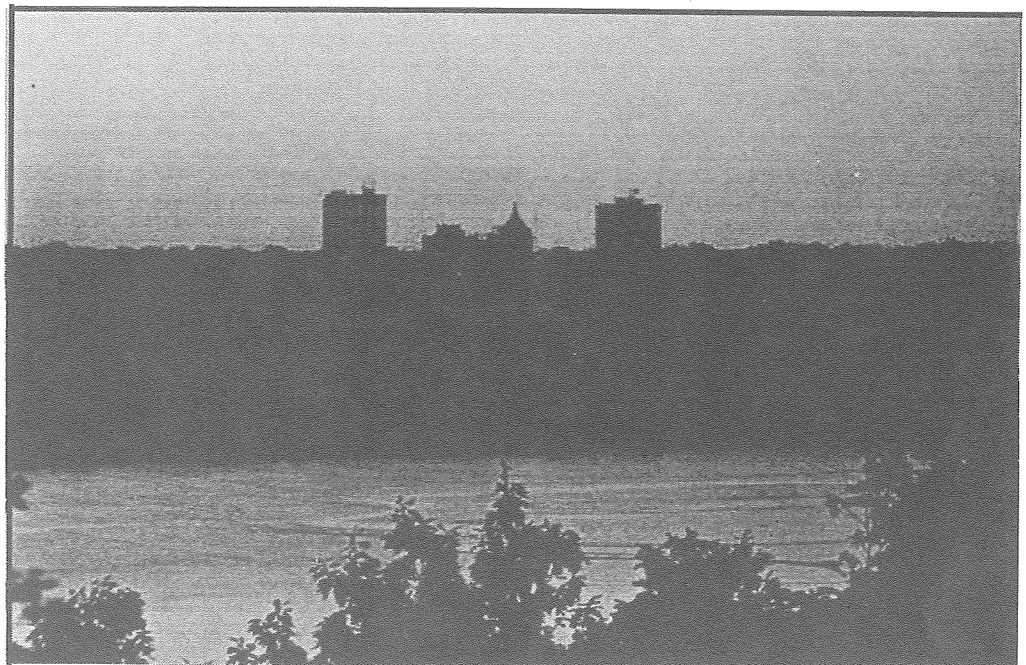
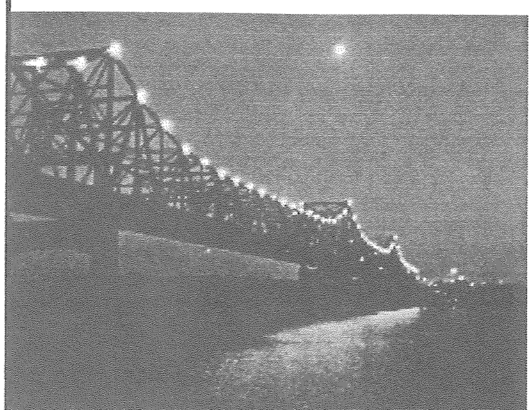
# SPECTRUM

# Fall 2001





- Best Practice in Science
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# SPECTRUM

JOURNAL OF THE
ILLINOIS SCIENCE TEACHERS ASSOCIATION
**Volume 27, Number 2**

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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 27, Number 2

Fall 2001

## Articles



## Departments



**Barbara J. Short, Guest Editor**

# President's Message


## *Edee Norman Wiziecki*

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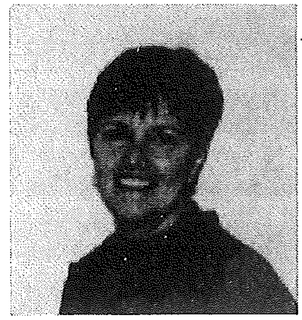

It seems that a day does not go by that the media announces a new finding in science—from genetically engineered foods to promising vaccines for dreaded diseases—new discoveries affect the world in which we live now as well as in the future. Advances in science and technology have made what previously seemed to be impossible, a reality. And more advances are teetering on the brink of discovery. *What an exciting time to be in science education!*

During the past few decades, there has been a technological revolution in how we access, store, and share information. As a result of faster computers and the development of new materials for storing data, we are deeply entrenched in the "information age." The computer has become a tremendous tool for both the scientist and the student. And this has a direct impact on our classrooms.

The Information Age began nearly 50 years ago when a "chip" of semiconducting material holding one transistor was created. Today more than a million transistors fit on one chip, and circuits are 10,000 times faster. Faster supercomputers enable scientists to complete calculations in hours that once took days, months, or even years to complete. Current research on new materials for storing data focuses on an understanding of individual atoms and electrons. These new materials, or *nanomaterials*, are a billionth of a meter in size—millions of times smaller than the period at the end of this sentence.

More recently, there has been a technical revolution in molecular biology, which has made it possible to provide enormous amounts of information about the sequence of amino acids in proteins and nucleic acids in bases for many organisms, including the human. To construct meaning from the vast amount of data collected from experiments in the laboratory and observations in the field, a new science, *bioinformatics*, was born to provide a way to analyze the many sequences and to search for patterns and similarities among them.

In the future, the "computational grid," an infrastructure that connects multiple computers to create a global source of computing power, faster and more powerful than we can imagine, will further change the way we think about, and the way we use computers. The power of the supercomputer will be available at your desktop or laptop computer.

*Our role is to help all students achieve science literacy.*

So, what does this have to do with science teaching? It adds up to this: New Science + New Tools = New Thinking. The need to move large amounts of data seamlessly from computer to computer, and the need to visualize and present the information has changed the sciences and the computational resources that are and will be developed. For scientists, modeling, visualization, and informatics have become essential tools of inquiry and new ways of doing science. The availability of these technologies offers us new ways of thinking about the how we teach science in our classroom. The tools that scientists use to conduct their research are available to our children to conduct their own investigations.

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variables, formulating and testing hypotheses, gathering, recording and interpreting data, graphing, defining operationally, experimenting, and constructing models.

Students must be able to identify what variables impact the results of their investigations. In discussions of the investigations, students need to identify the variables or what might change the results of the investigation. After identifying the variables, students need to discuss why the variables need to be controlled, how they could be controlled and define variables operationally. Defining a variable operationally means that you specify the procedure for how to measure the variable. The operational definition tells what is observed and how it is measured. The variables need to be identified and controlled so that what is causing what you are observing can be identified.

Students need to learn to formulate and test hypotheses. A hypothesis is an educated guess about what is happening in the investigation. The hypothesis states the problem in a way that can be tested. Testing the hypothesis requires brainstorming possible solutions for the problem stated in the hypothesis, selecting the most probable solution, designing investigations and/or creating models to test the possible solutions.

In the testing of possible solutions / models, students need to make systematic observations, collect and record data. In designing investigations, identify what variables might affect the investigation. Once these have been identified, determine what kind of an assessment is needed. Some uses for assessment include planning lessons and guiding student learning. Assessments are used to determine grades and access to special programs. They are also used to inform policy, allocate resources, and evaluate the quality of curriculum and/or instruction (NRC, 2000). Two different types of assessments are formative and summative. A formative assessment can occur anytime and summative occurs at the end of the learning activity.

What should be assessed? The NSES suggest that knowledge and understanding should both be assessed. Knowledge is defined as facts, concepts, principles, laws, theories, and models. Understanding is something that requires the individual to integrate many types of knowledge. It requires ability to use the knowledge and distinguish between what is and what is not a scientific idea. (NRC, 1996, p.23) The American Association for the Advancement of Science (AAAS) recommends that assessment needs to show reflective thinking and integration of information. (AAAS, 1998) The National Research Council (NRC) suggests that teachers also benefit from assessing their student's initial ideas about what it means to conduct an investigation and think scientifically and how these ideas and their skills change over time (NRC, 2000).

How do you assess abilities of inquiry? The National Research Council (NRC. 1997) suggests some ideas for assessing some of the abilities of inquiry. Abilities of inquiry in K-4 can be assessed by observation and listening. In grades 5-8 abilities can be assessed by observation, listening, examining the 4 phases of inquiry: precursor, planning, implementation, and closure/ extension defined by Champagne, Kouba, Hurley (in press 2000, found in NRC, 1996).

Who should be assessing student progress? According to the NRC, teachers and students should be conducting the assessments. Students should conduct some self-assessments to identify their own strengths and weaknesses. In choosing the type of assessment, a teacher needs to consider the natures of the standard to be met. One must consider the proficiency in the language of the assessment and distinguish between the knowledge of subject area and the English language.

In choosing an assessment, consider the need to use a variety of formats such as examinations, performance, portfolios, etc. Finally, take into consideration the need to assess conceptual understanding, scientific thinking, design and acquisition of knowledge; analysis and
7 evidence; and life, earth, and physical sciences. (NRC, 2000).

In conclusion, science education should be inquiry-based where students are learning the processes of skills of science. Students should understand the basic knowledge and concepts of physical, life, earth and space sciences. Students should have a basic knowledge and understanding of the following other content areas: unifying concepts and processes; science as inquiry; science and technology; personal and social perspectives of science; and the history and nature of science. Due to the nature and goals of inquiry -based instruction, assessment for needs to be different from traditional assessments. Teachers of science need to develop inquiry-based programs where they facilitate learning and ongoing assessments. Teachers need to design and manage learning environments, which facilitate inquiry and develop a community for learning science.

**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 for submission January 1.**

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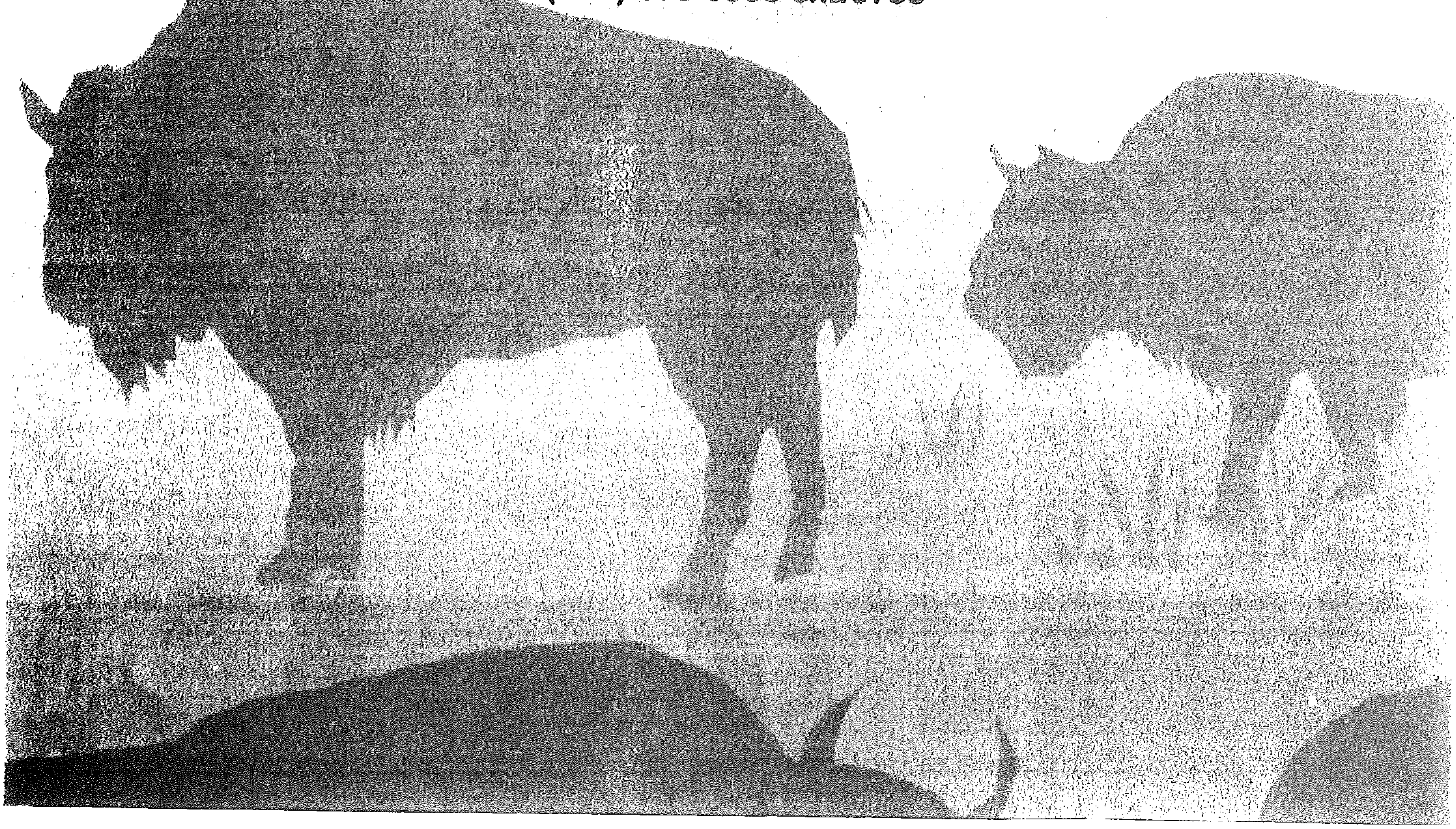

*To truly understand life in the information age, we must all become learners.*

*Teachers at every level play an important role in the overall science education of our children.*

While the "doing" of science is as important as ever before, new tools can provide another dimension to learning science concepts and promoting inquiry.

To truly understand life in the information age, we must all become learners—of new content, new technologies, and new ways to teach science. Teachers at every level play an important role in the overall science education of our children. Our goal should be for us to understand what the future holds for our children, so that we can prepare them to live in this rapidly changing world.

The ISTA is poised to help teachers learn new content and teaching strategies in a variety of ways by providing: professional development opportunities; resources such as those listed on our website; a professional journal with many "tried and true" ideas and activities; and an outstanding annual convention program. We are collaborating with other agencies to develop a network to support Key Leaders throughout our state, who will in turn, provide support to other teachers in their area. This summer, ISTA will hold a "scientific symposium" where scientists and educators come together to learn from each other. *I encourage you to take advantage of these tremendous opportunities.*

Over 10 years ago, Project 2061, "Science for All Americans" stated the there is no higher purpose in education than preparing people to be able to think for themselves and lead responsible lives. The purpose has not changed, but it will require many of us to learn new things to reach that goal. Our role is to help all students achieve science literacy so that they will be able to deal with and make decisions about future issues that have not yet been identified. Become an active part of the ISTA learning community by joining a committee, serving on the Board of Directors, attending ISTA functions, and/or networking with others. There is no greater profession than teaching—and no greater a professional association than the ISTA.

Edee

## 2002 Deadlines for Publication in Spectrum

| | Winter | Spring/Summer | Fall |
|---|---|---|---|
| **Deadline for authors** | 1/1 | 3/15 | 7/16 |
| **Issue target date** | 2/1 | 5/1 | 9/1 |
| **Theme** | Integration | Inquiry | Technology |

**See guidelines for submission on page 47**

# Best Practice in Science


## *Barbara Sandall*

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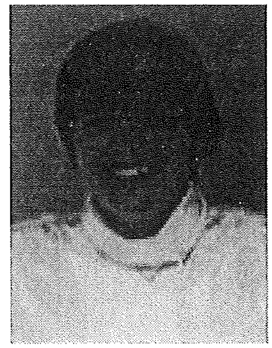


What is best practice in science? The National Science Education Standards(NSES) (NRC 2000) suggest the goals for science education are to develop students who know about and understand the natural world. They can use scientific processes and principles to make decisions and are able to engage in discourse and debate of issues related to science and technology. Finally, we need to develop students that can apply the knowledge and skills of science to increase economic productivity (NRC, 1996).

The Illinois Learning Standards (ILS) (ISBE, 1997) Goal 11 suggests that students should be able to understand the processes of scientific inquiry and technological design to investigate questions, conduct experiments, and solve problems. Standard 11A states students should know and apply the concepts, principles, and processes of scientific inquiry. Standard 11B suggests that students should be able to know and apply the concepts, principles, and processes of technological design.

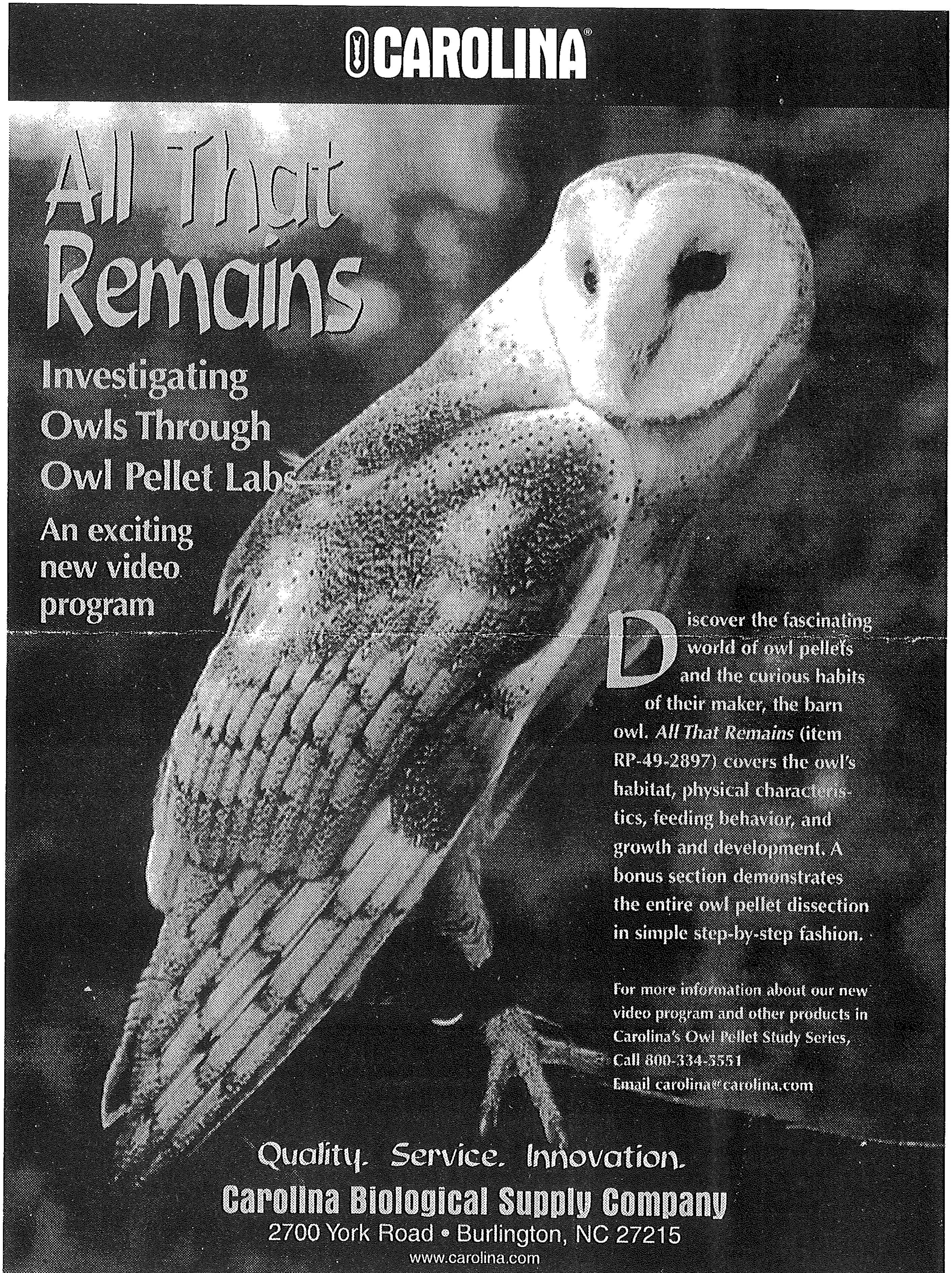
The NSES and ILS are based on the beliefs that learning science is an active process that develops an understanding of what science is, what science can so and how science and technology contribute to society.

How can these skills be developed in the classroom? Students need to begin to think and work like a scientist. This means that they must learn the processes of science and scientific inquiry. Scientists identify a problem, brainstorm possible solutions of the problem, design investigations and/or create models to test the possible solutions, test their solutions / models, make observations, collect and record data, analyze data and draw conclusions and inferences from the data.

The first step in learning to think like a scientist is to develop skill in using the processes of science. Basic process skills include observing, classifying, communicating, measuring, predicting and inferring. Observation is gathering information through the senses. Teaching observation in the classroom can be done in a variety of ways it might include using a discrepant event that challenges the students assumptions. Students could select a familiar object, examine the object with a hand lens and write a detailed description of the object. Students could also keep a journal of observations on the weather, classroom animals or plants. Students learn to make systematic observations of their natural world through these activities. In analyzing the data informally collected in these observations the students can learn the skills of communicating, measuring, inferring and predicting. Sorting buttons or other common objects is an easy way of teaching classifying.

*Science education should be inquiry-based where students are learning the processes skills of science.*

As students develop the basic process skills, they can begin learning to integrate process skills — identifying and controlling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# Mentoring: Beneficial for Both the Novice and Veteran Teacher

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Illinois State Board of Education
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Mentoring is an educational process that is destined to become increasingly important to both novice and veteran teachers in the near future. Often embedded in a new teacher induction program, mentoring plays a strategic role in the progression of novice teachers to the next certification level. Odell and Huling (2000) state that:

> as research and induction programs have matured over the years, it has become increasingly apparent that mentoring can be viewed as a professional practice that occurs in the context of teaching whenever an experienced teacher supports, challenges, and guides novice teachers in their teaching practice. (p. xii)

The Illinois State Board of Education (ISBE) now issues a 4-year nonrenewable "Initial Certificate" to all novice teachers. The renewable "Standard Certificate" is obtained by successfully completing the four-year probationary period. Evidence of successful teaching and professional growth are two key areas on which these novice teachers will be judged. To verify these two criteria, the ISBE is considering several types of assessment. As a result of this new certification structure, some districts have already instituted induction programs that include mentoring to help novice teachers progress from the initial to the standard certification. Designed as a tool to help novice teachers further hone skills and develop knowledge the induction programs will stimulate successful teaching and learning.

This article presents a discussion of mentors and mentoring, its history, some examples of important mentor relationships, and a description of the characteristics of a good mentor. Both novice and veteran teachers will be increasingly involved in the mentoring process in the years to come. Whether in science, math, elementary education, or any other discipline, it will be imperative that we all understand the importance of the mentoring.

Mentoring is an educational process that is destined to become increasingly important...

Mentoring can be viewed as a professional practice that occurs in the context of teaching whenever an experienced teacher supports, challenges, and guides novice teachers in their teaching practice...

**Examples of Mentorships**

- Vice President Hubert Humphrey mentored Walter Mondale
- Star Wars Ben Kenobi mentored Luke Skywalker
- Psychoanalyst Sigmund Freud mentored Carl Jung
- Socrates mentored Plato
- Jewel Corporation Executive Frank J. Lunding mentors new executives
- Westinghouse Science Talent Search R. F. Subotnik mentors gifted young scientists

## Brief History of Mentoring

The term comes from Greek mythology when Odysseus entrusted his son Telemachus to the care of his wise advisor, Mentor. Mentor assumed the role of guiding Telemachus into young adulthood in his father's absence. Athena, the goddess of wisdom, also assumed the form of Mentor when she appeared to Telemachus urging him to initiate a mission to find his father and to gain a fuller understanding of himself.

## The Process of Mentoring

**Mentoring is....**

. Patience
. Skills
. Nurturing ability
. Interpersonal relationships
. Define the roles
. Meeting weekly
. Observations
. Touching base
. Current events
. Mutual interests
. Planning for the future
. Sharing stories
. Reflecting on life
. Developing a philosophy of life
. Being there
. Encouraging them
. Empowerment
. Voluntary vs.mandatory
. Formal vs. informal
. Time commitment
. Motivation with objectives

**The Responsibilities of a Mentor**

Mentoring is more than orientation to a new location, rules and procedures, and responsibilities of a new job. The following list describes the key responsibilities of a mentor.

. Get involved in solving specific problems about curriculum, instruction, and relationships.
. Provide opportunities for classroom visits with feedback (beginning teachers classroom, mentor's classroom, colleague's classroom). Encourage visits to other classrooms by offering to cover the beginning teacher's classroom.
. Express positive feelings about teaching and help the beginning teacher attain those same feelings.
. Listen to daily concerns, progress, and questions.
. Demonstrate professional competence.
. Help expand the beginning teacher's repertoire of teaching strategies.
. Provide a task-oriented focus established through a two-way interchange about goals and procedures.

**The Evidence**

Several research studies show that novice teachers with induction and mentoring support move more quickly from concerns about management and control to concerns about instruction. A recent study completed by the University of Illinois at Urbana-Champaign found that classroom management concerns among inducted teachers decreased dramatically between the first and third years. Increasing in interest over the same period was information on student motivation,

### Characteristics of a Good Mentor

**A good mentor...**

. Boosts self-esteem of the protégé, gives validity
. Gives upward mobility, helps to make choices
. Lets the protégé share dreams, is a visionary
. Gives advice, counsel, support, companionship
. Teaches by example
. Gives the ropes, draws a roadmap
. Has good listening, sharing and negotiating skills
. Is a risk taker
. Knows the political games and organization
. Is good at what he/she does
. Is a professional, a teacher and motivated
. Likes children and knows their social and emotional needs
. Is articulate and expresses ideas well
. Knows when to let go
. Doesn't exploit the relationship

teaching strategies, assessments of student learning, and content knowledge.

Further evidence comes from Connecticut where research revealed that firstyear teachers in that state's induction program evidenced more significant progress in planning skills, handling class discussion, preparing teacher plans, managing discipline problems, and their ability to teach than novice teachers not formally inducted. Linda Darling-Hammond indicates that new teachers, guided by professional standards and under the leadership of trained mentors, develop competence more quickly than those who must learn by trial and error. Induction improves the instructional effectiveness of new teachers.

The benefits of induction and mentoring for the novice teacher are well documented. What are the benefits for the veteran teacher who serves as a mentor? The following are possible benefits to experienced teachers:

- An effective re-examination of teaching and the role of supporting new teachers.
- Increased professional growth through collaboration.
- More proactive in their schools and assume leadership roles.
- Awareness of updated teaching strategies based on insights gained from working with new teachers.

## Conclusion

The mentoring process in induction programs can be beneficial to both the novice and the experienced teacher and ultimately, the students. If your school begins an induction program, encourage mentoring as a part of the process. Participation as a mentor is also encouraged. The field of science is in need of outstanding teachers who remain committed to teaching. As a skilled veteran instructor in this field, you can be a valuable resource to your fellow teachers, your school and, most importantly, to your students.

## Resources


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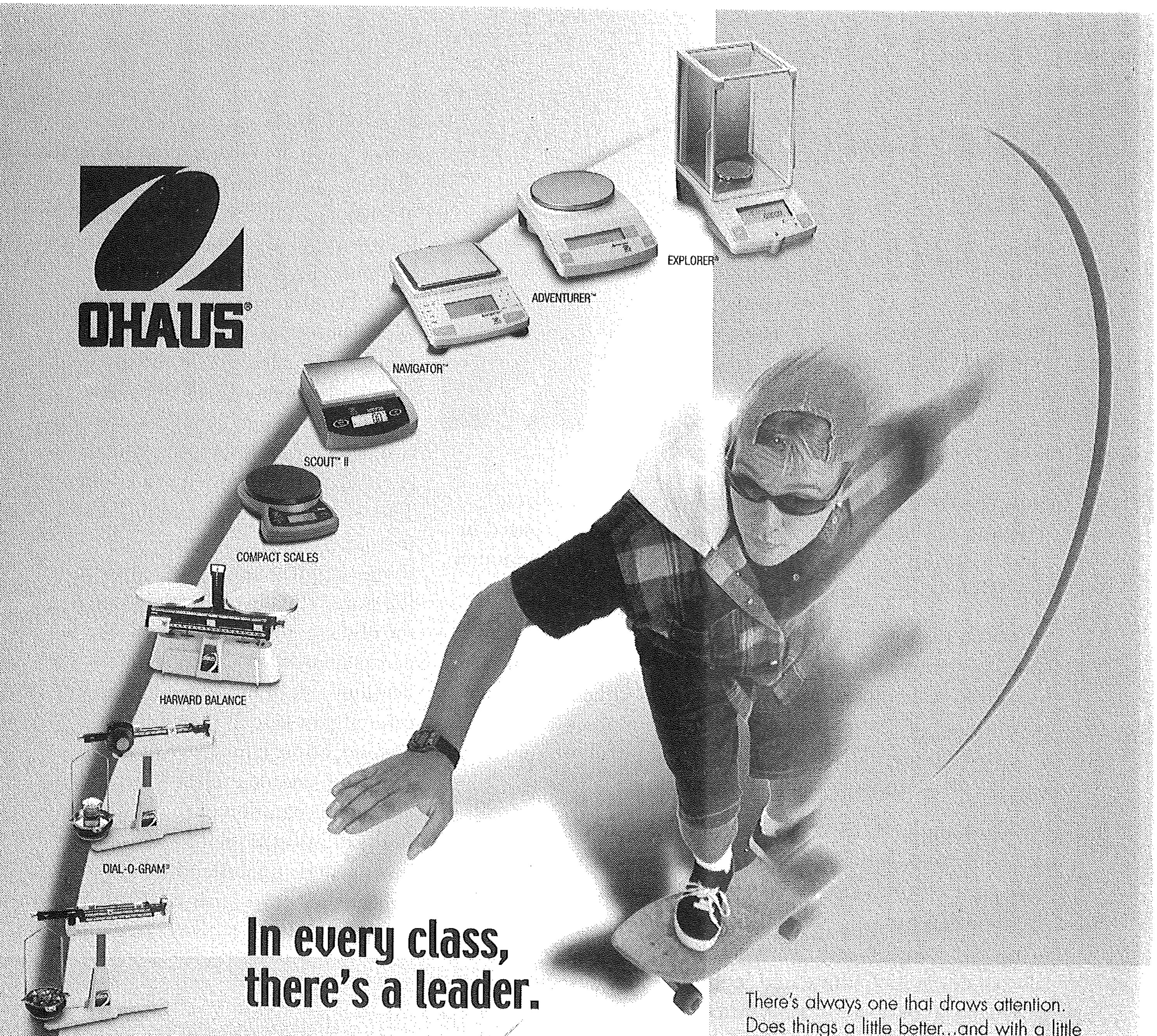
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# What Brings a Smile to your Face?

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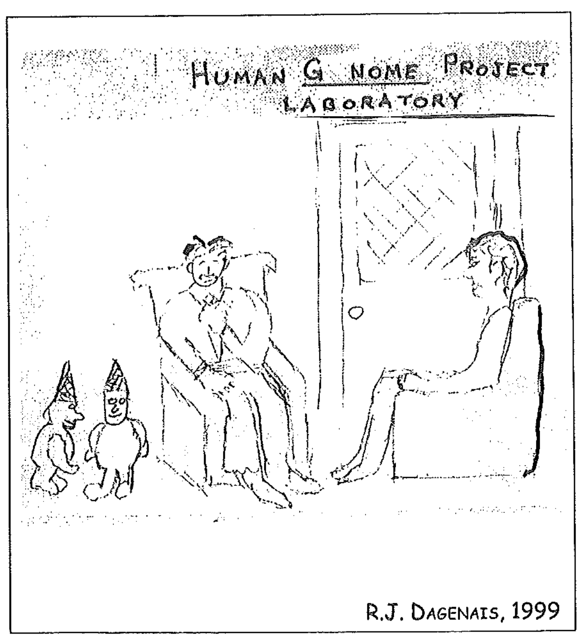
Almost every teacher has experienced times when students' attention has been piqued and they are thoroughly engaged in what is happening. A well-designed scientific demonstration or "problem" is often the focal point of such interest.

However, there is another catalyst that can mentally awaken and engage our students. That catalyst is humor. Sometimes humorous situations occur serendipitously. Other times, they are purposefully orchestrated. It is the intention of this short article to explore some of the benefits and pitfalls of humor in the classroom through example and critique.

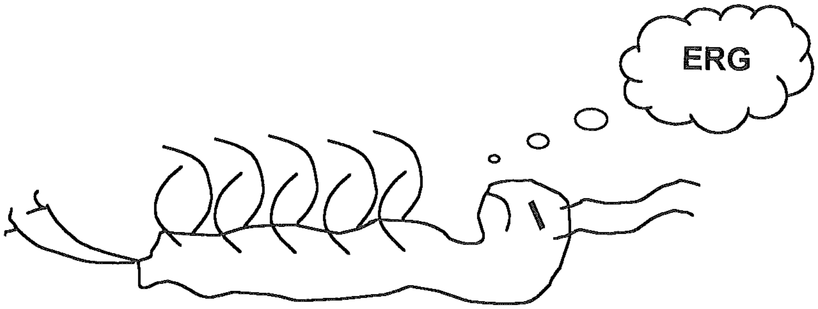
First and foremost, let it be said that humor should never be crafted at the expense of any person's feelings or reputation. Using oneself as an example is the only exception. In fact, the ability to accept being the focus of laughter is very often a mark of a strong and confident person. There are a great enough number of ethical and respectful situations out of which can be constructed a humorous experience that embarrassment of or disrespect for any individual or group should not be part of the story. And truly, story is the medium of humor.

People construct their knowledge in special and personal ways that depend upon a vast array of previous experiences. The humorous story implicitly asks the observer to connect what is happening in the story to what they either consciously or unconsciously "know" and "expect." When the story line takes a surprising (but not frightening) turn from the expected, the outcome is often an absurd and funny result. The cognitive dissonance that is established through the story is different than that created by a question or a problem for which one expects a logical and reasonable answer. The result of the "punchline" is a possibility, but not the one usually expected by the observer.

The "GNOME" cartoon below pictures two men bemoaning the fact that their work was impeded by lack of adequate funding. Their statement is notparticularly interesting or funny by itself. However, the observer is offered additional information that, when connected to the statement, projects a much different picture than the simple statement suggests. The understanding that emerges is that the two fellows (researchers one might guess) have really missed something. That view linked to the notion that researchers are usually on top of things supplies an unexpected twist to the story. Usually the story requires the observer to add additional personal knowledge for the development of meaning. This is certainly the case in the GNOME cartoon. Some knowledge of the Human Genome Project is required, as is the recognition of the creatures in the drawing as gnomes, and the more generic understanding of the dependence of research work on funding levels.




"If they had just given us the money we asked for, we could have added the remaining letter to the sequence and really been onto something"




## A DYNE CENTIMETER

Language is a medium that is extremely rich in meaning and understanding. Veteran teachers are frequent users of the "play on words" strategy, sometimes for the effect, and other times as a means to establish a memory link. The above cartoon is a favorite of physics teachers hoping to engage their students and provide them with a memorable picture of the definition of an energy unit.

The connection implied by the cartoon refers to a previously encountered statement that defines the energy unit ERG to be a DYNE CENTIMETER or a "dying" centimeter. The groan that inevitably follows the artful unfolding of the diagram on the board is both acknowledgement that the point has been made and, perhaps, more importantly, the pseudo-applause that recognizes teachers for their ingenuity.

The communication of a humorous situation depends upon the establishment of a special relationship between the storyteller and the observer. In face to face interactions the storyteller must get the audience to go along with the story. Successful comedians have a talent for "grabbing" their audiences. They establish a bond with the observers, even if only on a temporary basis. By entering into this unspoken agreement, the audience is saying, "I'm interested in what you have to say and I trust you." This agreement allows the storyteller to spin the yarn. In many ways the relationship teachers have with their students is like that of a performer and an audience. When students trust their teachers, teachers can employ humor in the classroom to good advantage.

The letter on the right was written in the name of a fictitious student after listening to a wellness teacher talk to faculty colleagues about an activity assigned to students in the wellness program.

The lesson in this letter is that in spite of our best intentions and our unflappable belief in our ability to make a point with our students, they manage to still find a way to misinterpret our teaching.

Humor can be used to drive home a point. A friend of mine directed a question to a particular student in his class. As the student hesitated to respond, a classmate blurted out the answer. Without blinking an eye the teacher looked intently at the hesitant student and said, "That was really good! I never saw your lips move at all."

After a moment of silence the class erupted into laughter. Presumably they understood the analogy to a ventriloquist and his partner as well as the fact that the teacher wanted the hesitant student to answer instead of the eager to please sidekick.

As you engage in discourse with your students on the wonders of the natural and man-made world, be alert for the opportunity to use humor to energize your students. When the chance presents itself, seize the moment and take advantage of a potentially humorous situation to grab your students' attention and connect with them on a special level.

*Ms. Walker,*

*I want to thank you for making us do the assignment on tracing our family's medical history. Upon compiling and analyzing the medical history of my male relatives, I found that my father, his father, and my grandfather's father all died of heart attacks before the age of 50. I have found this activity very informative and important for me. It has moved me to take action! As a result of this information, I have decided to change my last name.*

*Your grateful student,*

*Malcolm*

# The Illinois Performance Descriptors: An Invaluable Tool for Focusing Curriculum & Instruction*

*Anne Grall Reichel*
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The Illinois Performance Descriptors are to the curriculum developer what the telescope is to the astronomer, a tool for clarifying the image or vision that may appear to be beyond our reach. Over and over again we listen to a common concern from our colleagues; "we simply have too much to do". But, do we? Often we take on the new and forget about abandoning that which is familiar. This approach burdens the curriculum. With the help of Illinois Performance Standards & Descriptors, refined by clarification of concepts from the Atlas for Science Literacy (AAAS,) educators can provide a focus for science curriculum that gives them the freedom to determine, that which is really essential for our students to know and to be able to do.

As we know, scientific inquiry is a dynamic process. Yet, when we discuss science curriculum and instruction we discuss "covering" the curriculum. As Wiggins and McTighe astutely point out in *Understanding By Design* perhaps we need to think of "uncovering" our curriculum. "Uncovering" implies a dynamic process that affords us with the opportunity to "do science" rather than to "confirm science". Questions lie at the heart of our discipline and serve as the invitation to "doing science". We can creatively develop those questions informed by the Illinois Performance Standards and Performance Descriptors.

Lets take an introductory unit on matter at the middle school level to investigate the idea. The first important piece for the unit developer is to take the time to investigate the standards related to matter and discuss what is really essential for students to know and be able to do. This can be further clarified by using The Atlas For Science Literacy to see what concepts students need to know before, during and after that middle school experience. Lets look at a sample set of standards, descriptors and essential and unit questions to get the idea.

The unit developers selected the following standards and then used the descriptors to inform the focus for their unit.

**11A Know and apply the concepts, principles, and processes of Scientific inquiry.**
- Formulate hypotheses that can be tested by collecting data.
- Design experiments that control all but one variable.
- Make quantitative and qualitative observations.
- Record data in tables, charts, or other appropriate formats.
- Explain results of an investigation

**12C Know and apply concepts that describe properties of matter and energy and the interactions between them.**
- Describe how interactions of matter and energy affect changes of state.
- Identify physical and chemical changes in matter.
- Investigate, through experimentation, the relationships among atoms, molecules, elements, and compounds.

**13A Know and apply the accepted practices of science.**
- Formulate and practice safety rules during investigations.
- Compare systematic observation with experimental design.

**13B Know and apply concepts that describe the interaction between science, technology, and society.**
- Describe our scientific understanding of atoms in history.
- Identify scientists associated with atomic theory.

Clearly, the unit developers were focusing on a content standard while balancing Goal 11 and 13. After developing this sequence the developers moved to "Essential" and "Unit" questions.

**Essential Questions**

- What are the relationships between matter and energy?
- How do scientists use systematic observations and experimental method?

**Unit Questions**

- What are the characteristics of chemical and physical changes?
- What is the difference between a chemical and a physical change?
- What causes phase changes in matter?
- What are the relationships among atoms, molecules, elements, and compounds?
- How do scientists develop explanations using observations?
- How do scientists plan and conduct experiments to answer their questions?
- How do scientists determine the cause of an observed effect?
- How can graphing help determine the relationship between amount and temperature?
- How has our understanding of atoms and molecules changed over time?
- Where do we experience chemical and physical changes in our daily lives?
- How can I design an investigation to answer a question I wonder about?

In this example the curriculum developers used the standards and performance descriptors to bring the unit into focus. Essential and Unit questions evolved from the logical progression of standards and descriptors. Critical to the "Essential Question" is the idea that it should run through the curriculum both vertically and horizontally. On a vertical spiral a second grader may do simple experiments to determine the best place to keep an ice cube frozen. In this investigation second graders are investigating the interaction of matter and energy at a concrete level. This same essential question might be visited in later years as older students investigate endothermic and exothermic reactions. As for horizontal investigation of the question, students might revisit the interaction of matter and energy as they investigate earth movements or food production in plants. The idea of horizontal investigations is for students to address the same concept in several contexts. One might ask where do we go from here? The essential and unit questions serve as the focus to design units through backwards design. Now the curriculum planner can use the essential and unit questions to develop the summative assessment and sequence of learning experiences that will ensure student success.

## The Learning Cycle

It is best to embed a learning cycle in this unit sequence. This cycle includes several components. There are several learning cycles that can be used. The one that appears below is part of the STC curriculum developed by the National Research Council.

- **Focus**
- **Explore – Discover – Investigate**
- **Reflect**
- **Apply**

During the "Focus" stage student interest is engaged — this might be a problem to address, a real life event, an article or literature connection. During this phase teachers identify student misconceptions. The "explore" phase provides an opportunity for students to engage in hands-on investigations. As a result of investigations concepts and vocabulary emerge. These can be reflected upon during the "reflect" phase. Students might look for multiple meanings for vocabulary that emerges and identify the science meaning. Students might draw and write about the experience. Students might use a digital camera image to reflect and write about an experience. Most important, the unit ends in "Application" — the critical phase in which students apply their knowledge to a new situation. It is usually clearly linked to the Summative Assessment. For example, in the matter sequence above the summative assessment challenged students to ask a question related to their observations and to design a controlled experiment to uncover the answer to their question.

## Back to the Focus Phase

One might want to try a version of the KWL that we modified for science. We like to call it the KLEQ. Let's take a look at how this compares with the KWL.

### The K

The facilitator of learning starts out by finding out what students "Know." During this phase, which should be revisited throughout the unit, student misconceptions can be identified. The teacher can use these misconceptions to facilitate learning experiences that stand in contrast to the misconception.

### The L & E

The "L" implies finding out what students learned and the "E" is providing the evidence. During the "E" phase the teacher may prompt older students by asking; "What evidence do you have?" Teachers of younger students can get at the "E" by asking; "How did you know that?" "What did you see?"

### The Q

Now for the "Q." The "Q" in the KLEQ is dynamic and forever orbiting. Questions emerge throughout the unit. They may be recorded on an "I wonder" chart or older students may journal about their questions. These questions provide the vehicle for reaching a true inquiry-based experience where students gain ownership of their question.

## The Potential of the Question

If strong essential and unit questions are designed from the performance descriptors, students can use those questions to guide reading or focus journal writing or interactive writing on charts. The power in the questions is that they provide the opportunity to do science as well as the logical pathway for the integration of reading and writing.

## We Can't Do It All

As educators, our plates are full. We can no longer afford to spend time on that which is not essential. The Performance Descriptors can inform our decisions about what we should uncover in our classrooms each day.

* The thoughts above emerged as a result of a Scientific Literacy Staff Development Grant funded by ISBE: The Lake County Alliance for the Continuous Improvement of Science. Facilitated by Anne Grall Reichel through the Lake County Regional Office of Education.

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# Notes in the Margin of the Chemistry Activities Notebook: What's the Thread Connecting Oranges, the Pentagon and Citrate Synthase?

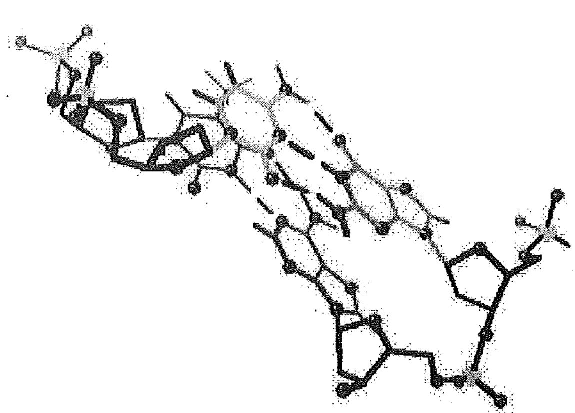
*Sharon L. Weldon*

Department of Chemistry
Illinois State University

*I recognize that the beginning of my understanding took root at an early age*

As the boundary between chemistry and biology gets more confusing everyday, the biochemist in me struggles to choose between the sheer amount of information which will challenge our students in the future and conveying core concepts so that students can develop lifelong tools to deal with that world of burgeoning information. One of the clear concepts that I share with my colleagues in secondary education is that of making and using models. Whether I consider the molecular way that sugars are digested in the body or how aspirin works on its target protein, my foundational knowledge is based on my ability to effectively utilize a model.

While this concept is an essential part of my goals in my college chemistry/biochemistry courses, I recognize that the beginning of my understanding took root at an early age and was helped along by various talented secondary school teachers who helped build the skill level that I use now. Important to my development, some of those tools for understanding were obtained outside of the science classroom in math and art projects. Just like me, the extent to which my students can begin to understand the complexity of molecular structure that governs biological processes is rooted in how well this ability to use a model is developed at those early stages.



Let me remember. Last summer my brother and I were discussing how to raise the level of interest in a General Education course where students hopefully develop some tools to deal with chemicals in everyday life. My focus was to more effectively present organic chemistry through drugs which impact society like ibuprofen and thalidomides. I wanted to use these drugs in particular as examples of why learning about chirality or asymmetric carbons in organic chemistry is fundamentally important, but also as a prelude to the "handedness" of biomolecules as well. While the discussion was centered on the attitude of the students, several minutes later my ten-year-old nephew stopped and asked me to define chirality.

I delivered my standard definition about the mirror images of four different groups around a central carbon to a pair of blank eyes, and then scoured the house for a construction set. Unfortunately, my mom had just deposited it and other toys at the local Goodwill agency. So, we hunted down two oranges, assorted nuts and toothpicks and constructed two non-superimposable models to describe chirality. My near-architect nephew had no problems finding the difference between the two models, and I gathered that he learned something about the drugs from his interest in the discussion. That experience emphasized my belief in using models early in the learning process. I also relearned the importance of an interested parent in the educational process. Needless to say, guess who received a model kit for Christmas! ***Note to self:*** **Realize the power of a model in my students' hands.**

Our tendency to dismiss working with models early on seems to correlate with an emphasis on process over structural detail. This spring's complement of sixth through ninth graders attending the "Expanding Your Horizons Conference" at Illinois State University were able to tell me why deoxyribonucleic acid (DNA) was important, but they struggled with my query of what it looked like. With additional questions, it was pretty clear that this particular group hadn't really worked with atoms or molecules to date.

Since the goal of the workshop was to build DNA on the computer, I was stretching back for a framework on which to build. Luckily, this year the coordinator sent out instructions with the student helper to identify the math connection in the workshop. Drawing on that three-minute discussion, we were soon using tetrahedrons to describe the placement of four other atoms around a carbon center, pentagons to find the ribose sugar and planarity to characterize the bases which interact to bind the double helix together. Despite the fact that the participants weren't prepared to comment extensively, we could discuss the structural elements of the DNA model in ways that were meaningful to them. ***Note to self:*** **Recognize my ability to convey a model in simple terms.**

Because so much of what I do is predicated on the interaction between structure and function, I was thrilled when we incorporated more models into the General Chemistry discussions in which I take part. One of my new inorganic chemistry colleagues, Gregory Ferrence, has developed an integrated VSEPR (valence shell electron-pair repulsion) exercise which links two-dimensional representations like chemical formulas or Lewis dot structures to three-dimensional models of computer representations (using Chime a web-based visualization program, http://molvis.sdsc.edu/visres/ready-to-use/titles.jsp) or classic ball-and-stick model kits.

Using these modeling tools, the students were able to predict the molecular geometry of small molecules using Lewis structures, define electron-domain geometry, describe the molecular structure and test their knowledge with a fully rotatable model on the computer screen. The use of a hand-held, physical model to confirm the relationships of these different models was a real eye-opener to me. The inability to physically prepare models of biochemical molecules had pushed me too far on the students' learning curve: they clearly needed to visualize and correlate the different models on a small scale to believe in the power of the computer to yield valid models. ***Note to self:*** **Coordinate the symbols with two and three-dimensional models.**

*Imagine my concern when half the class had never touched a molecular model; they simply didn't know where to start....*

*Too often, we educators in our zeal to get to new material or because we see the molecular architecture ourselves forego the challenge to present the three-dimensional shape of newly synthesized molecules.*

The relevance of molecular models is not restricted to the science major. I teach a course entitled The Chemistry of Life, which builds on a first year General Education chemistry course and is one of the courses which addresses the need for science literacy for all Illinois State students. A set of abbreviated labs was added to this course to allow more time for hands-on exploration. Melinda Baur, Illinois Wesleyan University, reconfigured a molecular modeling exercise for the organic chemistry portion of the course. This simple lab is well received because of its constructive and lecture-related appeal. Concepts presented in this lab about covalent bonding and isomers prepare a foundation for our discussion of drug and biomolecular structure. If we want our students to make informed choices about drug selection and genetic testing, we need to make the case for how these molecules look and work. *Note to self:* **Cheer all comers (that includes the art history, business or elementary education majors) who dare to pick up a model.**

Let me re-emphasize that point. Another set of students including allied health, nutrition, agriculture and some biology majors take a more abbreviated chemistry route to their degrees than our biology, chemistry and pre-professional folks; yet, many of these individuals reconvene in our course in Basic Biochemistry. As a transition between their organic chemistry and biochemistry coursework, I had them build ball-and-stick models of fatty acids and glycerol in groups. Then, three groups worked together to "synthesize" a triglyceride or fat. Imagine my concern when half the class had never touched a molecular model; they simply didn't know where to start. Their ability to understand the construction and reaction of molecules in a living system was clearly hampered relative to their counterparts who had had the opportunity to build molecules in earlier courses.

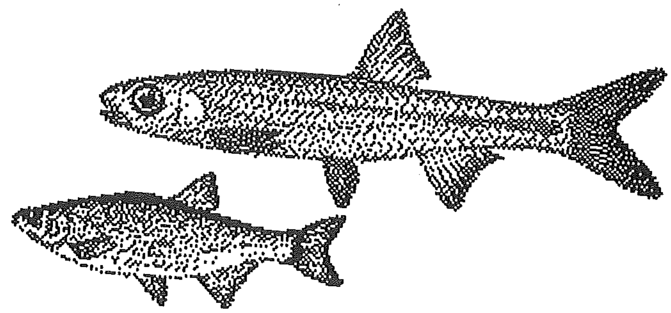
Yet, even the more experienced students with twice the chemistry background rarely had tried to visualize chemical reactions with model kits. Too often, we educators in our zeal to get to new material or because we see the molecular architecture ourselves forego the challenge to present the three-dimensional shape of newly synthesized molecules. My students definitely learned more about functional group reactivity and stereochemical constraints in their attempt to link their fatty acid snakes to a glycerol core than I could have lectured to them in a week. Later on in the semester, we used our ball-and-stick models to produce polypeptide chains from amino acids and to cyclize glucose and ribose sugars. My only regret was the difficulties imposed by an insufficient number of model kits. *Note to self:* **Practice reactions using models.**

By the time I get to more than five amino acids in my lectures on protein structure, my students are happy to interpret the monomers as beads on string. Yet, I want to talk about biologically functional proteins of 150-1000 amino acids with defined three-dimensional structure. To simplify the modeling, I often suggest that I am the enzyme. To take a specific example, I would present myself as citrate synthase, the first enzyme in the tricarboxylic or Krebs cycle, and I ask my students to suggest how we might represent the active site, any regulation sites and the substrates. The fact that I can still move my body helps them model the concept of induced fit where the enzyme conforms to the specifications of the substrate. Representing large or difficult structures as people models certainly makes more sense to non-science majors. My most effective tool to explain weak acids is the idea of 100 couples waltzing on the dance floor (the presence of vast numbers of members of the appropriate sex is usually enough to sell it). Whether the model is atomic or molecular, oranges or computer images, the logic process of how to make the model is a learned response. *Note to self:* **Pattern the development of model making to my students.**

The beauty of biochemistry is the blending of principles of both parent disciplines to understand a living system. I want to have my students see that the chemistry building blocks, that they have strived to achieve, can be exhibited in a biological system, but often we get stuck in a "can't see the forest for the trees" cycle. I decided that for many of my students I needed to model the exchange of information between the biological function about which most of them care and the structure dictated by the electronic properties and shape of the molecule involved. The result was a website (http://www.che.ilstu.edu/~weldon/dreyfus) detailing a recent discovery which has lead to a new set of drugs for those afflicted with AIDS. The key biochemical player in the website is a glycoprotein called gp120 which sits on the surface of HIV and tricks unsuspecting cells to let the virus enter. With this modeling tool, we can communicate both types of information, biological process and the consequences of three-dimensional structure. My students can investigate the biological details that they need, and I can spend my lecture time communicating the relationship between amino acids and overall structure or the effects of noncovalent intermolecular interactions, the material that they have never seen. They now get the message that protein structure is important to understand if they want to learn about cells and organisms. I see that it the way they use their hands to describe reactions and the elevation, at least in their minds, of having to learn the structures of the amino acids. *Note to self:* **Impart the impact of the structure on the functioning of the model.**

As I re-read my notes, I see that none of these ideas are particularly new, but I see that even I who believes in the power of a model forgets to present them all to my classes. But in an age of real world examples where relevance and consumerism drive student interest, I feel the need to do a better job about communicating fundamental tools; it's clear that I can't explain all the biochemistry that I'd like them to know. When I drag out my set of biochemical tools, the one that I grab first is my ability to create and work with a model. I realize that if my concern about topic coverage is great, then my colleagues teaching more basic courses have even more choices to make. The ability to make three-dimensional models does pay off and is definitely worth the effort, because it yet one more way to allow us to communicate important ideas. So as I make my "to do" list for my classes this year, it's appropriate to take stock of things I did right and tell all my friends. *Note to self:* **Encourage my colleagues to develop and use models in their classroom (but be sure that you do it too).**

# Another Look at the Data: Tracking the Fish that Got Away



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When I was a high school teacher, I prided myself on how good my chemistry courses were. "Good" was defined in my mind by the degree to which my students were prepared for the college and university courses they might take in subsequent years. My students would often come back after their first year at a local or national university and say that my course had really prepared them well for their college chemistry experiences. Wow, what a wonderful compliment! I really took those compliments to heart. It made me feel validated, and even sometimes vindicated. My course was supposed to be a university preparation course so clearly the things I was doing must have been appropriate. Many of the teachers I run into in my personal and professional life tell similar stories. At ISU, we are in the midst of a series of chemistry teacher workshops aimed at supporting teachers as they develop new ideas and lessons. During the workshop discussions, many of the teachers recounted stories similar to mine.

How often do students come back to you and recount a story of how well prepared they were for their chemistry course at UIUC, or ISU, or Northern, Eastern, Bradley, Southern, etc.? How many times did this happen to you in the last year? or in the past five years? One, two, three, four....ten? fifteen?

Now think about the shine on your face and the pride with which you recall those moments. As a high school teacher, I loved it. As a university professor, I still love it. These instances are important pieces of data that we use to guide our professional attitudes and decisions. Just as I did in high school, I use them to guide the content and pedagogy within my chemistry class at ISU. This is the first set of data to be considered in this article.

However, as science teachers, are there other data that we all should consider that tell us how appropriate our teaching methods, beliefs, and pedagogies are for our students? How do we know that we are reaching our students with the appropriate content and pedagogies that help them to learn best?

Again, I think it is necessary to use you as an example as we did above. I need you here, because you are the ones who are collecting this other data for me.

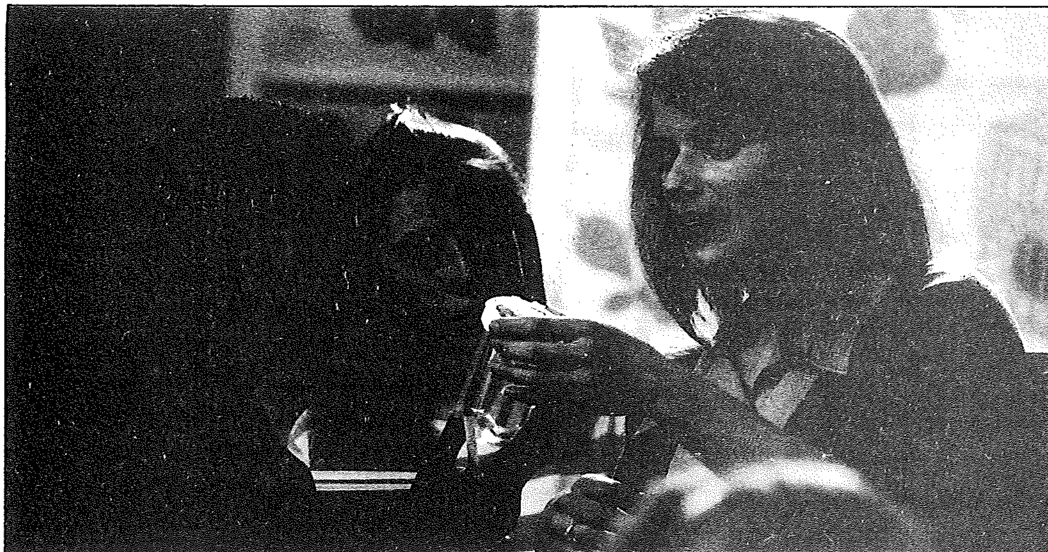
Here is my thought. I love chemistry and chemistry teaching. When I meet people, they ask me what I do for a living. Sometimes in the grocery store, I strike up a conversation, and it comes out that I teach chemistry. Perhaps this happens to you occasionally. The experience I get repeatedly is that I receive a comment that is either, "I didn't get chemistry in high school," or "you must be so smart." Usually, the comment is accompanied by an unpleasant facial expression. How often has that happened to you in the last year? One, two, three, four...ten? fifteen? I'll wager that it happens a lot to other science teachers. Perhaps some of you yourselves make that same facial expression with respect to chemistry.

I realized a couple of years ago, that most of my former students upon meeting me in the grocery store were giving me the same unpleasant facial expression. The evaluation of my classes on the street was not very favorable. My former students are too polite to run into me and choke. They don't say, "Dr. Hunter...I didn't get chemistry in your class." I bet your students are too polite to say that to your face. The people that say it to you are my former students, and the people that say it to me are your former students. It takes an act of thoughtful reflection to realize that when your former students tell me they did not get chemistry in your class that they are like my students who tell you the same thing.

So now I have another set of data — that most of my students are not enjoying chemistry, nor are they learning the central concepts of chemistry that relate to their lives. They are not empowered by the material in my class to participate as scientifically literate decision-makers.

What is the implication of these two sets of data? The first, that a few students found value in my course; and second, that many students found no value in my course. Taken together, what do the two sets of data mean for my classroom? Well, I need to carefully consider them. Clearly, those students who come back and tell me how wonderful my course was are learning something — perhaps valuable skills, insightful knowledge, and useful attitudes. Juxtaposed against those few students, however, are those who are disenfranchised from chemistry-decision making processes even after having been enrolled in my course. These two sets of data indicate that a few of my students are being served, but that many are not.

What is the take home message here? The purpose of this article is to point out at least two sets of qualitative data we need to consider when making decisions about content and pedagogy in our classes. We each make our decisions based upon our values and what we believe to be the purpose of our classes. How do we decide on how our beliefs and values should be manifest in our classes? That is for you to decide; I trying to highlight that we should look at all the data available. We need to examine all the possibilities that govern our choices as we make decisions in our science classes. If we examine only the fish in the boat, we might miss the fish that are still in the water.



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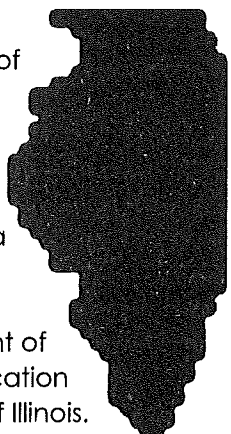

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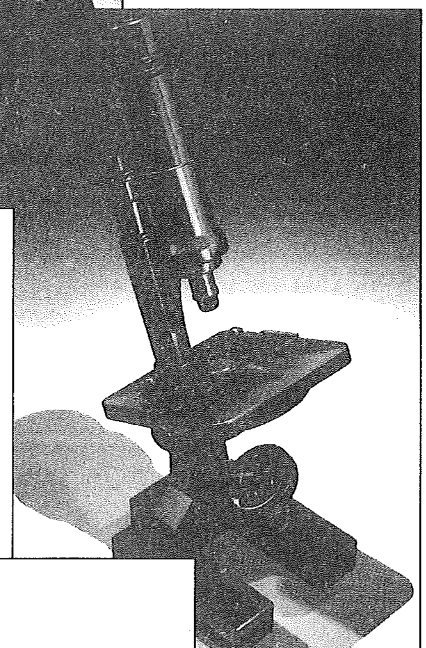

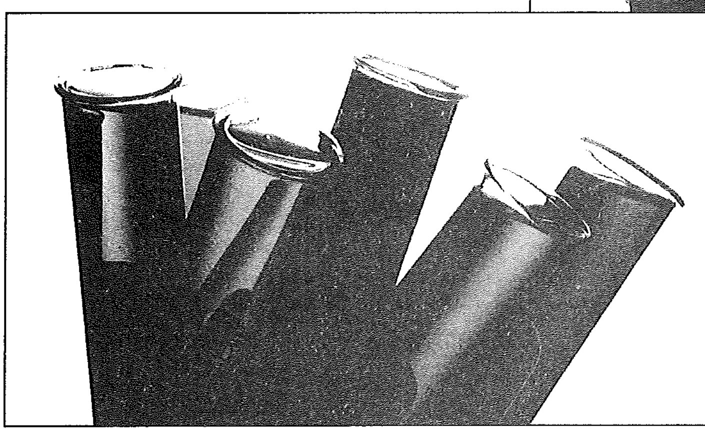

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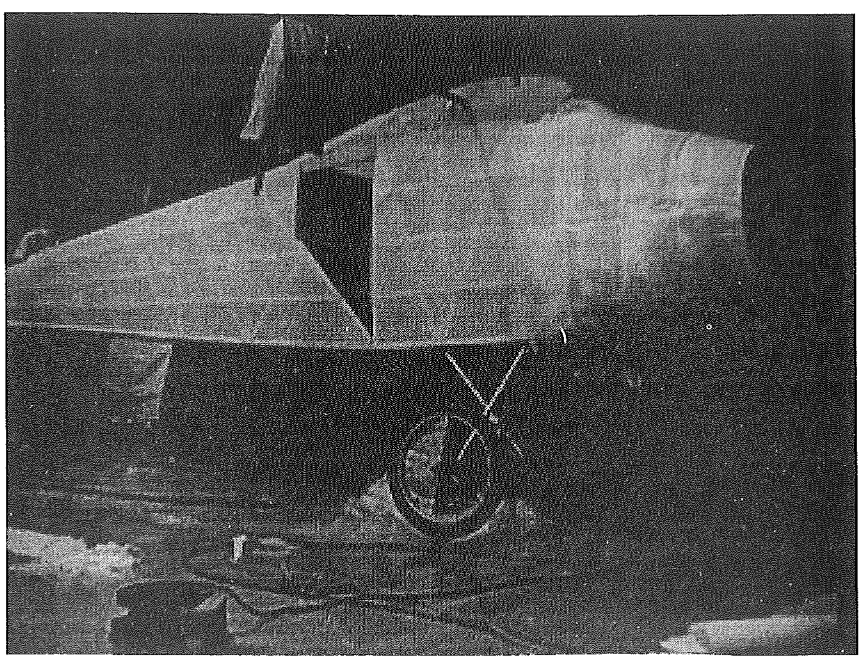
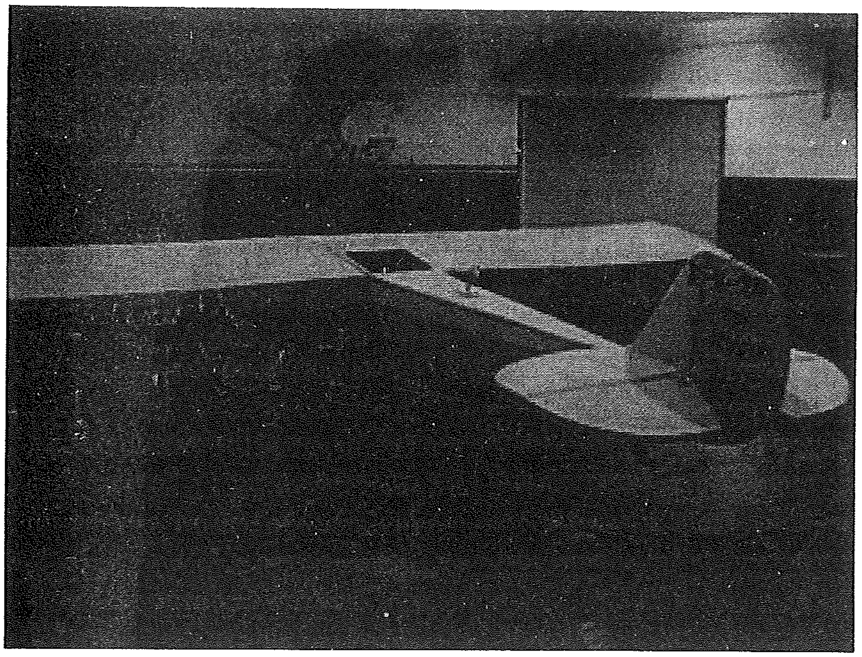
### *Coleen Martin*

5th grade teacher
Wilder-Waite Grade School


*Coleen, one of our ISTA elementary master science teachers, is an ExxonMobil Building a Presence Science Key Leader and 2001 Finalist, Presidential Award for Excellence in Science Education.*

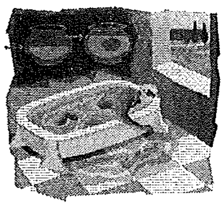
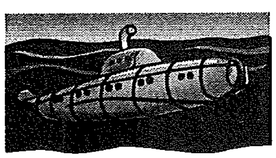
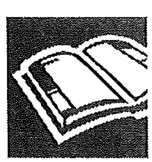
Getting students to soar with the exploration of flight is one of my main goals as a fifth grade teacher. To that end, over the years, I have developed a Space History/Rocketry unit. This past school year, with the help of my husband, the students, the faculty of our school, parents, and members of the community, we built a scale model of the Spirit of St. Louis to take this concept to a higher level. This plane, with a 20 ft. fuselage and 32 ft. wingspan, looked quite impressive sitting in the middle of our school gym. The students observed the construction of the plane from scale blueprints to a life-size replica. After the plane was built, the fifth grade students "flew" the plane for 33 hours to recreate Charles Lindbergh's famous crossing of the Atlantic Ocean in 1927. They learned about the authentic instruments in the plane and used the stick and rudder pedal to manipulate control surfaces. During the construction of the plane, teams of K-5 students researched a famous aviator and eventually gave presentations to the whole school. Many female aviators were included to give the girls a chance to see aviation as a possible career field. As a grand finale, the EAA (Experimental Aircraft Association) flying replica flew into a local airport. Our entire school witnessed its arrival. The pilot, Verne Jobst, dressed as Lindbergh, came to our school to see *our* Spirit of St. Louis plane and gave a slide show on Lindbergh. He then took three lucky students for a ride!





The building of the Spirit of St. Louis was one of the most exciting projects we have ever accomplished at our school. My husband, James Martin, is an engineer and modeler. With his expertise, we built this plane from wood and foam. Many parents, students, and community members spent hours helping complete this project. The students helped with as much of the project as was safe. The nine cylinders were built by the fifth graders. Rings of wood and foam were glued onto cardboard tubes. Pieces of foam creating the rocker boxes were glued on top. The cylinders were then painted by the students. The nine cylinders were attached to a nine-sided box. A realistic propeller was then added with a foam nose cone. As the fuselage was being built out of wood and the wings and control surfaces were cut out of foam, the students sketched the structure and observed the construction. Actual aircraft cloth was used to cover the fuselage. The students then helped paint the plane. The 51 fifth graders each took a 40-minute turn sitting in the cockpit during the 33-hour flight. A computer simulation of Lindbergh's flight was projected onto a screen outside the window of the plane. Each pilot had to radio flight data to a "flight control tower." This data was later incorporated into math and science lessons. This project gave the students a realistic feeling for what Lindbergh accomplished. All students in the school sat in the plane and got their picture taken. This project involved over 300 children, hundreds of parents, and many volunteers from the community.

# Cartesian Divers and Submarines

| | |
|---|---|
| Topic | The Relationship between Pressure and Buoyancy |
| Grade Level | 7 & 8 |
| Materials | • Glass jar, flask, cylinder, or plastic soda bottle<br>• Eye dropper<br>• Stopper or plastic membrane to cover the opening. |
| What Happens | • The diver sinks or floats depending on the amount of water forced into the dropper. |
| Background<br><br><br> | • The buoyancy of the diver is changed by the amount of water in the diver. As pressure is applied to a liquid in a closed container, that pressure is distributed evenly throughout the container (Pascal's Law).<br>• This principle is utilized in hydraulic systems such as car lifts, and brake systems.<br>• The density of the diver is less than the density of the water, so the diver floats. When the amount of water in the diver is increased the density changes. When the density of the diver is greater than the density of water, he/she sinks.<br>• In the dropper, the amount of air is decreased in the diver. Boyle's Law states that as the pressure in increased the volume is decreased. This relationship occurs in the diver.<br>• An illustration of Boyle's Law is present in tires. As the tire gets smaller (racing bike tires) the pressure is increased.<br>• A submarine changes its density in much the same way as the diver. |
| Thinking Questions<br> | • What makes something sink or float?<br>• How do some fish adjust their buoyancy?<br>• Would the temperature of the water make a difference? Why or why not?<br>• How does the diver simulate how a submarine changes its density and thus the depth?<br>• How would you make a Cartesian Diver?<br>• How have Archimedes, Boyle, and Pascal made contributions to science and technology? |
| References<br> | http://jchemed.chem.wisc.edu/Journal/Issues/2001/Feb/abs200A.html<br>http://www.science.lcc.whecn.edu/ScienceClub/DiverNotes.html<br>http://members.nbci.com/_XMCM/scibus/cart.html<br>http://lectureonline.msu.edu/~mmp/applist/f/f.htm<br>http://demoroom.physics.ncsu.edu/html/demos/4.html |
| Illinois Learning Standards | 13.b.3b Identify important contributions to science and technology.<br>13.A.3c Explain same/different about observational and experimental investigations.<br>11.B.3c Select the most appropriate design and build a prototype.<br>11.A.3a Formulate hypotheses that can be tested by collecting data. |

# Mini Ideas

## Science on the Guitar: Using a Familiar Instrument to Teach Simple Physics

*Mike Davis*

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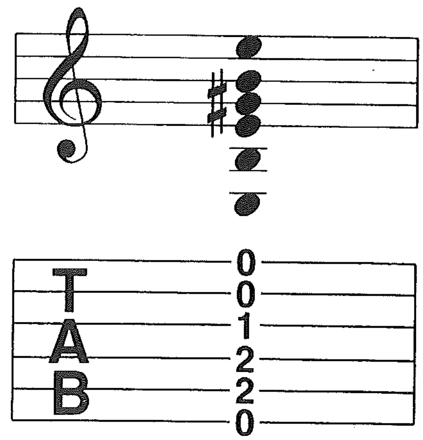
There is something about the guitar that seems to make the person holding it very cool. I don't know what it is, but whenever I am standing in front of a room of students, guitar in hand, they are silent before I even explain what I am trying to do.

The guitar is exactly like a piano, in the fact that it is a string-based instrument. The note produced on the guitar is dependent upon the thickness of the string, its length, and its tension. A grand piano similarly uses strings of different sizes and lengths to make a variety of notes. There are three basic rules for the vibrational frequencies of strings[1]

1. A long string vibrates at a lower frequency than a short one, assuming that the tension is constant. Doubling the length lowers the pitch by one octave.
2. The frequency of a string rises proportionally with the square root of the tension. One must quadruple the tension in order to raise the pitch an octave.
3. The frequency of a string falls proportionally with the diameter of the string, assuming that tension and length are constant.

If you take your class on a field trip to the music room and open up the grand piano you'll notice that all three things are varied in the strings. Bass notes are longer fat strings, while high notes are short skinny strings. If the string thickness were never varied, a grand piano would have to be over 22 feet long to get some of those lower notes!

The guitar on the other hand varies only string thickness and tension. All of the strings are the same length. You get different notes on the guitar by holding down the strings, essentially changing their length.




### Activity I
**Complex Wave Behavior: Nodes**

Every guitar aficionado loves to work some of those cool harmonics into their songs. They are the high clear tones heard by placing your finger lightly across the 5th, 7th, or 12th fret. Generally, when you move fingers up the fret board, notes get higher. Ask your students, why the trend is reversed for harmonics. Why is the harmonic at the 12th fret lower than that at the 7th and the 5th?

The answer is simple and is a great introduction to complex wave behavior. The harmonic at the twelfth fret sets induces a node that divided the string into halves. The harmonic at the seventh fret induces a node that divided the string into thirds. The harmonic at the fifth fret induces a node that divided the string into fourths. Therefore the frequency of vibration increases with the increasing number of nodes.

**Activity II**
**Induction of a Wave: Tuning Forks**
My students love the tuning forks. One thing I try do is make sure that I don't have a headache on the day I pass them out. There is a reason no one has started a tuning fork orchestra. At any rate, a vibrating tuning fork sets up an oscillation of air molecules that can cause vibrations in other strings. Striking a tuning fork and holding it near a piano or guitar string will set up a vibration in the string. For example, striking an 'A' (440 Hz) and holding it near the guitar sound hole will cause the A string to vibrate. If using the guitar, it may be helpful to hold the G-string down at the second fret to get a second A note. On the piano, go for the middle A.

My students really like this approach, and we usually go on to make wind chimes out of copper tubing or conduit following the length rules stated previously. Using the medium of music to introduce the concept of waves can be very successful, and a lot of fun.

1. Benade, Arthur H. *Horns, Strings, and Harmony* Dover 1992, pp. 110-111

# Are You Attracted to Me? Discovering Magnets and Magnetism Lab Investigation*

*Abour H. Cherif, Ph.D.*

Columbia College Chicago
Science & Mathematics Department

## Safety Procedures:

1. Remove your wristwatch before you work with a magnet or a compass.

## Objectives:

The objectives of this hands-on- investigation are for students to:

1. discover, understand, and be able to define a magnet.
2. distinguish between a magnet, matter that is attracted to a magnet, and matter that is not attracted to a magnet.
3. understand that magnetic force can't be seen but its effect can be seen and felt in various ways.
4. discover that a magnet attracts or exerts force from some distance away.
5. understand why the ability to attract iron and ferrous metals (metals that have a molecular structure similar to iron such as cobalt and nickel), is called magnetism.
6. discover and understand why the magnetic field can go through many different materials without any apparent loss of power.
7. discover and understand why a magnetic field can go through various thicknesses of matter.
8. develop recording, estimating and predicting thinking skills.

*The two activities incuded here are part of a larger unit on magnets developed by Dr. Cherif. Space limitations prevented publication of the entire unit. Please contact Dr. Cherif for information on more activities. Dr. Cherif teaches biology and science education at the Departments of Science and Mathematics, and Educational Studies, Columbia College Chicago, 600 South Michigan Ave., Chicago IL, 60605 (312-663-1600 x 5360).

# Activity 1. Discovering the Structure of the Magnet and How It Works

### Materials:

Magnet Bar
Two iron or steel bars (use the bars from activity 1)
Steel Paper clips

### Procedures:

1. Hold a bar of magnetic material (such as iron or nickel) from one end, and touch the other end of the bar into a small pile of paper clips. Then record your observation.
2. Place one steel bar on the surface of your desk and hold it with your left hand.
3. Hold the magnet bar from one end with your right hand fingers.
4. Stroke the steel bar (from one end to other) by the free end of the magnet bar 30 times, BUT always in the same direction; from left -to-right or from right-to-left.
5. After you finish step 3, then, touch one end of the steel bar to a small pile of the steel paper clips and record your observation.
6. Use what you observe to explain what has happened.
7. Predict what will happen if you stroke the steel bar by the free end of the magnet bar 30 times, BUT in all directions with no specific order. Discuss your prediction with the members of your group then write it down.
8. Test your prediction by doing the following:
   a. Place the other steel bar on the surface of your desk and hold it with your left hand.

   b. Hold the magnet bar from one end with your right hand.

   c. Stroke the steel bar by the free end of the magnet bar 30 times in all directions with no specific order.

   d. After you finish step "c", then, touch one end of the steel bar to a small pile of the steel paper clips and record your observation.

9. How and to what degree does your prediction compare or differ from what actually happened?

10. Use what you observe to explain what has happened in step 8-d.

11. How and to what degree does your observation in step #4 compare or differ with your observation in step # 8-d?

12. Can you come up with a reasonable explanation why this happened?

### Answer the following questions:

1. What do you think will happen if you hold the iron bar from one end with your right hand and then hit the edge of your disk with the other end of the bar 10 times? Find out how and to what degree your prediction compares or differs from what actually happened by placing that end of the iron bar into a small pile of the steel paper clips.
2. What do you think will happen if you leave that iron bar undisturbed for 42 hours and then place one of its ends into a small pile of the steel paper clips?
3. Use what have you learned to propose structure for a magnet.
4. Use what you have learned to propose a hypothesis of how a magnet works.
5. Based on your findings in activity 1, can you make your own magnet? Why and how?
6. If you can make your own magnet, what is the difference between the one you make and the one your teacher already gave you?

## Activity 2: Mapping The Magnetic Field of Two Close Magnets

### Materials:

2 Magnet Bars, 8 small compasses, a large piece of paper, a pencil, Iron filings.

### Procedures:

**1. Predict what the magnetic field will look like when:**

a. two similar ends of two magnets are facing each other, end to end.

b. two different ends of two magnets are facing each other, end to end.

c. two magnets are laid side by side with a distance of 4 inches between, and their poles are in the same direction.

d. two magnets are laid side by side with a distance of 4 inches between, and with their poles in opposite direction.

**2. Discuss your predictions with the members of your group, and then write them down.**

**3. Using the materials listed above, design experiments to find out how and to what degree do your predictions compare or differ from what actually happened.**

**Then answer the following questions:**

1. How does the magnetic field look when the two similar poles of two magnets are facing each other?
2. How does the magnetic field look when the two different poles of two magnets are facing each other?
3. How does the magnetic field look when the two similar poles of two magnets are laid side by side?
4. How does the magnetic field look when the two different poles of two magnets are laid side by side?

## Activity 3: Problem Solving

### Materials:

Compasses, Bar magnet, pencil and white paper.

**1. Predict the magnetic lines of force if you move the compasses at a distance of:**

a. 1 inch

b. 2 inches.

c. 5 inches

d. 7 inches.

**2. Predict what kind of magnetic lines force and magnetic field you will obtain if you:**

a. turn the magnet over on its narrow side?

b. turn the magnet over on its wider side?

c. stand the magnet on one end (pole) of the bar?

d. stand the magnet on the second end (pole) of the bar?

| The Way the Magnet Bar is Laid Down | Prediction of Magnetic Force | | What Actually Happened In the Magnetic Force | |
|---|---|---|---|---|
| | Lines of Force | Field | Lines of Force | Field |
| over on its narrow side | | | | |
| over on its wider side | | | | |
| on one end (pole) of the bar | | | | |
| on the second end (pole) of the bar | | | | |

**3. Is there a difference in the direction toward which the needles of all the compasses point at when:**

a. the magnet is turned over on its narrow side? and why?

b. the magnet is turned over on its wider side? and why?

c. the magnet is placed on one end (pole) of the bar? and why?

d. the magnet is placed on the second end (pole) of the bar? and why?

## Critical Questions & Answers

Q. Explain why modern life would be impossible without magnetism. Support your answer with a number of examples.

A. Magnetism is used to produce electricity in power stations, to make compasses, loudspeakers, electric motors, refrigerator doors, cassette recorders, and computer disks.

Q. Why should you remove your wristwatch before you work with a magnet or a compass?

A. Because most wristwatch include parts that are made up from metal. The metal in your watch might interfere with your experiments and obtaining accurate data.

Q. The imaginary lines that pass from one magnet to the other are called flux lines. Do you expect to have flux lines if you put two opposite poles of two bar magnets close together? Why or why not?

A. The flux lines will be formed because the magnets attract each other.

Q. Do you expect to have flux lines if you put two similar poles of two bar magnets close together? Why or why not?

A. The flux lines can't be formed because the magnets repel each other.

Q. What is the invisible force of the pulling magnet which can be noticed only by the effect it produces called?

A. A magnet is an object that has the ability to attract iron and other magnetic materials. The pull of the magnet is called magnetism.

Q. How can you make triangle, square, or ______ with magnetic bars? What does this say about the behavior of the same kind poles and the behavior of different kinds of poles?

A. To make triangle, square, or ______ with magnet bars, you need to put earth north pole next to south pole. This will make the opposite poles attract to each other, the geometric shape keeps its shape. But if you put two north poles or south poles together, the geometric shape will fall apart.

Q. Which of the physical properties of an object can help in identifying a magnet from non-magnet material?

A. None of the physical properties of a given object can be helpful in identifying a magnet from non-magnetic material.

| **Properties** | **Matter before being magnetized** | **Matter after being magnetized** |
|---|---|---|
| Appearance | | |
| Weight | | |
| Size | | |
| Smell | | |
| Taste | | |
| Feel | | |
| Sound | | |
| Picking Paper Clips | | |
| Attracted to Magnet | | |
| Repelled by Magnet | | |

Q. Tin is not magnetic matter, yet a tin can is attracted to magnet and effected by magnetic force (magnetism). Can you find a reasonable explanation to this phenomenon?

A. A tin can is not really made of tin. It is made of iron or steel coated with tin. Thus, the magnetic force affects the iron and not the tin.

Q. Magnetism is defined as the invisible force that a magnet exerts on to pull a magnetic material or to pull or repel another magnet. This force can be felt but it cannot be seen. Can you think of other forces that cannot be seen but their effect can be felt?

A. Gravitational force which pulls everything on earth to the surface of the earth and keeping it from flying. Also, the wind force that can be used to generate electricity, pulling water from the ground, etc.

Q. What will happen to the weight, size, appearance, smell, taste, sound, feel of a material when it becomes magnetized?

A. When a material becomes magnetized, it doesn't change its weight, size, appearance, smell, taste, sound, feel.

2. Can weight, size, appearance, smell, taste, sound, and feeling be used to distinguish between magnetic and non-magnetic materials?

A. Since a matter cannot change its weight, size, appearance, smell, taste, sound, feel when it becomes magnetized, it cannot be used to distinguish between magnetic and non-magnetic materials.



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# Mini-Ideas in Astronomy

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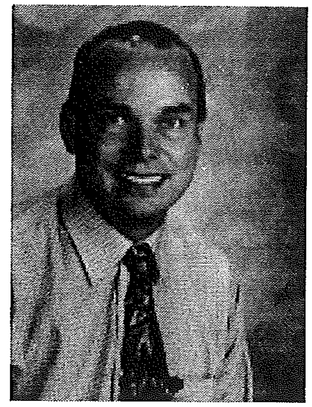

## How Many Stars Can I See?

**Grade Level 6-8**

This is a good night time activity for extra-credit or a long-weekend homework assignment.

Procedure: Give each student a piece of paper about 8 x 11" and show them how to roll it into a cone. The diameter of the cone multiplied by 4, divided by the length of the cone is the fraction of the sky that can be seen through the cone by looking through the small end. Explain to the students that they are to look through the small end and count the number of stars they see in the field of view. Have them do this in ten directions, then average the number of stars seen. The student then multiplies the average by one over the fractional part of the sky their cone can see. This is the number of stars that can bee seen with the unaided eye.

**Extension Idea:**

Find someone on the ISTA list-serve that will do this same activity in a darker location (away from bright city lights) or a light polluted area (Chicago, Rockford etc...) and have the two classes compare their results vie e-mail.

## Calculating the Diameter of the Sun

**Grade level 6-12**

This activity can be performed on any sunny day in approximately 45 minutes

**Warning: Looking Directly at the Sun Will Cause Blindness!**

**Explain to your students the following directions:**

1. Make a hole in a piece of cardboard with a sharp pen or pencil. Make the hole about 1-2 mm large.

2. Measure the diameter of a dime and record the measurement in km. Remember that: there are 1000 meters in 1km, and there are 100 cm in meter, and there are 10 mm in 1 cm.

3. Place the dime on the ground and hold the cardboard in such a way that the Sun's light falls upon the coin and just covers the dime.

4. Have your partner measure the distance between the cardboard and the coin using kilometers.

5. Use the following information:

a. The Sun is about 150,000,000 km away from the Earth.

b. The ratio of image size of the Sun to image distance is about 1/10.

6. Use this formula to solve the problem:

$$\frac{D}{H} = \frac{D^{**}}{150{,}000{,}000 \text{ km}}$$

Where:

D = diameter of the dime in km

H = The distance between the cardboard and the dime in km

D** = The diameter of the Sun in km

As the students bring their results to class, discuss the various results and ask them ways they analyzed the results. If you are trying this in a high school setting, lead the students into a discussion about measuring distances and sizes using similar triangles.

## Measuring the Sun's North-South Movement

This activity can be performed on any sunny day and is exceptionally good as a long extension activity.

**Grade level 6-12**

Teacher note: Introduce the activity, but do not explain immediately why the class will be doing it or what information will be learned from the activity

Ask a group of students to measure the length of the shadow of a prominent pole or building on your school grounds at one-week intervals for several weeks (at least 6) at the same relative time of day. Have the students make a scale drawing of the Sun's motion on a community poster board that subsequent groups will use to make measurements. Display the poster board in class and invite students after a few weeks to discuss what is happening and why.

The Sun's motion will become obvious after the fourth week and at that time you can lead the students in a discussion about what they have observed if no one in your class has made the connection.

# Names For That Term

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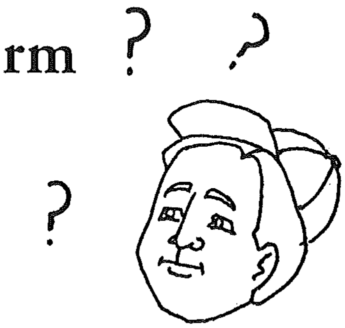


It is often a daunting task for school children to remember terms and definitions. I have found that if they can associate something with the term, the task of recalling content is easier. Many of the scientific terms we teach are named after memorable scientists. Teaching about the individual for who the term is named personalizes the information and makes it more interesting. Below are just a few terms and definitions named in honor of great men and women who have made contribution in science.

**Ampere:** A unit of electric current, also known as "amp", named after Andre Marie Ampere. Ampere, 1775-1836, was a French mathematician and physicist who is regarded as the father of electrodynamics. The **ampere turn**, a unit of magneto motive force is also named for him.

**Celsius:** The temperature scale that registers the freezing point of water as 0 C and the boiling point as 100 C. Also know as "centigrade." The scale was developed by Anders Celsius, 1701-1744, a Swedish astronomer.

**Coulomb:** A unit of electrical charge equal to the quantity of charge transferred in one second by a steady current of one ampere. The unit is named for Charles Augustin de Coulomb, 1736-1806. This French physicist experimented with elasticity, electricity, and magnetism. Also named after him: **Coulomb Field**—An electric field equivalent to that produced by a point charge so that the force at every point is described by Coulomb's law. **Coulomb Force**—An attractive or repulsive electrostatic force described by Coulomb's law. **Coulomb Potential**—The potential at any point in a Coulomb field. **Coulomb Scattering**—The scattering of a charged particle from another charged particle, especially from an atomic nucleus, as a result of Coulomb forces. **Coulomb's Law**—The fundamental law of electrostatics stating that the force between two charge particles is directly proportional to the product of their charges and inversely proportional to the square of the distance between them.

**Curie:** A unit of radioactivity which designates radioactive disintegration. The term is in honor of Marie Curie, 1867-1934. The Polish born French chemist discovered radioactivity in thorium, polonium, and radium. She received the Nobel Prize in physics with her husband Pierre for their discoveries.

**Curie Law:** The law that the magnetic susceptibility varies inversely with absolute temperature in a paramagnetic substance with negligible interactions among magnetic carriers. Named after Pierre Curie. Also named for him, **Curie Point** which is the transition temperature making a change in the magnetic properties of a substance, especially the change from ferromagnetism to paramagnetism.

**Curium:** Element 96 named for Marie and Pierre Curie.

**Einsteinium:** Named after Albert Einstein, 1879-1955, the German-born American physicist. Einsteinium is element 99 and is a synthetic element.

**Fahrenheit:** The temperature scale that registers freezing as 32 F and boiling of water as 212 F. Named in honor of Gabriel Fahrenheit, 1686-1736, a German born physicist who lived in Holland and developed the mercury thermometer.

**Farad:** A unit of capacitance, equal to the capacitance of a capacitor having a charge of one coulomb on each plate and a potential difference of one volt between the plates. Named for Michael Faraday, 1791-1867, British chemist and physicist. Also named for him, **Faraday** which is the quantity of electricity that is capable of depositing or dissolving one gram equivalent weight of a substance in electrolysis.

**Fermion:** A particle, such as an electron, proton, or neutron, having half-integral spin. Named after Enrico Fermi, 1901-1954, Italian born American atomic and nuclear physicist whose experiment led to the first self-sustaining chain reaction. Also in his honor, **Fermium,** a synthetic element with the atomic number of 100.

**Henry:** The unit of inductance in which an induced electromotive force of one volt is produced when the current is varied at the rate of one ampere per second. Named for Joseph Henry, 1797-1878, an American physicist who performed the fundamental studies of electromagnetic phenomena.

**Joule:** The unit of energy equal to the work done when a current of one ampere is passed through a resistance of one ohm for one second. Also, the unit of energy equal to the work done when the point of application of a force of one newton is displaced one meter in the direction of the force. Named for the British physicist James Prescott Joule, 1818-1889.

**Lawrencium:** A synthetic transuranic element having a single isotope with a mass number of 257 and an atomic number of 103. This element has a half-life of eight seconds and its symbol is Lw. Named after Ernest Orlando Lawrence, 1901-1958, an American physicist who invented the cyclotron.

**Mach Number:** (As in Mach 1) The ratio of the speed of an object to the speed of sound in the surrounding medium and is used to measure the speed of sound or sonic barrier. Named for Ernst Mach, 1836-1916, an Austrian physicist and philosopher.

**Mendelevium:** A radioactive transuranic element with the atomic number of 101 and a mass numbers of 255 and 256. Its atomic symbol is Md. It was named in honor of Dmitri Ivanovich Mendel, 1834-1907, a Russian chemist who first and devised and published the periodic table of elements.

**Mendel's Laws:** The principles of heredity of sexually reproduced organisms formulated by Gregor Mendel. Mendel, 1822-1884, an Austrian monk is considered the founder of the science of genetics.

**Nobelium:** A radioactive transuranium element, artificially produced in trace amounts. Its atomic number is 102 and has mass numbers of 252, 253, 254, 255, and 256. It is named for Alfred Nobel, 1833-1896, a Swedish chemist and inventor. Nobel invented the explosive TNT and established the Nobel Prizes.

**Ohm:** Named after Georg Simon Ohm, 1787-1854, a German physicist. A unit of electrical resistance equal to that of a conductor in which a current of one ampere is produced by a potential of one volt across its terminals.

**Pasteurization:** The process of destroying most disease producing microorganisms and limiting fermentation in milk, beer, and other liquids by partial or complete sterilization. Named for its discoverer, Louis Pasteur, 1822-1895, a French chemist who made discoveries in immunology and microbiology. Also, named for him is the **Pasteur Treatment,** which is a treatment for rabies in which the growth of antibodies is stimulated during the incubation of the disease by increasingly strong inoculations of the attenuated rabies virus.

**Roentgen:** A unit of radiation dosage named for Wilhelm Roentgen, 1845-1923, the German physicist who discovered and studied x rays.

**Volt:** A unit of electric potential and electromotive force equal to the difference between two points on a conducting wire carrying a constant current of one ampere when the power dissipated between the points is one watt. Named for Count Alessandro Volta, 1745-1827, an Italian physicist and pioneer in the study of electricity.

**Watt or Wattage:** An amount of power, especially electric power. It is the amount of power needed by an appliance or device. It is equal to one joule per second. Named for James Watt, 1736-1819, a Scottish engineer and inventor who invented the modern condensing steam engine and the centrifugal governor.

**Weber:** A unit of magnetic flux equal to the magnetic flux that in linking a circuit of one turn produces in it an electromotive force of one volt as it is uniformly reduced to zero within one second. Named for Wilhelm Weber, 1804-1891, German physicist who studied electricity.

# Merry Scientific Christmas


*Lee R. Marek*

Lmarek@aol.com
http://www.ncusd203.org/north/depts/science/chem/marek/


**1. Twas the NIGHT before Christmas**

A. because the Earth was rotating on its axis

B. because the Earth was revolving around the Sun

**2. And all THROUGH the house**
**What type of object allows light to pass through?**

A. opaque

B. translucent

**4. Not even a MOUSE**

A. vertebrate

B. invertebrate

**5. The stockings were hung by the CHIMNEY with care**
**A chimney allows heat to escape mainly by**

A. conduction

B. convection

**6. In hopes that St. Nicholas soon would be there.**
**What chemical element is represented by the symbol Ni?**

A. nitrogen

B. nickel

**7. The children were nestled all snug in their BEDS**
**As you sleep your metabolism**

A. increases

B. decreases

# Opportunities

## It's That Time of the Year

*Scott Evans*

Illinois Junior Academy of Science
847-991-6200 ext. 2069

Autumn is in full swing. Each year as summer dies, familiar autumn rituals are played out in science labs all over Illinois. Science teachers prepare for thundering herds thirsting for knowledge, shattering the peace now permeating our dark and deserted hallways. What is it that brings science teachers back to the classroom year after year? Is it the nostalgic smell of sweaty sneakers mingled with formaldehyde? The irresistible drama of the carbon cycle? Or is it those damn little coupons in the mortgage booklet that never seem to end.

In hundreds of schools across the state, one autumn ritual that rewards both teachers and students is science fair. For many, participating in science fair is one of unforgettable highlights of middle and high school. For students, it's an opportunity to focus all those science, math, language arts, history, and computer skills on a single project that they can choose and develop. They may also receive prizes and scholarships. For teachers, it's an opportunity to meet state science goals while helping their kids get excited about science.

The Illinois Junior Academy of Science (IJAS) has sponsored the state's regional and state science fairs since 1927. IJAS is a not-for-profit, volunteer organization made up of science teachers such as yourself and others interested in the advancement of science education in Illinois. Our mission is to help you share the excitement and adventure of science with your students in a noncompetitive environment. Our emphasis is on development of individual and team excellence.

It's easy to get involved. Just call the number below to talk an IJAS volunteer. We'll tell you how to join IJAS and get started. Your $50 IJAS membership gives your school access to all IJAS activities and benefits. Call IJAS today and make science fair involvement one of your autumn rituals.

NEW THIS YEAR...If you have participated in the regional or state fairs in the past and would be willing to mentor a new sponsor, please call the number above. Your help is greatly appreciated.I hope to hear from you soon!

## ISTA Regional Conferences

Regional conferences foster opportunities for Illinois science teachers to meet in locations close to home and to encourage science teachers who are not ISTA members to join the Illinois Science Teachers Association. For guidelines regarding consideration for financial support up to $500, individuals or groups interested in running an ISTA Regional Conference should contact:

Diana Dummitt
University of Illinois
College of Education
1310 S. Sixth Street
Champaign, Illinois 61820
ddummitt@uiuc.edu
217-244-0173

TOSHIBA

# Looking for Classroom $$?

**The Toshiba America Foundation provides cash grants to classroom teachers to assist them in making improvements in the teaching of science and mathematics.**

Toshiba America, Inc. is a $10 billion holding company of diversified operations including electronic products and systems. TAI is a subsidiary of the $60 billion Toshiba Corporation, a world leader in high technology which manufactures numerous products related to electronics and energy.

The Toshiba America Foundation is a private, endowed, not-for-profit grant making organization dedicated to supporting education programs and activities in the United States. The mission of the Toshiba America Foundation is to contribute to the quality of science and mathematics education in U.S. communities by investing in projects designed by and with classroom teachers to improve science and science-related education for students in schools, grades 7 thru 12. The Foundation reviews hundreds of proposals every year. The average award for a small project is slightly less than $4,000. For a larger grant, the average is approximately $9,500. The Foundations total annual grants budget is approximately $500,000. The Toshiba America Foundation was created in 1990 by Toshiba America, Inc. (TAI) and the five Toshiba America group companies operating in the U.S. Grants are available for teachers in grades K-6 and for grades 7-12.

Small grant proposals less than $5,000 are reviewed every month except March and September. Proposals larger than $5,000 are reviewed in March and September each year.

To request an application, please contact the Toshiba America Foundation at: 212-588-0820
e-mail: foundation@tai.toshiba.com.
Web: http://www.toshiba.com/about/taf.html.

# New High School Science Webquests and Websites

*Alwyn Botha*

http://www.what-is-the-speed-of-light.com/webquests/science-webquests-index.html

http://www.what-is-the-speed-of-light.com/webquests/high-school-science-websites.html

http://www.the-planet-mars.com

http://www.galileo-galilei.org

http://www.the-solar-system.net

http://www.the-planet-pluto.com

http://www.the-planet-saturn.com

http://www.the-planet-jupiter.com

http://www.why-is-the-sky-blue.org

http://www.what-is-the-capital-of.com

http://www.what-is-the-speed-of-light.com

http://www.1001-periodic-table-quiz-questions.com

# Awards

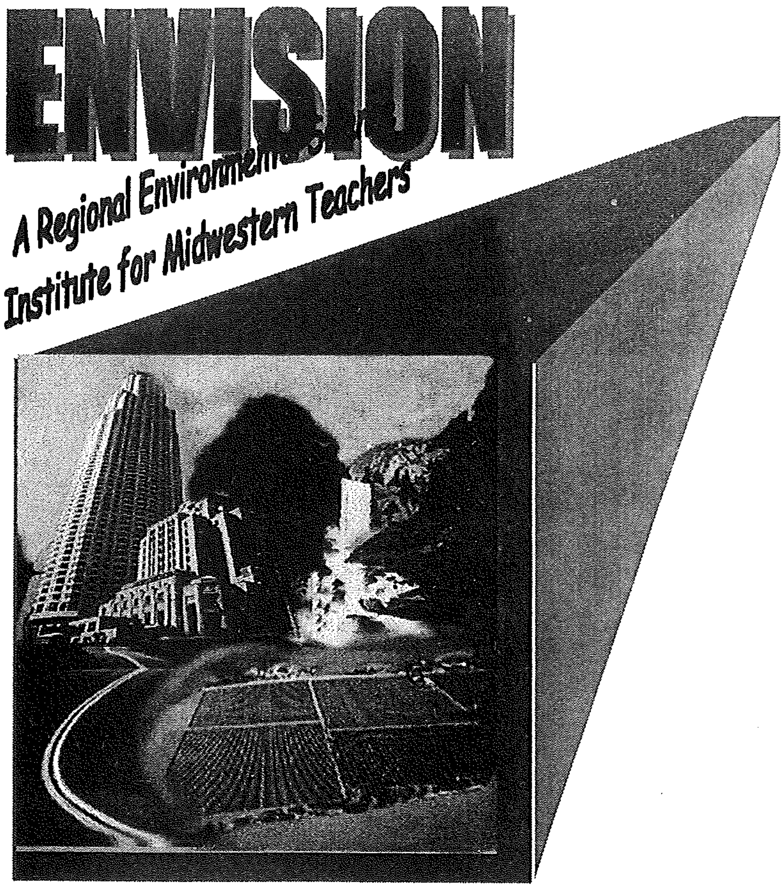
## Congratulations to the 2001 Presidential Award for Excellence in Science Teaching Finalists!

Honored at the ISTA Recognition luncheon at the Pere Marquette Hotel in Peoria on October 12, 2001. Left to right: Elaine Modine, Coleen Martin, Randi Brown Hattery and ISTA President Edee Norman Wiziecki. Unable to attend: Lydia Davenport, Deborah Clinebell, and Lisa Tomlin.

## Don't Be Left Out!

**ISTA will be unveiling several new monetary awards and interships early in 2002. Check out the website in January**

**www.ista-il.org**




**Spring Pre-Institute**
**April 25, 26, 27, 2002**

**Summer Institute**
**July 8 – 30, 2002**

**ENVISION** A Regional Environmental Science Institute for Midwestern Teachers from Wisconsin, Minnesota, Michigan, Indiana, Iowa, Illinois, Kentucky, and Ohio. ENVISION, funded by the National Science Foundation, is recruiting for the 2002 Institute. ENVISION utilizes modules to prepare middle level leadership teams that are experienced in team-based research and knowledgeable of: environmental concepts and issues, inquiry skills for investigating environmental issues, appropriate curricular, pedagogical, and assessment practices for teaching science within studies of local environmental issues, and strategies to develop educational partnerships with local government, industry, and business.

## Participant Responsibilities

Leadership teams consist of teachers, grades 4-9, at one of two levels of participation. A team should have a minimum of one Level I and one Level II participant.

**Level I** participants will attend all spring and summer project activities and will lead a local staff-development program in their school district. They will work with Level II participants in the local adoption of ENVISION concepts and approaches.

**Level II** participants, trained by their Level I teammates, will attend project activities conducted at the regional and local school site, will actively implement the ENVISION concepts and approaches, and will assist Level I teachers with staff-development.

## Module Descriptions

**ENVISION** is a multidisciplinary approach to the development of scientific concepts and inquiry skills focusing on:

- **Water and Watersheds** – emphasis is on environmental science concepts and issues surrounding water, streams, and wetlands.
- **Urban and Built Environments** – environmental concepts and issues related to buildings, cities, and suburbs are investigated.
- **Rural Environments** – the effects of human activities and agricultural practices on rural environments are explored.

## How to Get Involved

- visit our web site at http://www.eas.purdue.edu/geomorph/envision
- contact us via email at envision@purdue.edu
- send your name and address to: ENVISION 1442 LAB, Dept. of Curriculum & Instruction, Purdue University, West Lafayette, IN 47907-1442, 765-494-0803

**APPLICATION DEADLINE: FEBRUARY 15!**

## Expanding Your Horizons Through Mathematics and Science

***A Conference for 6th - 10th grade girls, their parents, and educators***

**Saturday, March 2, 2002**
**Illinois State University**

- **Participate in exciting "hands-on" career workshops, investigate careers, and visit displays in mathematics, science, medicine, business, government, and computers with successful women in these fields.**
- **CPDU credits available in math, science, and technology toward the renewal of the Standard 5-year or Master 10-year certificate.**
- **Scholarships available for participants requiring financial assistance.**

**For More Information Contact**

**Dr. Carol T. Benson, Director**

**Telephone: 309-438-3012**
**E-mail: EYHatILSTU@netscape.net**

**Website: www.eyh.ilstu.edu**

# SWE and ISTA Present The Hoffman Program

# A workshop to encourage girls' interest in Math and Science

On Saturday, March 2, 2002, the Chicago Regional section of the Society of Women Engineers (SWE) presents a 9AM-3PM workshop focused on improving guidance counseling for Junior High School girls especially in regards to math and science. The workshop program consists of sessions on mentoring, self-esteem, and tools to help encourage girls in math and science. The tools include activities, web page information, and local SWE section activities for girls. The workshop will provide math and science teachers, and guidance counselors the chance to interact with SWE members and learn how SWE can help with activities to keep girls interested in math and science. It will be held in the western suburbs of Chicago (location to be announced).

The workshop is provided at no charge and lunch is included. Funding for this program is provided through the National Society of Women Engineers through the Hoffman Program. Presenters are professional engineers who are members of the National SWE Career Guidance Committee. CPDUs will be offered by the Illinois Science Teachers Association (Provider #100251).

Registration is required. Detailed information will be available shortly on the Chicago SWE Career Guidance web site at: http://www.iit.edu/~swe-chi/careerguidance.html

For advance information, send email to Anne Lucietto at anne.lucietto@swe.org.

# ExxonMobil

# Congratulations to Our First Annual Awardees!

Left to right: J. Patrick McGinn, ExxonMobil Midwest Public Affairs Manager, Jacklyn Naughton, Diana Dummitt, ISTA Executive Director, Edee Norman Wiziecki, ISTA President, and Bill Donato at the 2001 Reception at the ISTA Convention in Peoria.

## ISTA/ExxonMobil Exemplary High School Science Teacher
## $5,000 Winner: William Donato

Bill Donato currently teaches Environmental Science and Advanced Biology at Woodstock High School in Woodstock. During the past 11 years, Bill and his students have been involved in the analysis and testing of the Kishwaukee River. One of his former students (now colleague) wrote, "Bill is one of those educators who are so passionate about children that he is considered a friend to many of his students. He presents challenges to his students and makes them work hard, but also allows enough humor into the classroom to encourage students to want to be there."

## ISTA/ExxonMobil Exemplary High School Science Teacher
## $2,500 Runner Up: Jacklyn Naughton

AP Biology and Honors Biology are the subjects currently taught by Jacklyn Naughton, teacher at Niles North High School in Skokie. Jacklyn utilizes computer technology in data collection, graphing and statistical analysis. She has developed many online activities and employs a web site that is written in conjunction with the text she uses in AP Biology. Students can prepare for labs using this site and email their results. She started the Research & Investigators Of Tomorrow (RIOT) Club, twelve years ago with five members and it has now grown to 57 members.

# Student Corner

## Chemical Reactions

*Carol Dreyer*

Student, Columbia College

Now I know you know about atoms in and out
But what's this reacting stuff all about?
Well, these atoms decided to get into action
And this is what's called a chemical reaction

Basically these atoms just got bored
And decided to share the energy they'd stored
The atoms can make and break their bonds
And join up with other atoms of which they're fond

Atoms do this reacting stuff all the time
They can hook up with any atom they find
That is, if the other has something they need
Or if they can help one out, yes indeed

Electrons are the stuff atoms share
Or lose one to another, if they dare
But sometimes they'll gain an electron or two
Or sometimes they share or exchange quite a few

Oxidation is what we call it when an electron is lost
To another atom and this is no cost
Because from the other atom they will receive
Something that it really really needs

When an atom gains an electron, we call it reduction
And it will develop a whole new construction
Oxidation and reduction occur at the same time
That's what it takes for atoms to combine

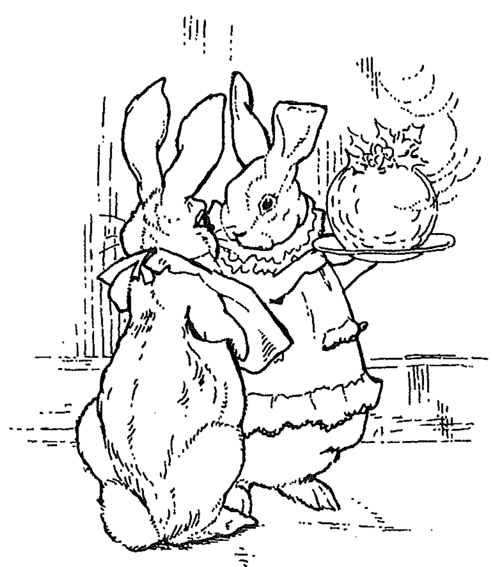
So what do we call the parts of all this?
(This is a part you won't want to miss)
Reactants or substrates are the stuff we need to start
(That's basically just all the separate parts)

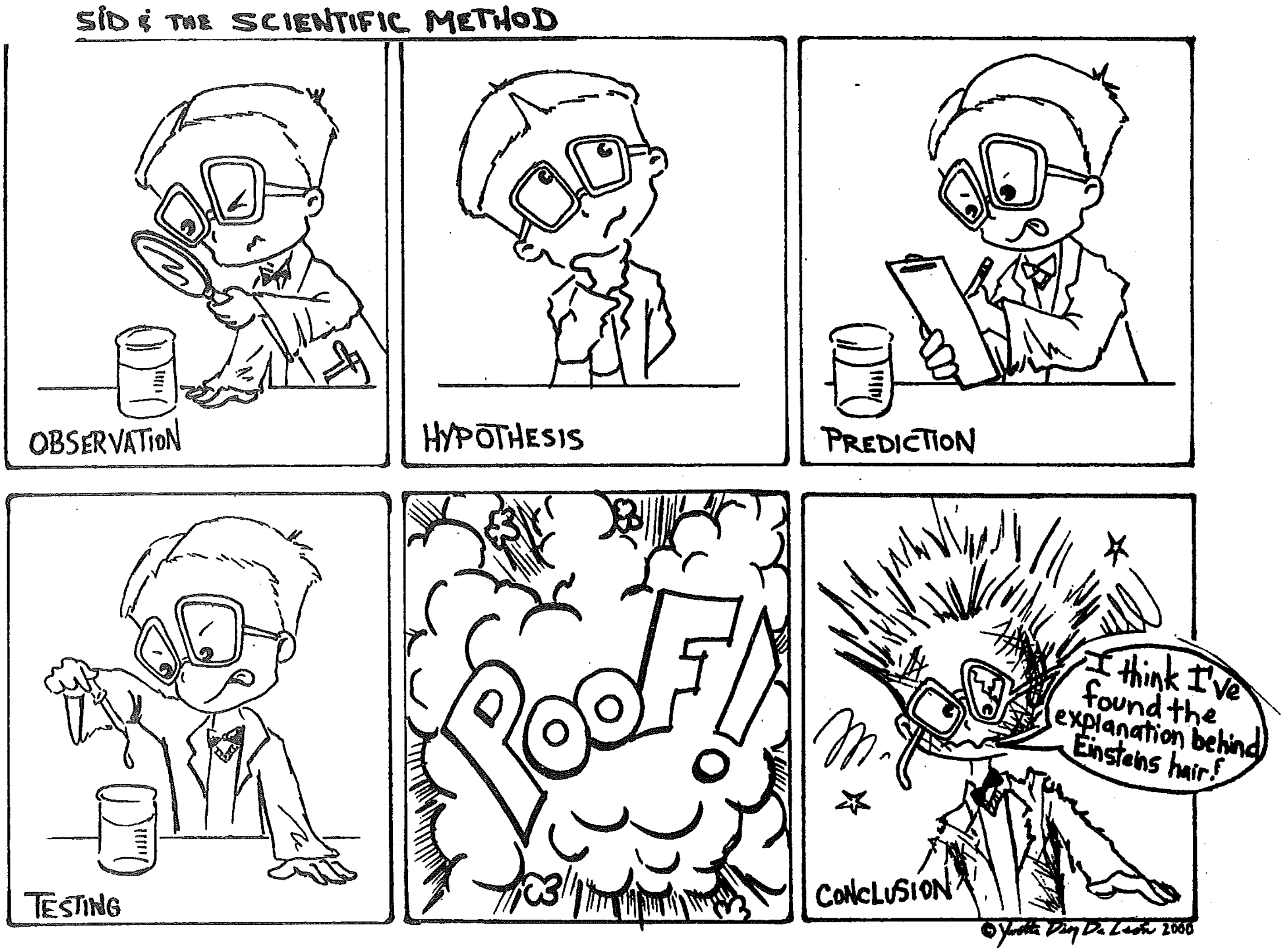
Not all chemical reactions are the same
If they were, that would be quite a shame
Since there's a ton of energy flowing around
We have to define them according to what we've found

Energy, that is, is what determines what kind
Of reaction we have – it's easy to define
Exergonic reactions are ones that give off energy
(It's released in the reaction, you see)

Endergonic reactions are just the other way
They take in energy, at the end of the day
But this energy just doesn't come out of thin air
And outside source has to put it there

So, now we know about chemical reactions
But how can we be sure that one really happened?
Any change in energy is how we can tell
And now you know about reactions quite well






# WRITE FOR *SPECTRUM*

The quality of *The Spectrum* is directly proportional to the relevance of its contents to your classroom. This invitation is a request for you to help colleagues across the state to take advantage of your experience.

In responding to this invitation, you will get a three-fold return on the opportunity. You will: 1) obtain experience in publishing; 2) receive feedback from the teachers across the state about your idea(s), and; 3) participate in the responsibility that is key to science: The communication of ideas!

With this in mind, share with us your teaching ideas for curriculum, laboratory experiences, demonstrations, assessment, portfolios and any innovations you have found to be successful with science students. Photographs for the cover are also needed. Please send to Diana Dummitt at the address on the inside front cover:

- if possible, the article on disk (IBM or Mac) saved in RTF format, in addition to a hard copy, or sent electronically as an attached RTF document. Email to: ddummitt@uiuc.edu
- a title page with the author's name and affiliations, a brief biographical sketch of three or four sentences, home address, home telephone number (If there is more than one author, send all information for each), and e-mail address (if applicable).
- black and white photographs that are of good composition and high contrast.
- sketches, figures, and tables when appropriate.
- references if necessary—format is your choice.
- indicate whether or not the article has been published or submitted elsewhere.

Spectrum is published 3 times a year. Deadlines and publication dates can be found on page 3. Materials, including photographs, will be returned only if accompanied by a request in writing and a self-addressed stamped envelope.

# *Are you a current member?*

## *Check the label on the back cover. If it says Dues to 1/2002 this will be the last Spectrum you will receive.*

## *Don't Miss Out! Renew today!*

**Here are your membership options:**

**Option 1**

Full Membership Dues- $35.00 Full Membership entitles individuals interested in Illinois science education to the following benefits: a one year subscription to the SPECTRUM, and ISTA ACTION; notification of regional conferences and meetings; invitations to science issues activities; a reduced registration fee for the Annual ISTA Conference; voting privileges; and the opportunity to hold an ISTA Officer position.

**Option 2**

Two-Year Full Membership Dues- $60.00 — Two-Year Full Membership entitles member to Full Membership benefits for two years.

**Option 3**

Five Year Full Membership Dues- $125.00 — Five Year Full Membership entitles member to Full Membership benefits for five years.

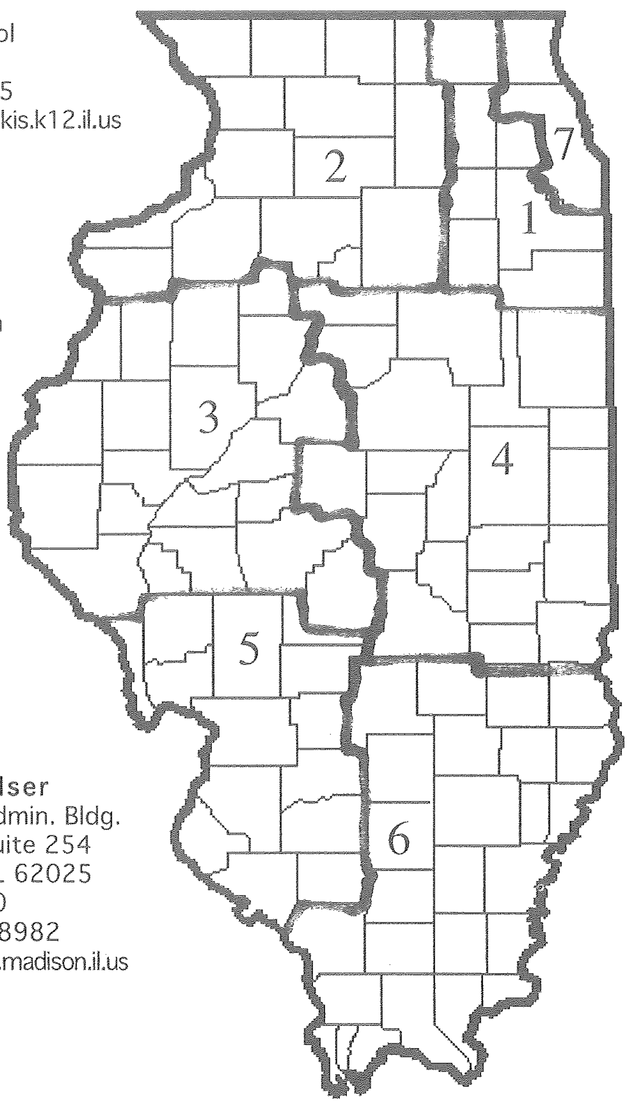
**Option 4**

Associate Membership Dues- $15.00 — For full-time students and to individuals who are on retirement status. Entitles member to Full Membership benefits, with the exception of voting privileges and the opportunity to run for office.

**Option 5**

Institutional Membership - $75.00 — Institutional Membership entitles the member institution, for a period of one year, to two subscriptions to the SPECTRUM and ISTA ACTION; notification of regional conferences and meetings; invitations to science issues activities; and a reduced registration fee for the Annual ISTA Conference for a maximum of three members of the institution.

# ISTA REGIONAL DIRECTORS





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# ILLINOIS SCIENCE TEACHERS ASSOCIATION
# 2002 MEMBERSHIP APPLICATION

PLEASE PRINT OR TYPE AND FILL OUT COMPLETE FORM

| | |
|---|---|
| Name | Day phone |
| Affiliation (School or Organization) | Home phone |
| Address of above organization | Home address |
| City, State, Zip Code | City, State, Zip Code |
| e-mail and/or FAX | County |

## CHECK APPLICABLE CATEGORIES IN EACH COLUMN

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| o Elementary Level | o Elementary Sciences | o Teacher |
| o Middle Level | o Life Science/Biology | o Administrator |
| o Senior High School | o Physical Sciences | o Coordinator |
| o Community College | o Environmental Science | o Librarian |
| o College/University | o Earth Science/Geology | o Student |
| o Industry/Business/ Government | o Chemistry | o Retired |
| o Other____________ | o Physics | |
| | o General Science | |
| | o Integrated Science | |
| | o Other_______________ | |

Send form and check or money order made payable to Illinois Science Teachers Association to: Diana Dummitt, ISTA Membership, College of Education, University of Illinois, 1310 S. Sixth Street, Champaign, IL 61820

**MEMBERSHIP OPTION** (See page 48)__________

**AMOUNT ENCLOSED**__________

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