using up a very finite resource. We are also using up finite resources in other ways when we use metals, paper. The places where where trees can be grown are finite as well and they are becoming smaller and smaller every year. I'm not saying that we are about to be buried in garbage but I am saying that people who look to the future responsibly in terms of what future generations are going to face should say, "Hey, maybe I should keep as much stuff out of land fills as I can" and that I should also say is very pragmatic in the sense in that right now today the land fills that in place were pretty reasonable in cost. When those landfills get filled and new ones are sited they are going to cost ten times to 50 times more money to build to keep the garbage in and to keep pollutants out of the environment. So by expanding the life of the land fills that we have, we are saving a lot of money.



**Jim Albracht of WOC-AM 1420 Talkradio from the Quad Cities, is a normal guy who hosts a talk show aimed at the thinking man or woman. Each morning he invites people to join in the conversation on a wide variety of topics. The talk comes without ideologies, labels, or phony airs. Jim's a father of three girls and a loving husband. He likes to use his life experiences to create a lively forum for conversation. When he can find the time, Jim is a weekly columnist for the Argus/Dispatch newspapers.

Jim: Bill, you talk about all the people starving, for example, in Afghanistan. When you go through landfills you basically can find out the truth about what people are saying and what they are doing. And is it a fair assessment that we are just wasting way too much food.

Bill: Oh yes. And we also study garbage "fresh" with protection of animosity for the households whose garbage we picked up and examined. What we found by looking at garbage fresh is that the average household (we've studied garbage in Arizona, California, Louisiana, Illinois, New York State) throws away 15-25% of the solid food that they buy. I'm not talking about peeled rinds, top skin, bones, I'm talking about a piece of steak, half a head of lettuce, a grapefruit, edible stuff. So it is huge. The quantity, in fact, it is enough to feed everyone in Canada, including the lumberjacks.

Jim: Wow.

Bill: So, it follows that the more conservative that we can be, in terms of food waste, the more food will be available at cheaper prices to go other places.

Jim: Now I want to talk about what you call precycling, specifically how corporate America is designing itself to be more environmentally friendly. Maybe we can break it down to something that people can relate to. This basically boils down to using products that use less packaging. Where do you start then? Easier said than done?

Bill: Sure, easier said than done. But it isn't going to change your lifestyle significantly and if you think ahead in terms of your buying habits, it isn't that difficult. Precycling means things like buying drinks in recycle aluminum cans, versus say, if it were more difficult here to recycle PET plastic you'd buy them in the cans versus the plastic. The plastic gets picked up; you buy it in the plastic. So in other words you buy things that are in easily recyclable containers. And

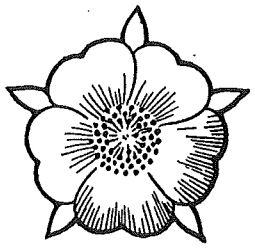
you also buy to just cut down on the general quantity of garbage you are going to have anyway. For example, if you want to buy grapefruit juice and you want to buy 32 oz. If you buy that in a glass bottle and take that home, you are bringing home 32 oz of grapefruit juice and about 26 oz of glass. If you buy that in plastic, you are bring 32 oz of juice and about 1.5 ounces of plastic. Which squashes in landfills. A lot of people are afraid of plastics because as they say, it does not biodegrade in landfills. But let me tell you glass doesn't either, in fact, it is the most nonbiogradable thing on the planet. And because plastic doesn't biodegrade it does not generate hazardous substances that will go into leak or anything else. So if you can buy juice and throw out 1 oz of garbage vs. 26 oz, then you are saving a lot of space in the landfill.

Jim: Bill, when it comes to changing we live in America and people vote with their money. I would like to have you tell folks what at least one major company in America is doing in terms of being environmentally friendly and still keeping business as usual as their attitude. That company would be the Ford Motor Company. I think when somebody this big starts the process, it is eye opening, and it means others will follow.

Bill: I agree with you and I think that the Ford Motor Company deserves a tremendous amount of credit for what they are doing in the solid waste area. What they basically decided to do is make virtually all the components of their cars recyclable. Now what happens to cars is that they go to a scrap yard and are crushed and the metals are sent overseas to be made into new steel. Today with all the plastic in cars, that plastic just gets thrown out. Ford is figuring out ways to recover the plastic and the metal for United States Foundries, which have changed their practice so that now the new furnaces in the U.S. require recycled or old steel in order to gear up for producing new steel. So both Ford and the steel industry have made recycling a key component of their existence and that is cool. That is as good as you can get. And they are hoping the consumers will respond by saying, that is really good, we will give you the benefit of the doubt. If I have a toss up between what to buy, I'll go with you because you recycle.

Jim: And this fits into something even as horrific as the World Trade Center building crumbling. That is what you are talking about. What do you do with all of that tons of steel and everything else?

Bill: It is important for people to realize that virtually all of the steel from the World Trade Center has gone to be recycled. And I thought it was very interesting, I read a news story that somebody has paneled a grand jury to find out if the Mafia is involved in stealing the steel. And that is crazy. No. In any kind of case where you've got the destruction of a large building, usually under much happier circumstances, we try and recycle and recover as much as we possibly can because right now construction and demolition debris alone is 30%



of what we put into our landfills. And that is with recycling all of the steel and all of the other items that we can. But it is important to realize that will be recycled.

Jim: Bill, in your studies you can estimate a household's net worth by examining the household hazardous waste and discards. We all have this in our garages and in our homes. Where do we go with this. Because this is the hardest part of recycling. It takes an effort.

Bill: It does take an effort in many communities today. There are some communities throughout the US where they will have hazardous waste collections every three months or every six months in a neighborhood. That is really very rare because it is very expensive. In most places when you buy new motor oil and new batteries, you need to ask that business what to do with the old stuff. And most businesses are now responding by saying, we'll collect the old stuff in one place, we'll get enough stuff together that it will be economically feasible and then either recycle or dispose of it properly. So if you ask when you are buying what you should do with the old stuff, you will get some alternatives that will work.

Jim: Before we run out of time Bill, I have to ask you. I know in your line of work there are some oddities. Can you tell us about your collection of pop-tops, by chance?

Bill: Well, Jim yes. I have been collecting pop tops and the reason is, believe it or not, all pop tops were different on different cans based on brand and even within the brand different types. They have different shapes, different color, different dents in them. I originally thought that was for brand name purposes, but it isn't. It is because it's the copyright mark of the canning machinery. So that it identifies literally the machine that made that can. So each large machine that makes literally hundred of thousands or millions of cans has a different pop-top to identify it. So we have that as an archeological collection and you show me a pop-top and I can tell you what kind of soft drink it came from.

Jim: Briefly, about the future in terms of how we handle our waste. Are we getting better? Do you see good signs?

Bill: I want to say, I'm here in Peoria to speak to the Illinois Science Teachers Association and that is what is going to make the difference. Talking to our kids now so that they become ingrained with the right attitudes, the right recycling and precycling behavior and it isn't something that they have to change, it is something they grow up with. That is why teachers are so important.

Jim: Bill, my thanks for your time, sir.

Mini Ideas

Revisiting the Moon: An Interdisciplinary Learning Activity

Gerald E. Adams, Ph.D.
Abour H. Cherif, Ph.D.
Wendy Barrow-Johnson, MS.

The Department of Science & Mathematics
Columbia College, Chicago

Introduction and Rationale

Revisiting the Moon is an interdisciplinary activity designed to learn how to study the geology of other planets, and at the same time, to better understand the scientific process of inquiry. It includes data gathering, problem-solving, and decision-making processes, and how scientists used geological facts and information to select moon landing sites where they conducted (via the astronauts who actually went there) research "on location." The activity is designed to use students' experiences to generate enthusiasm for and participation in the learning process. Although the activity is designed for use in classes such as planetary geology and space exploration, with simple modifications, the activity can be integrated into any geology or environmental science curriculum.

We originally thought of this idea when we realized (somewhat to our dismay) that many of our students were born after the Apollo landings took place (some of our readers may also belong in this category). Thus, what was for us one of the most dramatic of events in the scientific exploration of space, is for our students only a dull, ancient and mostly irrelevant event in a history book. Our primary motivation is to re-create the thinking processes that went into the design of the Apollo landings on the moon, and to revitalize these events in students' awareness. In doing so, we invite students to actually apply the scientific method to solve real scientific problems, simultaneously applying the principles they have learned as theoretical knowledge in class to practical situations. Thus, students learn about planetary processes, geological principles, the scientific method, and the relationships between science, technology and society, all within a single activity.

A Sense of History: The Mission and Goals of the Apollo Program

In 1961, the whole world woke up with news of one of the most dramatic scientific and technological accomplishments of the time, putting the first human in space by the (former) Soviet Union. In response, the U.S. space program developed a policy and designed a space program that would enable the United States to beat "The Russians." In an historic and memorable speech, President John F. Kennedy vowed that not only would the United States match the Soviet accomplishment, but by the end of the decade the United States would put a man on the moon.

The National Aeronautics and Space Administration (NASA) was charged with developing the technology and scientific basis for successfully landing people on the moon and then returning them safely to Earth. The Apollo program (as the moon landing program came to be known) was built and designed based on two previous programs involving manned space flights: the Mercury and Gemini programs

The Mercury program, NASA's first trial in manned space flight, involved placing a single person spacecraft into low Earth orbit. The primary goals of the program were to collect scientific information about the near Earth environment, biological information about the response of the human body to space flight, and technological information about the ability of the astronauts to pilot the spacecraft and perform other (mostly simple) tasks while in space. The original design of the spacecraft called for no control input from the human passenger (although instrumentation and control devices were available). Early on in the program, it was found that remote management of the flight systems was less than 100% reliable, and in several of the Mercury flights, the mission was only saved by the on-board astronaut taking decisive action, taking over for the automated systems. The importance of on-board pilot control was built in to each of the later programs of manned space flight.

In the Gemini program, the size and complexity of the spacecraft was increased, to accommodate a crew of two astronauts on more extended space missions. Particular program highlights included extra-vehicular (space walk) activities to investigate the ability of astronauts to work outside the spacecraft in the harsh environment of outer space, and docking activities to examine the ability of pilots of more than one vehicle to match orbits and link the vehicles together. Each of these abilities was crucial to the plan of Apollo, which was to place a two vehicle combination into orbit around the Moon, and send one vehicle to the Moon's surface, while leaving the second in orbit, to be used in the return trip to Earth.

The Apollo program was the culmination of the manned space flight program, and was designed to carry a three man crew to the Moon, land two of them safely on the Moon's surface where they would perform various scientific activities outside the spacecraft, and then return the crew and a small sampling of lunar materials back to Earth. The program was delayed for more than two years by a catastrophic fire on the launch pad # 34, that destroyed the Apollo 1 spacecraft, and took the lives of astronauts Virgil T. Grissom, Edward H. White II, and Roger B. Chaffee; three weeks before they were to have flown in space. Following an extensive redesign of the spacecraft systems, and flights of missions to test the systems in space and perform all the crucial stages, one at a time, of the culminating mission, the stage was set for the first Moon landing.

The Apollo mission which landed the first astronaut on the moon was Apollo 11, on July 16, 1969. The three astronauts who carried out the mission were Neil Armstrong, Buzz Aldrin, and Michael Collins, and took four days to reach the moon's surface. However, only Armstrong and Aldrin actually landed on the moon's surface:

> Neil Armstrong and Buzz Aldrin planted the American flag on the moon's surface, held a telephone conversation with President Richard Nixon, set up science experiments, and collected rocks and soil samples. They left behind a plaque that read:" Here men from the planet Earth first set foot on the Moon, July 1969 A.D. We came in peace for all mankind."
> (Engelbert and Dupuis, 1998, p. 520-521)

Following the success of Apollo 11, more missions were planned, to collect additional samples of lunar materials, test new technology and establish advanced procedures for living in space for extended periods of time. In what was in retrospect one of the most significant missions of the program, Apollo 13 was launched on April 13, 1970, from Cape Canaveral, Florida, commanded by Capt. James A. Lovell, with crew members Fred W. Haise, Jr., and John L. Swigert. Unfortunately, this mission didn't land on the moon because an explosion occurred in the service module. However:

> The story of Apollo 13 is worth remembering and retelling not only as an example of human heroism and ingenuity in pulling back from the brink of disaster, but also for its relevance to our predicament here on "Spaceship Earth." Our global life-support system that provides air, water, food, and power is being stressed by pollution, poor management, and population pressure. (Odum, 1989, p.1)

As a result of the accident in the Apollo 13 mission, Apollo craft was again redesigned and five more successful moon flights were conducted (Apollo 14, 15, 16, 17, and 18).

One of many important outcomes of the Apollo program is that:

> Pictures of the earth taken from the moon during these landings showed us how unique and beautiful our planet was and how fragile and alone it looked in space. These pictures played a major role in launching the first Earth Day in 1970 and attracting worldwide attention to the dangers of pollution and other threats to environmental quality. (Odum, 1989, p. 2)

Revisiting the Moon: The Teaching and Learning Module

This activity is divided into five stages, each with specific learning goals and objectives: Tapping into the Students' Curiosity, Interpreting the Geology of the Moon Using Geological Principles, Selecting the Best Locations for Moon Landing and Research Studies, On Our Way to the Moon, Analyzing Data and Information, and Students Assessment and Evaluation. Descriptions of the details of each stage immediately follow; samples of student responses, and additional thoughts can be found in the discussion that follows these descriptions.

Stage I: Tapping into the Students' Curiosity

In this stage, capitalize on students' past experiences to stimulate their thinking and activate their background of knowledge and information to help them become active learners in class.

1. The 1st day of class, students are divided into groups of four. Each group is given a set of photographs. The students are unaware (formally at least) that the photos they are examining are of various areas on the moon.
2. Each group is asked to examine the photos, interpret them, and write answers to each of the questions below.
   a. Describe as many kinds of landscape features as you can see in these photographs.
   b. What are some mechanisms that might have formed the features that you have identified?
   c. Is this a place where living things can be seen now, or might have been present in the past, and why?
   d. Are any of places in the photographs, or any of the specific features you identified, clearly older or clearly newer than any other places or features? Why do you think so?
3. Each group is asked to share their interpretation with the rest of the class. Then a general discussion takes place regarding students' interpretations of the photos and the reasons behind them.
4. The students' written presentations are collected and saved for further analysis and comparison.

Stage II: Interpreting the Geology of the Moon Using Geological Principles

This stage takes place after the students learn about the general principles of geology; specifically, after they learn the concepts and principles of relative and absolute dating, the principles, mechanisms and results of impact crater formation, and basic information about volcanic processes. The goal of this stage is for students to apply newly learned general principles to the interpretation of a specific case study, thus solidifying and demonstrating their mastery of the basic principles. An additional goal is to introduce students to the idea of revising one's interpretations, based on additional knowledge or information.

1. Each group is given the same set of photos again, and is informed this time that these photos are of the moon. Then they are asked to:

   a. re-examine and re-interpret the photos using what they have learned about geological processes;

   b. identify the geological events that took place on the moon on the basis of their new interpretation;

   c. interpret the relative ages of the various events using their understanding of the laws of relative dating;

   d. discuss and compare their new results to the previous photo interpretations;

e. choose 5 locations on the moon as landing sites. Each group will include a written rationale for each choice, explaining why each location is desirable, what kind of information they intend to gather, and why it is important.

2. Each group's written interpretations are again collected and saved for further analysis and comparison.

Stage III: Selecting the Best Locations For Moon Landings and Research Studies

In this stage, students will be involved in an academic debate to justify their chosen locations for moon landings and moon research studies. The students will also generate a justifiable comprehensive agreement on the selection of the final location for the moon landing. The primary goal of this stage is to have students justify their choices, based on answering some question that arose from their preliminary interpretations. Thus, for example, they might choose a landing site next to a crater, to see whether the surroundings have debris from what was once inside, so they can tell whether the crater is a sink hole, or a volcanic crater, or an impact crater. With appropriate direction from the instructor, students should also see the more general principle; that a hypothesis (like "the holes are sink holes") is always tested by acquiring more specific information, using the hypothesis to tell you what to look for.

Students should therefore be directed to justify their choice of landing sites by having questions that can only be answered by obtaining samples from the spot chosen.

1. The entire class will meet outside of their groups, and debate the various advantages and disadvantages of each landing site.

2. The students will then re-group, this time based on their selections of a location for the moon landing.

3. These new groups will then debate their choices until they agree on the best possible landing site, giving justifiable and comprehensive reasons for their choice. This will then be the one chosen site for their moon landing.

4. As a homework assignment, every student will get back his or her two written interpretations of the photos and then be asked to:

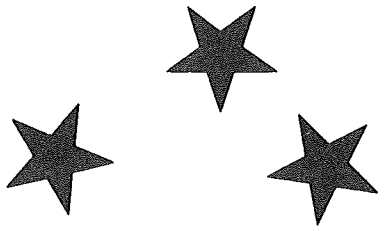
   a. read, compare, and analyze their interpretations.

   b. write a proposal for the moon landing. This proposal should include:

      i. What data and information must be collected?

      ii. How is this data and information to be collected?

      iii. What do we expect to learn from this collected data and information?



Stage IV: On Our Way to the Moon

During this stage, students will discover the components and dynamics of a functional ecosystem, then relate this knowledge to the basic needs for survival. The class is divided into four groups: the technology group, the ecosystem group, the humans' basic needs group, and the coordinating group.

There are two major goals of this stage. One of these is for students to see how knowledge from many disciplines must be integrated in order to accomplish some major goal (like putting a person on the Moon). The second, equally important, is for students to see how many different requirements must be met for human beings (or any other living things) to survive and function properly.

The Technology Group:

The technology group is responsible for determining the technology, tools and equipment that will be needed to:

1. design a rocket to send four people and the necessary equipment to the moon.
2. maintain four people alive on the moon, and
3. communicate with people on earth.

The Ecosystem Group:
The ecosystem group is responsible of determining and designing a functional ecosystem that enables four people to live and survive on the moon as normally as possible. This group consists of students who represent each of the disciplines: biology, physics, chemistry, geology and ecology.

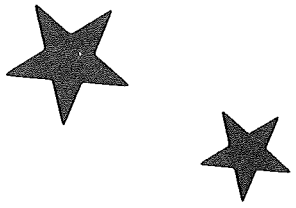
The Human Basic Needs Group:
The humans basic needs group is responsible of determining what the four people need to live on the moon and to overcome the natural tendency for physical and biological disorder (entropy), emotional breakdown, etc. They must determine the biological needs, social and cultural needs, and psychological and emotional needs of the crew.

The Coordinating Group:
The coordinating group is responsible for the coordination of all the processes and communications between the other three groups. This group is also responsible for gathering all the general data and information needed by the other three groups to do their jobs effectively. For example the members of this group will conduct a survey in class to gather information about the following questions (adapted from *Global Science Laboratory Manual*, by J. W. Christensen, 1991):

1. What are the basic needs of every human being in order to survive?
2. What are the ten most important items people will need to bring from the Earth to Moon?
3. We are restricted in size and weight of what we can take along, therefore, what are the five items from the previous list that we can afford to leave behind on Earth and why?
4. Who should be included in the list of the four people who will make the voyage to the Moon?

Alternative Approach for"On Our Way to the Moon"
The students can be divided instead into the following alternative groups (especially in the upper level science classes): Aerospace Engineer Group (AEG), Research Group/ Transhab Research Group (TRG), Biology and Meteorite Group (BMG), Virtual Environment Technology Lab Group (VET), The Psychology Group (TPG), and The Atmospheric Environmental Group (AEN).

AEG will develop research that makes the moon mission possible and affordable. TRG will research and examine the possibility of making portable habitats home for astronauts on the surface of moon. BMG will develop research studies to collect evidence, data, and information about the possibilities of existing life on the moon. VET will study virtual reality to help astronauts troubleshoot systems in space. TPG will help solve problems astronauts experience from weightlessness in space. AEN will develop research reducing the hazards of space travel.



Stage V: Analyzing Data and Information

In this stage, students have learned about the geology of the moon, including information about the actual Apollo landings, how the sites were chosen, and what the results were in terms of returned samples and other information. Students examine photomicrographs of lunar rocks representative of the location the students chose for sampling, and look at hand samples of Earth materials that are analogous to lunar rock materials. Students also determine absolute ages for lunar materials, either from actual isotopic analyses or from "made-up" but realistic analyses of rocks representative of the students' chosen location. Students also discuss analytically whether there are important locations that they (the students) missed in their sampling program (because they still have unanswered questions), and whether there are important locations missed by the actual Apollo landings, which would aid in the interpretation of the geological history of the moon.

Discussion of Examples of Student Responses

The following are examples of students' responses to the question (in stage 1 and stage 2) of the kinds of features they thought they saw in the photographs: Craters, Basins and ranges, Domes, Basalt plains and flood basalts, Ridges, Fissures, cracks, low spots, etc., Features of high places and low places, Layer of rocks, Hills, Sinuous cracks, River valleys, and Calderas.

Any reasonably clear photograph of the Moon has a couple of strengths that make such photographs particularly useful for interpretation. First, at any scale, there are lots of features in each picture, so students find them interesting. Second, because there is no weather on the Moon, every feature is clear and unobscured, so you can see *everything* that is there.

The second question "What are some mechanisms that might have formed the features that you have identified?" is a very important question. This is simply because, if the students can come up with *multiple, possible* ways of how these features might have formed, then, their answers give us more questions to ask. For example, which one of these possibilities is more likely to occur? Are there things in the photographs that we can see to verify which of our possible explanations for these features is the correct one? If our answer to these various questions is no, and we still need to explain the origin of a given feature, then how can we obtain more information to help us decide how it formed? One of the possibilities is *to go there* and take samples to find out which of these possible processes could have made any of these observed features. (This is how the landing sites and sampling protocols for obtaining lunar samples was actually established by NASA scientists in the mid-1960s. Once the U.S. decided to put a person on the Moon, for reasons of national prestige, NASA, the U.S. Geological Survey, and other organizations used the opportunity to acquire samples that would answer crucial questions about the Moon's geological history.)

The following are examples of students' answers about the processes that might produce the identified features. Students related some of observations and or events that they made and/or encountered in the past to explain how the feature might have happened:

Craters:

Impact is one of the possibilities that create craters. If for example, you drop a rock in mud, you will create a crater.

Explosion is another possibility that causes craters. Anyone who has the opportunity to see pictures of the battlefields from World War II, can easily see that many of them contain features similar to those in the photographs.

Sink Hole is dissolved out from underneath and the surface collapses into the hole.

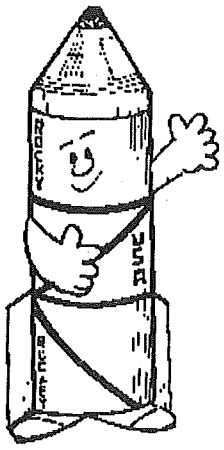
Volcanic Crater is formed by a volcanic explosion and can be found at the top (or the surroundings) of many kinds of volcanoes, in a variety of sizes and shapes.

Students' explanation of how any of these features might have happened help us create some models based on students' thinking, perspective, and imagination about the topography in the photographs. We look at the students' answer with a critical eye because we want to see whether or not they: (a) applied some kind of thinking processes, and (b) were able to recall previous knowledge, daily observations, and past experience.

After four weeks, we come back to these same photographs. During these four weeks. students studied tectonic process on earth, volcanic process on earth, winds, rivers, and other factors that affect the earth's landscape. We talked about crater processes and how they formed. When we go back to the photographs, we go back with all this newly learned knowledge and information and with pictures from Earth that have features similar to those the students saw in the previous photographs.

Then we ask the students the same questions, reinterpreted in the following light: now that we have learned a number of geological concepts, principles, and processes, can we use all these to make more sophisticated interpretations of what processes

might have formed the identified features? The students are given enough time and are allowed to interact with each other as a part of the learning process. If, for example, the students come to a decision based on their observation and re-interpretation that the craters in the photographs are volcanic craters, this is acceptable for the time being because among Earth observers, until the mid 1960s, the consensus opinion was that those craters were probably volcanic craters. This scientific judgment only changed when scientists began investigations into the mechanism of crater formation in preparation for going to the Moon, and making craters in the laboratory to find out whether they are more likely to be impact craters or volcanic craters. When the scientists did the experiments, they found out that the lunar craters are more likely to be impact craters. Thus, they made the decision to look for evidence for and against this hypothesis once the astronauts reached the Moon.



Student Assessment and Evaluation

Using McCormack and Yager's (1989) taxonomy for science education as a framework for students' achievement, some examples of assessment criteria follow (Note: Many assessment questions could fall into more than one domain, depending upon how the questions are formed):

Knowledge Domain

What concepts did students learn and how well did they understand them? How well did the students integrate knowledge from different subject areas? To what extent did students demonstrate the understanding of multiple relationships of various bodies of knowledge? What kind of explanations did students offer for the relationships and or phenomena they observed and understood?

Process Domain

How did members of a given group compile data and information? Was there cooperation in putting the information together? How efficient was each group in presenting and communicating the collected data and information? Were their delivery of statements and arguments smooth and coherent? How well did the students use knowledge meaningfully? Did all members participate in the activity?

Creative Domain

In what new ways did students use information and ideas generated during the activity to enlarge their understanding? How imaginative were students in identifying relevant problems, solutions, and conceptualizing new ideas?

Attitudinal Domain

How persuasive were group members in articulating their positions in order to justify their position and or to change the attitudes of the others? How effectively did each group function? Did members of a given party demonstrate skills and abilities to resolve conflicts with others constructively? How might each group have functioned more effectively?

Application and Connection Domain:

Did they come up with practical and workable solutions? To what extent did the students utilize their personal experiences and collective group understanding in making decisions related to the activity? How well did the students integrate knowledge from different disciplines in problem-solving strategies? How well did the students learn to negotiate constructive solutions to conflicts?

Acknowledgment: We would like to formally acknowledge the help of all friends and colleagues in a variety of ways. We would also like to thank all the teachers who volunteered to try this interdisciplinary activity with their students and those who attended our workshops in various conferences (such as1998 NABT, 1999 IASCD, 1998 ISTA, & 2000 NSTA) for their constructive suggestions and valid observation.

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Appendix 1

Revisiting the Moon Homework Assignment

Traveling In Space

You are in charge of identifying and solving the problems of astronauts who travel and spend more time in space than usual. From your perspective, identify some of these problems and propose how you will deal with and (hopefully) solve at least three of them. An example of one possible problem and a proposed solution are given for you in the table that you can use for your own answers.

Problem	Proposed Solution	Experiment	Applicability In Other Traveling Situations
Packaging & Preparing Food	Using dry food	Measure the volume and the weight of dry noodle soup. Then add hot water, and re-measure the volume and weight again to calculate the differences.	Traveling across the oceans and deserts.

*Note for teachers: some of the problems that your students will most likely identify as astronauts problems are the following:

a). Providing adequate supplies of energy, air, and nutrition.
b). Controlling temperature in both space suits and spacecraft.
c). Dealing with gravity and weightlessness in the space.
d). Providing adequate space in the spacecraft for healthy resting and sleeping.
e). Preparing and packaging food in a way that takes less space and weighs less (dehydration and freeze-dried techniques.)

Appendix 2

Science, Technology, and Society

Revisiting the Moon Research Assignment

1. Select one of the following Apollo missions: Apollo 7, Apollo 8, Apollo 11, Apollo 12, Apollo 13, Apollo 14, and Apollo 18.

2. Select three of the following types of contributions that you would like to learn more about in regards to the Apollo missions: Scientific significance, technological significance, social significance, cultural significance, economic significance, educational significance, global significance, and environmental significance.

3. Then conduct a library and/or Internet research on your topics.

4. Write a research report on your findings and include the reason behind your selection of the Apollo missions, and the three types of significance.

5. Use the following table to provide a narrative summary of your findings.

Narrative Summary of The Significances of Apollo ___ (19___)

Type of Significance	Examples of Significance or Contribution
Scientific Significance	
Technological Significance	
Social Significance	
Cultural Significance	
Economic Significance	
Educational Significance	
Global Significance	
Environmental Significance	

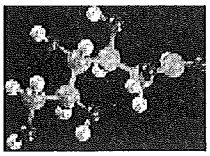
Opportunities

Rural Educators using Visualization to Inspire Teacher Advancement and Learning to Improve Science and Mathematics Education

REVITALISE is a two-year effort that begins with a two-day workshop in October, 2002 to be held on the campus of the University of Illinois at Urbana-Champaign.

Teams of teachers from rural schools in Illinois and the surrounding region are encouraged to apply to participate in this program. Applications guidelines and forms are available at www.eot.org/revitalise

Team members may be from the same school or from neighboring schools. Each team should include at least one mathematics teacher, one science teacher and one administrator, placing emphasis on including both novice and veteran teachers. An administrator may be a school district superintendent, principal, assistant principal, curriculum leader, or technology/media center staff.



Teams selected through the application process will be provided with travel costs, lodging, meals, a stipend, and substitute support in the classroom. Additional resources will be provided to support classroom activities. Funding for this program is provided through a grant from the National Science Foundation.

The goal of REVITALISE is to help address the critical shortage of mathematics and science teachers in rural schools. The Program will provide professional development workshops for middle and high school mathematics and science teachers. Teachers will have extensive hands-on opportunities to learn how to develop basic and advanced visualization modules to instruct students on fundamental principles using standards-based approaches.

For additional information on REVITALISE, see the web site at www.eot.org/revitalise or feel free to contact Scott Lathrop – scott@ncsa.uiuc.edu

Girls Summer Web Camp: Creating an Internet Business

Loyola's Center for Information Management and Technology at Loyola University Chicago would like to invite young women, ages 14-17, in the Chicagoland area interested in technology and business to register for the **Girls Summer Web Camp: Creating an Internet Business** at Loyola University Chicago, Water Tower Campus.

July 29 - August 2
Monday through Friday
9:00 a.m.-4:30 p.m.

Attendees of the camp will gain hands-on experience in developing a Web-based business.The girls will work in teams and learn about hot, new Web technologies. The attendees will take a field trip to a high-tech company and will be matched with women mentors who are technology students and professionals.

Registration is limited. The registration fee is $125. Scholarships are available. For more information:
<http://www.cimt.luc.edu/womenandtechnology/web_camps.html>

Or phone Laurel Tinker at 312-915-6223.

Galapagos!

December 21, 2002-January 3, 2003

Would you like to explore on of the most biologically and geologically diverse places on our planet and retrace the sights, insights and investigations of Darwin? If so, an opportunity awaits you this December in a special holiday expedition to Ecuador and the Galapagos Islands. Come and let your winter holiday be filled with the sea, sun, and all the wonders that a pristine environment holds. Credit will be available for those who request it.

The trip will be in two parts with the first from 21-24 Dec to explore Quito and the cultural and mountainous areas around the city. On the 25th the journey of a lifetime will occur as we explore several of the islands of the Galapagos. If you would like the full itinerary or have additional questions please email Bob Williams at rivers@siue.edu or Marylin Lisowski at mlisowski@eiu.edu or call Sandy Doss of Holbrook Travel at 1-800-396-0763.

Prairie Flowers

Rebecca Hall
Vital Connection/Prairie Flowers Program Manager
hall@life.uiuc.edu

"Science education blooming on the prairie" is the focus of the Prairie Flowers program. Designed for upper elementary and middle school teachers in central and south central Illinois, the program promotes quality science instruction through the interaction of teachers and their students, school districts, and university faculty. The Prairie Flowers program is funded by a grant fro the Howard Hughes Medical Institute to the University of Illinois at Urbana-Champaign (UIUC), School of Integrative Biology and School of Molecular and Cellular Biology.

The Prairie Flowers program provides training and support for teachers interested in implementing investigative learning activities in their classrooms. Training is provided at summer workshops and biannual meetings. Prairie Flowers teachers are encouraged to use 'hands-on, minds-on' science kits that have been planned, constructed, and field-tested by the teacher-participants in the program. These kits are loaned and delivered to participating teachers at no charge. The kits have been developed around thirty topic areas that are typically taught in grades four through eight. For more information, please see our website

www.life.uiuc.edu/hughes/prairieflowers

This summer the training for new participants (Newbies) will be held July 15 – 26 on the UIUC campus. Primary goal of this workshop is to develop Instructional Plans for using two Prairie Flowers science kits personalized for use in the participant's classroom.

Supporting goals are to use the kits with ease and incorporate technology in the classroom. Specific technology lessons will be search engines, Excel, and word processing. Class will meet from 8:30 to 3:00 daily. Newbies have options for either a stipend and they pay tuition for University of Illinois credit or a stipend and CEUs. Housing and meals will be provided at Hendrick House.

For more information or registration forms, please call the Prairie Flowers office (217/244-1984). Or send an e-mail to ISTA Board member Rebecca Hall at the above address or

Shirley Splittstoesser
splitts@life.uiuc.edu

Annette Lynch
alynch@life.uiuc.edu

Awards

The ComEd100 Award

Beginning today, Northern Illinois students can apply for a ComEd 100 award, which includes the choice of three prizes: a desktop computer and printer; a tuition scholarship in the amount of $1,000 for the winner's preferred school; or a Palm Pilot package consisting of the Pam Pilot, case, keyboard and software. Now in its second year, the ComEd 100 program recognizes 100 young people who have demonstrated extraordinary leadership in improving their communities through the use of science and technology. Any student in grades K-16 attending a public or private school or university throughout ComEd's service territory may apply for a ComEd 100 award.

ComEd has partnered this year with the Illinois Science Teachers Association. As a ComEd 100 partner, the ISTA will promote the program via various channels, handle the administration of awards and be a key player in the ComEd 100 selection process.

Applications are available at www.ista.org

The deadline for applying is September 6, 2002. ComEd 100 award winners will be honored at a luncheon on Saturday, 27, 2002, and will be at Pheasant Run in St. Charles, Ill.

###

Commonwealth Edison is a unit of Chicago-based Exelon Corporation (NYSE: EXC), one the nation's largest electric utilities with more than $15 billion in revenues and a customer base of five million. ComEd provides service to more than 3.4 million customers across Northern Illinois, or 70 percent of the state's population.

CHECK the WEBSITE for the latest information on Awards http://www.ista-il.org

ExxonMobil

ISTA/ExxonMobil Exemplary High School Science Teacher Award

Deadline: September 16, 2002

ExxonMobil and ISTA are honoring a high school science teacher with a $5000 cash award, a crystal trophy, one-year free ISTA membership, free fall conference fees, and a luncheon reception at the fall ISTA convention. To win this award the teacher must demonstrate exemplary science teaching practices in the following areas:

- Alignment of instruction with Illinois Learning Standards.
- Original design and use of hands-on material in the science classroom.
- Imaginative design and implementation of science curriculum.
- Promotion of innovative practices that result in high expectations, improved achievement, and enhanced learning environment for all students.

Download the 2002 application packet today from the ISTA website!

Congratulations to the 2001-2002 NABT Outstanding Biology Teacher

Christopher Hilbert

Glenbrook South High School

Congratulations go out to

Bob Grimm

of Fremd High School on being named the 2002 Illinois Teacher of the Year!

Do you have a successful unit for LinkingScience with Math, the Fine Arts, Language Arts, History, or other disciplines?

Please share your great idea with your colleagues by submitting it to the Spectrum!

Deadline: January 1, 2003

Are you a Shutterbug?

Why not share your photos with us for publication in the Spectrum? Whether they are photos taken at a recent workshop, in your classroom, or an outdoors scene, as long as they are high contast color or black and white, send them in!

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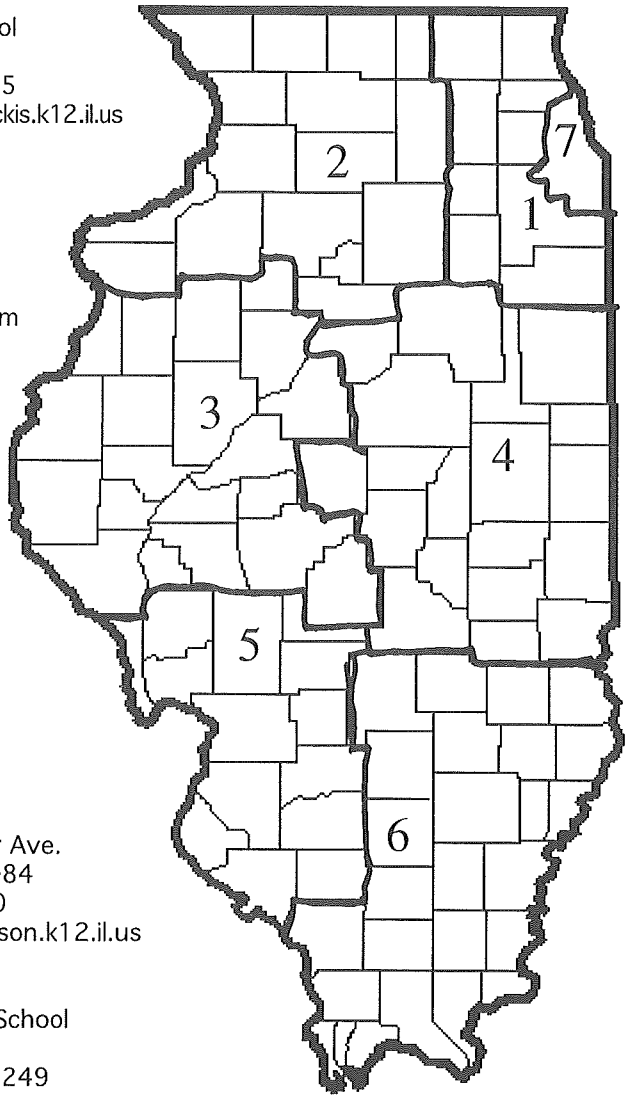

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