SPECTRUM

THE JOURNAL OF THE ILLINOIS SCIENCE TEACHERS ASSOCIATION

Congratulations to Sandra Gasparovich ISTA Teacher of the Year!

SPRING 2001

SPECTRUM

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ISTA President Donald Nelson presenting the ISTA Teacher of the Year Award to Sandy Gasparovich at the 2000 ISTA Awards Luncheon. Read more about Sandy on page 3 of this issue.

ISTA NEWS

PRESIDENT'S LETTER

ISTA Town Meetings: Listening To Our Members

Any organization that loses touch with its membership does so at its peril. While ISTA's officers and board members take their leadership roles very seriously, we know that without your support there is little that we can do for science education in Illinois. As a result, we have continued to seek opportunities to share our ideas with you and, in turn, to hear what's on your mind. One approach that we have instituted to facilitate such communication is the ISTA Town Meeting held in conjunction with our annual conference.

The purpose of the ISTA Town Meeting is to bring together our leadership and our members to discuss important issues regarding science education and our organization. Last fall at the ISTA conference at St. Charles, a Town Meeting was held after our Awards Luncheon. ISTA officers and board members met with conference participants to answer a series of key questions derived from ISTA's strategic plan. Those questions included...

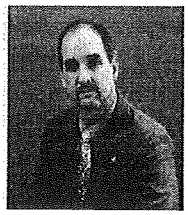
- What can ISTA do to support science teachers' professional development needs?
- How can ISTA support communication and networking among Illinois teachers of science?
- What can ISTA do to establish collaborative relationships with others interested in promoting science education (business, industry, professional organizations, state agencies, etc.)?
- How can ISTA effectively disseminate information of interest to Illinois teachers of science?
- What can ISTA do to advocate for Illinois teachers of science?
- What can ISTA directors and members do to promote science education within your region?

Following the Town Meeting, each group's responses were recorded, collected and summarized. The ISTA board reviewed these collected comments at our December meeting and asked me to share a summary of the Town Meeting remarks with you. I also want to let you know how ISTA's leadership is reacting to those suggestions.

Many of our members were concerned about recertification and wondered what ISTA will do to help meet their continuing professional development needs. One way ISTA reacted to this need was to have participation forms available at the St. Charles conference for interested attendees. ISTA has now been approved as a professional development provider and ISTA will offer a variety of CPDU and CEU opportunities to our members during the coming year.

Several members advocated for enhanced communication and dialogue through a variety of means. I want to let you know that we are revamping our ISTA-il.org web page to improve its value to our members. We are also considering a revision of the format for our journal, *Spectrum*. We will also continue to offer the quarterly *ISTA Action* newsletter. In addition, we will encourage our members to sign on to our list serv, *ISTA-talk*.

The Town Meeting revealed that ISTA members clearly appreciate the value of collaboration and asked what ISTA is doing to work with other education organizations and agencies. One of the ways in which are in touch with other organizations is through our involvement with the Illinois Alliance (see my message in the Fall 2000 *Spectrum*). We are also very excited about the *Building a Presence for Science* project where we have partnered with NSTA and ISBE to offer science education information and training to teachers across Illinois (see my message in the Summer 2000 *Spectrum*).



Participants at the Town Meeting were also interested in learning more about science education activities within their own regions. ISTA has worked long and hard to find a mechanism for addressing regional needs. As a result, we have cosponsored several regional conferences such as "Science in the South" and the "K-8 Update Conference." Many of our regional directors have put in considerable effort to reach out to their regional members. For example, Region 2 and 3 directors recently sponsored a field trip to the Illinois State Museum and State Forensic lab for members.

The ISTA board was gratified to see that many of the suggestions from our members are already being addressed by our strategic plan. It will be crucial for us to continue to implement this plan and, just as importantly, to communicate to our members what we are doing on their behalf. You have our assurance that we are interested in your ideas and in helping put those ideas into action.

However, I cannot end this essay without reminding you, our members, that ISTA's effectiveness relies as much on you as on your leadership. It is absolutely essential that you keep your membership current, participate in ISTA-sponsored events, and offer your time as an ISTA officer, board member or committee member.

Our Town Meetings imply that we are "all in this together" as educators who share a collective vision about teaching and learning. Let's capitalize on this common belief by helping ISTA fulfill its commitment to quality science education for all of Illinois' students.

"Exploring the Environment Through Science"

Illinois Science Teachers Association Annual Convention

October 11-13, 2001
Peoria Civic Center

Call for Presentations
Deadline for presentations: April 16, 2001

ATTACH NAMES AND ADDRESSES FOR ALL CO-PRESENTERS SO THEY WILL APPEAR IN THE FINAL PROGRAM.
I can be available for o Friday's program o Saturday's program o either day

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
FAX	E-mail address

Title of presentation (10 word maximum) _____
Program description as you wish to appear in the program book (25 word maximum)

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DUE TO LIMITED SPACE, PRESENTATIONS MUST BE LIMITED TO 50 MINUTES.

I. Type of Session	II. Intended Audience	III. Subject Area	IV. Science Goals
o hands-on workshop	o preschool	o earth and space science	o Goal 11
o demonstration	o elementary	o chemistry	o Goal 12
o lecture	o middle/Jr. high	o physics	o Goal 13
o other	o high school	o biology	
	o college	o ecology/environment	
	o teacher preparation	o science/tech/society	
	o general	o technology	

IV. Equipment Required o overhead projector o slide proiector
Note: We are prepared to furnish only overhead, screen, and slide projector. Other equipment, including computers, needs to be furnished by presenters. If you need any special arrangements or equipment, including internet connection, contact Diana Dummitt ASAP at 217-244-0173, e-mail ddummitt@uiuc.edu

V. How many participants can you accommodate at your session?
o 30-50 o 51-80 o 81-150

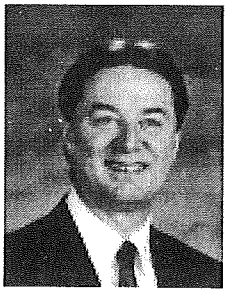
As a professional, nonprofit organization, the Association is unable to reimburse participants for travel or other conference expenses. ALL PARTICIPANTS INCLUDING PRESENTERS, ARE REQUIRED TO REGISTER FOR THE CONFERENCE. This form is not for commercial or non-commercial exhibits. It is only for educators!
All Presentations are required to conform to the NSTA safety guidelines.

Signature_____ Date_____

Return to: Tracy Trimpe, Program Chair, Havana Jr. H. S., 801 E. Laurel, Havana, IL 62644.
e-mail: mrstt68@theramp.net

Meet your newly elected board members!

President-elect
Marylin Lisowski
Eastern Illinois University
Charleston



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Aurora

Secretary
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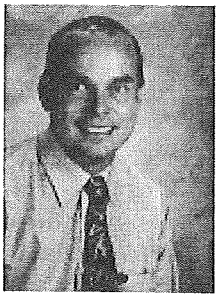
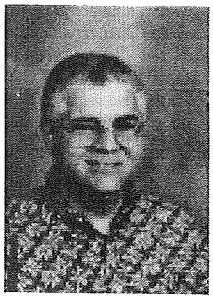
Waterloo CUSD #5
Waterloo



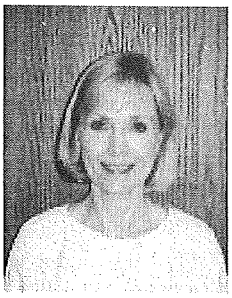
Region 1
Walter Glogowski
Ridgewood High School
Norridge



Region 2
Andrew Apicella
Riverdale High School

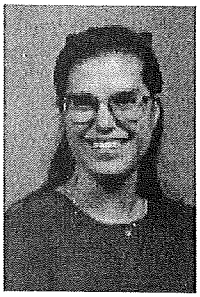
Region 3
Jill Schimmelpfennig
Pekin Community High School
Pekin

Region 4
Kevin Seymour
ROE SchoolWorks
Rantoul



Region 5
Rebecca Merrill
O'Fallon Township High School
O'Fallon

Region 6
Mary Jane Morris
Marion High School
Marion



Region 7
Nancy Grim
Chicago State University
Chicago

Sandra (Sandy) Gasparovich, ISTA Teacher of the Year

Background: I am a life-long Peoria, IL area resident. I received a Bachelor of Science in Elementary Education Degree rom Western IL University in 1969. From 1969-1975 I taught fifth and sixth grade at Paul Bolin School in East Peoria. I have taught science at Central Junior High School since 1977. I am currently teaching seventh grade science. I have completed graduate course work from Western IL University, IL State University, Southern IL University, and Drake University. I have sponsored and judged science fairs at the local, regional, and state levels. I have served on district science, technology, in-service, prevention, and curriculum committees. I have served on many local committees: Hult Health Education Center Teacher Advisory Board, East Peoria Is Concerned (a city prevention commission), Lakeview Museum of the Arts and Sciences cadres to develop materials and curriculum for the Children's Discovery Center, Heartland Committee to write and test water awareness units for the Illinois River. I have also made science presentations at district and county workshops in the area and the ISTA and NSTA Conventions. I have had the opportunity of work with IMSA and IL State University in the Summer Adventures Program for several years. I have also participated in 'ITEAMS' integrating the teaching of Math and Science and Project Moonlink. I have mentored and trained many student teachers from IL State and Bradley Universities.

Special Honors: 2000 ISTA Teacher of the Year; Sigma Xi Scientific Research Society Science/ Math Teacher of the Year; First science teacher in the nation to complete USDA Teacher Fellowship Program; USDA Certificate of Appreciation for Excellence in Performance of Scientific Achievements for work with recombinant DNA; Who's Who in American Education (multiple years); Society of Applied Engineers Award of Recognition

Professional Affiliations: ISTA, NSTA, CISE (Central IL Science Exchange), IEA, NEA, EPEEA

Life Away From School, and Family: I have been married to my husband, Steve, for 32 years. We have two wonderful sons, Stephen is a third year student at University of Illinois School of Dentistry and Scott is studying horticulture and landscape design at IL Central College. I am an active member of scout, school, and church committees. I love to read and travel as time allows.

LETTER FROM THE EDITOR

Controlling Our Own Destinies

One of the long and deeply held convictions among Americans has been a sense of independence. Our forefathers fought wars over this, and it was a part of the psyche of the early pioneers as they moved westward to "tame" the frontier. These people valued the opportunity, indeed their self-perceived right, to make decisions for themselves. One might call this being in control of one's own destiny. American education has similar roots. Even though individual teachers have historically not always had absolute freedom in deciding, in a general sense, what to teach and how it should be taught, those decisions were at least exercised locally through local boards of education.

As time marched onward, local control in educational decision making resulted in some schools being more adept at their task than others. However, by and large, the level of performance in our nation's schools was relatively high. But one exemplar of this is the surprising number of Nobel prizes won by Americans, compared to winners from other nations, over the years since the award's inception. However, one might argue, as have critics of education, that the performance of our schools has ebbed, and they point to scores from state, national, and international tests (such as TIMMS) to support their contention. Despite many badly flawed tests and even more abysmal efforts to compare one nation to another, or one state to another, or even one school to another within a state, the critics' contentions found their way into the mainstream press and has been taken on as a mantra by many legislators and policy makers who really do not understand education. Research to the contrary has certainly been conducted, yet these results have not typically been accepted as newsworthy by the media. One of the most notable of these efforts was the Sandia Report, which was buried by a former administration because it simply did not support their manufactured crisis, which was their contention that our students were woefully ill prepared, were behind those of other nations, and that our schools were miserable failures.

In a similar way, if not for the potential political fallout for one presidential candidate in the just-completed election, the problems with the disaster of a state standardized test called TAAS (used in Texas) would not likely have made the news at all. There are so many things wrong with the TAAS and its management that one scarcely knows where to begin discussion about it. For this editorial, let it suffice to say that far too many teachers in Texas have stopped teaching science so that time can be devoted to teaching about how to take the TAAS. Further, increasing numbers of Texas teachers are leaving the profession as a consequence of the excessive emphasis necessary in preparing students for the TAAS.

In Illinois, science has been removed from the state's list of priority subjects to be addressed. What's going on here? Even today, we can find many sources which speak to the critical need for science instruction in our schools at every level. Some recent publications have noted that barely six percent of our nation's adult population can be considered even moderately scientifically literate. Wouldn't the prudent educator see that science is a critical and integral component of the curriculum, and take steps to insure some science instruction occurred? Most of us in ISTA would probably agree, yet we are out of step with the political forces controlling so much around us these days.

How did this state of affairs arise? When did educators lose their input on what education should be about? A number of historians point to President Clinton, although the seeds of change were probably planted before he took office. It was on his watch that a national conference on education was convened, including only political leaders and members of the large corporate business community. Not a single educator was invited or participated. The same scenario evolved within the borders of many states. All this gave business the opportunity to step in and wrest control of education from educators, and they have been very successful since then. I'm not saying business is bad, or that they don't know what they're doing. I am saying that education should not be run as a business with raw material inputs and uniform products at the end. I am saying that business, even successful ones, have little business dictating what education should be like. Imagine the chagrin of business leaders if they suddenly had no choice but to have educators mandate to them how to run their businesses. In Illinois, we don't have someone who knows anything about education leading the state board of education. Rather, we have a businessman who doesn't have a clue about what constitutes quality education. Is it any surprise, then, to see a move from local control to more state control, from well-established educational priorities to something less?

The manufacturers and businesses in this state are in the driver's seat with respect to education. And the worst thing about this is that we've let it happen. We've not educated our legislators very well about education. The manufacturing and business lobby in the legislature has a very strong presence, dwarfing what little influence educators might have. Education has become a vehicle to insure business can get what it wants, and what it wants is profit. Some lip service may be given to the importance of preparing our children to enter the workforce, but the underlying motive is profit. Education is not, and cannot be, a profit-generating enterprise. Education is a human endeavor, and is an investment in our future. Such investments often have intangible immediate results, yet that is what is increasingly being demanded of educators. We have been all too silent with our congressmen and legislators. How many of us have kept pace with educational legislation introduced in our state legislature, much of it ridiculous micromanagement and unfunded mandates, or with the twists and turns of federal education funding initiatives such as the Eisenhower (Title II) program? How many of us have made our voices heard on these matters? The answer is, "Far too few."

So here we are. Faced with ever increasing mandates from the state, inundation with standardized test after standardized test, and decreasing ability to control what we feel is important to teach in our own classrooms, we find ourselves becoming frustrated and overwhelmed. We see more teacher testing on the horizon, more "accountability" measures coming, adding to the perception that we are not in control of our own destinies. We've had some chances to make things right. A case in point is that we've had significant input in developing new science education standards. However, the way in which those standards are assessed is imposed from without, not within. Again, I'm not against standards, nor am I against assessment -- provided both are appropriately designed, implemented, and used to improve science education. The end result should never be a club to be wielded over our heads by individuals who know little about education.

If business/manufacturing leaders and legislators truly believe all these mandates and testing are appropriate, if they continue to distrust educators in our schools and in our institutions of higher education, and if they think they know better than those who have spent the majority of their lives devoted to developing and delivering quality education, then I have a proposal for them.

A test should be developed to assess their knowledge of a broad variety of topics. For business, this test should not be written by anyone associated with business. For legislators, the test would not be written by anyone associated with the legislature. Before a license to run a business is granted, business/ manufacturing leaders would be required to not only take the test, but to pass it at a high proficiency level. Further, they would have to retake a similar test every few years and pass it in order to retain their licenses to conduct business. Similarly, even though duly elected, each legislator would have to pass his/her respective test before being allowed to take a seat in the legislature. And, as with the business model, each would have to retake a similar test every couple of years in order to retain his/her seat. And all this aside from being elected. Finally, all this should have little or nothing to do with respect to how much product a business produces or the profit it makes, nor anything to do with regard to the number of bills a legislator introduces and gets passed or the number of committees on which he/she serves.

If nationally and regionally accredited (NCA, NCATE, etc.) education programs are not good enough for legislators or business/manufacturing leaders to allow educators to do what they have been prepared to do, if they can't trust that our teacher education programs will produce good teachers, if they can't trust that teachers in our schools will do their best to educate an increasingly problematic population, if they have so much distrust that they must impose all the extraneous testing and "accountability" measures, then isn't it only fair and appropriate that educators should be distrustful of them and require similar testing and accountability for them? Sure, educators will have their failures, but is it warranted to let business usurp control of education? Do we really want or need business/manufacturing to run education, particularly when those same entities far too often put profit before consumer good (re: SUV tire problems, mixing silt with grain to sell overseas, manufacturing and selling pesticides to other countries which are banned in the U.S., etc., etc.)?

Let's set the record straight. Let's educate those who legislate. Let's point out that, even before the statewide reform and teacher testing was imposed, Illinois students' ACT scores continued to rise compared to most other states' scores. Let's point out the exemplary programs and further highlight excellent teaching, as ISTA does each year when we recognize outstanding teachers. Let's make it clear that educators know what is best for education, that science educators know what is best for science education. Let's make sure the public sees and hears the good news and comes to better understand how to sift the senseless dribble and meaningless activity from what can contribute to improved science education for every child. Let's regain the control of our own destiny in science education! The time is not too late, but it will be -- if we let it.

EVALUATION OF THE IMPLEMENTATION OF ILLINOIS LEARNING STANDARDS

Year Two Report: Summary of Findings and Recommendations

The Evaluation of the Implementation of Illinois Learning Standards (Reissued) Project is a four-year endeavor funded by the Illinois State Board of Education to assess the extent to which local districts are implementing Illinois Learning Standards (ILS), to identify factors which enhance or inhibit implementation, and to investigate the relationship between ILS implementation and student achievement. The project began on January 18, 1999, and ended its second fiscal year of operation on June 30, 2000.

The Study's Two Components

1. Survey of Practitioners.

During Year Two, a stratified random sample of approximately 1,996 teachers was surveyed to determine the extent to which they were implementing ILS in their classrooms, schools, and districts. Teacher survey data were used to place schools at various levels of implementation and assess ILS implementation at the state level. It was also used to examine the relationship between ISAT performance and ILS implementation. A parallel Administrator Survey was developed and sent to 118 building principals. The Administrator Survey was used to assess principals' perceptions of ILS implementation. A Superintendent Survey was developed and sent to all public school superintendents in the state to assess superintendents' perceptions and concerns regarding ILS implementation.

2. Qualitative component.

In Year Two, four districts, with two schools from each district, were selected for intensive case study. Participation was completely voluntary at both the district and school levels. The districts selected for inclusion varied in size as measured by student enrollment, district organization pattern, community size, and geographic location. Specifically, one district was a unit district (K-12) that serves a largely urban population and is located in the southern part of the state. Current student enrollment is just over 11,000 students. A second is an elementary district (K-8) located in a mid-sized city in central Illinois and has a student enrollment of approximately 4,100 students. The third district is a high school district (9-12) located in a suburban community in the northern part of the state. Student enrollment is approximately 2,800 students. The fourth district is also a unit district (K-12) and is located in a small rural community in central Illinois. Student enrollment is just over 1,000 students. The 8 schools selected from the four districts that agreed to participate in this study included: three elementary schools, two middle/junior high schools, and three high schools. Over the past year, more than 30 site visits to district offices and individual schools were conducted for the purpose of data-gathering activities—especially, intensive open-ended and focused interviews. Respondents included superintendents, associate superintendents, curriculum coordinators, building principals, deans, department chairs, grade-level chairs, and district curriculum committee members.

This report summarizes findings and offers recommendations based on the first two years of operation. Descriptions of procedures used and detailed findings are included in the two reports that follow this summary.

Findings

Qualitative Study and the Survey of Practitioners Summaries

Implementation Has Increased from a Year Ago and, as a State, Illinois is in Level Two Implementation.

A finding confirmed by both the qualitative and quantitative components was that there was an increase in implementation activities of districts and schools. From the survey data, it appears that approximately eighty-one percent of the responding schools were judged by their teachers to be in "Level Two," the second stage of implementation as described by our five-stage model. This represents a 6% increase from 1999. Level Two is defined as "Awareness and Expectation of an ILS-Led System." It is characterized by:

- A developing realization that change is necessary in the present system for improvement in learning to occur for all students;
- Initial distribution and exploration of ILS by teachers and administrators;
- Beginning discussions and development of implementation strategies at the district, school, and classroom levels;
- Formulation of rationale and procedures for introducing ILS to parents and community members;
- Minimal consideration of ILS in instruction, evaluation of student learning, and communication with parents; some consideration of ILS in professional development, curriculum development, and textbook choice;
- View of state standards as passing policy and possible intrusion into district standards or curriculum; and
- Establishment of parent and community group information sessions.

Approximately 19% of the schools (up 15% from 1999) we surveyed reported being in Level Three Implementation: Transition to an ILS-Led System. These schools were differentiated from the Level Two schools by higher levels of professional development surrounding ILS, the presence of specific timelines and policies for ILS implementation, and significant activities aimed at aligning district curriculum with ILS. No schools fell into Level One Implementation, as compared to 10% in 1999. Mean levels of implementation increased significantly ($p \leq .05$) between 1999 and 2000 across all dimensions except District/School Infrastructure and Community/Stakeholder Involvement. These findings would seem to indicate that, statewide, schools have made some progress toward implementation of the Illinois Learning Standards during the past year.

While this is clearly encouraging, the qualitative data reveal that for the districts and schools examined, the changes made have tended to be rather modest and clustered largely at the district level. As noted in the case study report, three of our four districts appear to be approaching implementation with a caution and conservatism that has not allowed them to move beyond a basic alignment of existing curriculum with the state standards, which is a defining characteristic of Level Two Implementation. Aligning curriculum may be an important first step, but data from the case studies as well as other research (see Elmore, 1993; Elmore & Sykes, 1992) suggest that more than alignment will be necessary to fundamentally change teaching practice and improve student learning, benchmarks of Implementation Levels Three, Four, and Five.

Professional Development and Curriculum Development Are the Most Highly Implemented Dimensions

As evidenced by both survey findings and case study results, the predominant implementation activities are teacher professional development concerning ILS and curricular alignment. Teachers reported an increase in the availability of professional development on ILS from a number of sources, including ISBE, ROEs, districts, schools, outside consultants, and colleges and universities. More than 66% of teachers reported that curricular change was occurring in their schools as a result of ILS implementation. More than 20% associated the adoption of block scheduling, increased summer school options, and expansion of after-school tutoring with ILS implementation. Changes in instruction and student learning are not yet reported by a majority of teachers, and teacher effect toward standards remains cautious.

Elementary Schools Exhibit Higher Implementation Than Other Levels

On average, elementary schools in our sample scored higher on all seven dimensions and on total implementation than middle or high schools. High schools were lower than elementary and middle schools on all seven dimensions. While the patterns of implementation were similar, high schools consistently lagged behind elementary and middle schools across the seven dimensions. This is not especially surprising, as few areas of the educational system have more consistently shown general resistance to substantive reform and change than American secondary schools (Codding & Rothman, 1999; Muncey & McQuillan, 1996; Wilson & Rossman, 1993).

The qualitative component takes a slightly different perspective and is more cognizant of district influence on individual school's efforts, rather than aggregating data from individual schools by level. With such a small sample of schools in the qualitative component, such aggregation would be ill-advised. However, consistent with the findings from the survey, it is interesting to note that the elementary district is by far doing the most comprehensive work on standards implementation and has progressed much further than any of the other districts in the case study.

Community and Stakeholder Involvement Is Exceedingly Low at All Levels

Survey and qualitative data revealed that community and stakeholder involvement in ILS implementation was minimal at all levels (elementary, middle, high, and special). Respondents indicated that parents, school boards and the community had little awareness and understanding of the ILS and limited access to information and educational opportunities about them. We found only a handful of cases in which parents and the community were meaningfully involved in standards implementation at the local level.

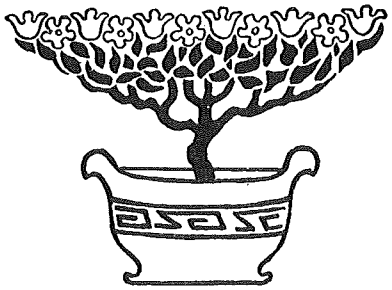
An issue for further study may be investigating what "meaningful" involvement actually entails. One of the case study districts has an exceptional website that is permeated by information about the learning standards. Parents or community members even casually browsing the site would find a great deal of information. In Year Three, we plan to investigate community and stakeholder involvement and related influences as part of the qualitative component.

With Only One Year of ISAT Data Available, It is Not Possible to Determine the Relationship Between ISAT Performance and ILS Implementation At This Time

As previously noted, learning standards implementation is proceeding, albeit slowly, cautiously, and conservatively. From the qualitative data, it became readily apparent that the approaches termed as "implementation" vary widely across districts and even across schools within districts, running the gamut from next to nothing to massive, concerted efforts affecting all levels of the system. The meaning survey respondents attached to "implementation" is even less clear. It is apparent from both the survey and the case study data that the implementation of the learning standards will take a good deal of time, and such implementation is not likely to proceed in isolation from other school improvement efforts. Thus, disentangling the unique contribution of the learning standards to improving student learning will likely be a near impossibility.

Nevertheless, a strong systemic focus on curriculum and instruction issues would lead one to expect such efforts to show up first in changes in teacher behaviors and practices and, eventually, in student results. Data from both the survey and the case studies show that respondents from across the state are beginning to acknowledge that the state learning standards are bringing a new and sharper focus to their school improvement efforts and influencing their choices about professional development, curriculum selection, instructional approaches, and classroom assessment practices.

As 2000 ISAT data become available, we will begin an analysis of the relationship between school-level ISAT scores and school ILS implementation levels that will continue through Years Three and Four.



In Order for Standards Implementation to Occur, Administrators at Both the District and Building Levels Must Clearly Understand What This Means and Carefully Define Their Roles in the Process.

The survey results show that, in general, building administrators and superintendents rate learning standards implementation at higher levels than teachers. In addition, qualitative results show that there is a tremendous variability across administrators both at the district and building levels in their knowledge and understanding of what implementation of the state learning standards should entail. Limited understanding most frequently leads to a representation of the standards as simply curriculum content. In turn, such limited understanding leads to curriculum crosswalks that do little more than match up the state standards and benchmarks to the most rudimentary and superficial elements—textbook chapters, curriculum kits, course description, or syllabi.

Unless administrators themselves have a clear understanding that standards are not just content but also hold instructional implications, it will be unlikely that the schools as a whole will move forward in implementing the learning standards in a meaningful way. This responsibility for understanding cannot be abdicated or passed down to the classroom level for teachers to figure out for themselves. Unless enlightened and knowledgeable administrators are leading and sharing in the standards implementation work, it is unlikely that the school or district will significantly change current practices.

ISAT Scores Remain the Primary Concern for Schools and Districts

In spite of increased public visibility and growing acceptance and approval, the ILS still do not command the attention or concern that is generated by the ISAT. Most of the administrators we interviewed for the case studies were largely unconvinced that there is a direct relationship between implementing the learning standards and raising ISAT scores, or at least did not know how to go about putting the two together. Unless this link becomes more firmly established in the minds of teachers and administrators, the increased implementation activity witnessed this year may be little more than a superficial altering of curriculum with very limited impact upon instruction and student learning.

Recommendations

There are several actions we recommend to the state agency based upon the findings from the first two years of data collection.

Capacity Building at the District Level is Essential for Effective Standards Implementation

The importance of district-level involvement in standards implementation cannot be underestimated. It seems imperative that state policymakers do not ignore or fail to appreciate the critical role the district level will and does play in implementation. While the school level may be the main focus of the state accountability measures, districts remain the legal and fiscal agents that oversee and guide schools and school personnel (Goertz, 2000; Massell & Goertz, 2000). Districts are also the major sources of capacity building for schools—coordinating, channeling, and controlling access to professional development, curriculum materials, and new instructional ideas; making critical decisions regarding the quality as well as quantity of school staff; and maintaining and filtering relationships with various external agencies. From a variety of perspectives, districts have a powerful and immediate influence on what happens or does not happen in schools. The schools themselves are likely to need all the assistance they can get in successfully implementing learning standards, and a strong, reciprocal alliance between the state and district levels seems a most providential means of providing this.

We believe that there is a strong argument for directing state policy attention and resources toward improving the capacity of districts to manage instructional improvements like standards implementation, because successful implementation of such policies at the school and classroom level will depend, in large measure, on district capabilities. One of the glaring deficiencies of the standards-based reform movement, in general, has been the neglect of systematic professional development for district and building level administrators.

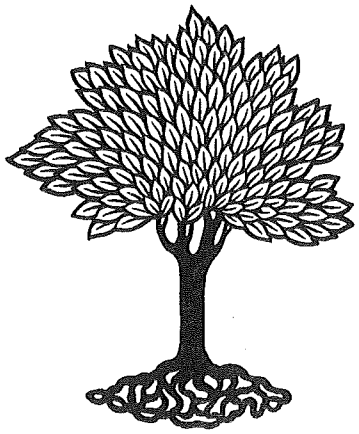
There is a Pressing Need for the Development of the Specifics of Implementation at the District, School, and Classroom Levels

Illinois school districts have begun to focus on implementing the learning standards. However, at this time, many of their efforts appear to have little to do with instructional changes and improvements in the classroom and more to do with a paper exercise of aligning existing curriculum to the standards. While this may be a start, it will not be sufficient to bring about the kind of instructional change and student learning improvement envisioned in the state learning standards.

A good part of the problem seems to be that many districts and schools simply do not have a clear idea of how to go about effective implementation. Implementation of the learning standards is a highly complex and sophisticated activity that must encompass the district, school, and classroom levels. Right now, there is a pressing need to demystify the implementation process as much as possible—to remove ambiguity, uncertainty, and confusion that is currently evident. Research consistently reports that the most effective and successful reforms provide some mechanisms that help each level define what it is they are supposed to do in fairly concrete terms (Hannaway, 1993; Spillane, 1994). One way to pursue this might be through the state-level development of a rubric for implementation that districts might then use to assess their efforts and, in turn, refine and adapt this model for use by their schools, which in turn could refine and adapt it for use by their classroom teachers. The Indicators of Implementation developed in Year One of this study could serve as a content rubric. A corresponding performance rubric for these indicators is needed to assist districts and schools toward implementation in a more concrete way. That could be a major product of this study during Years Three and Four.

Pay Attention to Teacher Talk and Student Work

While we have focused on administrators and external support in this early phase of ILS implementation, it is equally important to involve teachers and students. Our qualitative data and survey responses indicate that teachers are engaged in ILS implementation when they discuss the ILS among themselves and with parents, principals, and their students. Teachers who are actively implementing ILS in their classrooms use them as the basis for choosing textbooks and materials, designing lesson plans, evaluating student work, and giving feedback to students and parents. Administrators from "high implementation" districts/schools reported that the learning standards were posted in the classroom in "kid" language, were incorporated into district and school websites, served as the basis of progress reports and rubrics, and were regular topics at faculty meetings. It seems that an important mechanism for informing teachers and helping them to implement the learning standards would be to provide them with concrete examples of ways in which ILS can be prominently integrated into a classroom. A critical aspect of this is the use of student work to illustrate the standards. The state should put examples of student work, benchmarked to the standards, in the hands of teachers as soon as possible.



Model Stakeholder and Community Involvement

Community and stakeholder involvement in ILS implementation was uniformly low in the districts we sampled, yet it is viewed as a critical element in standards-based reform at both the state and local levels. The state agency should model stakeholder and community involvement as a means of promoting it at the local level and leveraging public awareness and support statewide. Activities might include:

- Supporting the creation of an active, visible education partnership or consortium that includes the Business Roundtable, corporate representative, community groups, etc., which operates independently to promote and monitor standards-based reform within the state.
- Conducting public events around the state that highlight ILS and their accompanying changes. These events can generate a tremendous amount of positive publicity for the initiative and raise awareness among the general public.
- Developing a prominent role for parent organizations such as the PTA in state level policymaking, dissemination, and training involving ILS.
- Identifying districts that have developed model websites and other dissemination mechanisms that thoroughly incorporate the learning standards and disseminate these to districts across the state for use.

Begin to Develop a Role for Higher Education in Standards Implementation.

The changes that accompany standards-based reform have implications for higher education in terms of undergraduate admissions, teacher and administrator preparation, and recertification. Though Illinois is early in its implementation, it is not too soon to begin to engage higher education in meaningful ways. With regard to admissions, engagement needs to be at two levels:

- Chief Academic Officers of the state universities and colleges need to be aware of the Illinois Learning Standards and work toward an agreement that will have them figure prominently in admissions decisions at their institutions; and
- Admissions Officers in those institutions must work to ensure that policies are put in place which incorporate the learning standards into admissions procedures and decision making.

With regard to preservice teacher education, colleges of education are greatly concerned with the extent to which their students pass the state certification exam and become employed. One way to infuse ILS-relevant information into teacher education curricula is to make sure that the state certification examination emphasizes that knowledge and holds universities accountable for the pass rate of their graduates. To some extent, this is beginning to happen in Illinois.

Standards implementation creates tremendous demands for continuing education and innovative models of professional development. The state universities are a potential resource to provide that training, although less than one-fourth of the teachers surveyed indicated colleges and universities as a source of professional development. ISBE should enter into cooperative agreements with more universities across the state to provide continuing education opportunities on ILS for practicing professionals. The new continuing education requirements will provide powerful leverage for this kind of change to occur. This is not to diminish the role of other sources of professional development, but to strengthen the connection throughout P-16 institutions and thus strengthen the entire system.

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ILLINOIS JOINS NATIONAL SCIENCE TEACHER INITIATIVE

The Illinois Science Teachers Association and the Illinois State Board of Education Collaborate with National Science Teachers Association and ExxonMobil Foundation

WASHINGTON, DC, January 25, 2001 - The National Science Teachers Association (NSTA) and ExxonMobil Foundation announced today the funding of an Illinois-based teacher initiative to bring standards-based science education into every classroom in the state. The project, Building a Presence for Science, links educators to a nationwide science learning community and provides increased professional development for science teachers. Illinois will receive $243,000 to implement the program.

Illinois will identify a cadre of 215 educators to serve as Key Leaders in the state who will, in turn, establish a network of Points of Contact in all 5,250 public and private school in the state. Points of Contact provide resources and professional development opportunities to science teachers that emphasize state and national standard-based science teaching and learning. Teachers and schools adapt the program to fit priorities and needs in their individual states.

Started by NSTA in 1996 and funded by ExxonMobil Foundation, Building a Presence for Science has been transforming the way teachers and students learn K-12 science. A primary objective of the program is to help science teachers implement state and national science education standards in their schools. A second goal is to create a network through which science teachers can share the latest ideas about effective science teaching. The program now includes 15 states and the District of Columbia. Eight more states are slated to join over the next two years.

ExxonMobil Foundation has contributed more than $6 million to the Building a Presence for Science program. Since 1955, the ExxonMobil Foundation has provided more than $500 million in financial support to education organizations. The Foundation's principal areas of interest in education are: K-12 science education; mathematics education with an emphasis on K-5; the restructuring of elementary and secondary education; reform of undergraduate science, technology, engineering and mathematics education; and increasing opportunities for minorities.

The National Science Teachers Association, founded in 1944, is the world's largest professional organization dedicated to promoting excellence and innovation in science teaching and learning for all. NSTA's 53,000 plus members include science teachers, science supervisors, administrators, scientists, business and industry representatives and others involved in science education.

In Illinois the program will be implemented under the leadership of co-directors, Illinois Science Teachers Executive Director, Diana Dummitt and ISBE Principal Education Consultant, Gwen Pollock. More information can be found at www.nsta.org or www.ista-il.org

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Provide valuable teaching ideas and take-home material for the classroom.

Provide a venue for exchanging ideas with other educators.

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MARCH 17, 2001
APRIL 7, 2001
MAY 21, 2001

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SPECIAL INTERESTS

WEIRD SCIENCE "BEYOND THE MILLENIUM" FOR A WEEK @ UIC, WOW!

With Dewayne Lieneman, Lee Marek, Bob Lewis, and Dr. Wade Freeman

The University of Illinois at Chicago plans an even NEWER and more IMPROVED WORKSHOP - "A Fifth WEEK WITH WEIRD SCIENCE & WADE" August 6-10, 2001. This Institute is for high school/junior high teachers. It combines demos, labs, computers, make-and-takes and lectures in chemistry. This course is Chemistry 572, Teaching Methods in Chemistry, with 3 semester-hours of graduate credit in chemistry. It will have different content/material from last year and may be repeated for additional credit- this years topics- Solids, Liquids, and Glass- yep that's right GLASS + we will have lots of build-it-yourself-stuff this year! For details, contact Wade Freeman Univ. of IL. at Chicago, Chem Dept, 845 W. Taylor St. Chicago, IL. 60607 phone; (312) 996-3161; e-mail: Wfreeman@uic.edu

WEIRD SCIENCE is a series of short, easy and sometimes "weird" demonstrations, labs and ideas on chemical and physical phenomena, designed for teachers of the chemistry/physical science, primarily at middle school and high school levels. The program presents novel demonstrations, labs, make & takes, and sharing guaranteed to hook kids and adults into thinking about science concepts. As Hubert Alyea said "Surprise, humor and truth are the servants of a good lecture." WEIRD SCIENCE entertains while it educates— it is infotainment. It is our job to awaken our student's desire to learn—to keep the students mentally coming back. You cannot communicate with people who are not mentally present. If you want "presence" you have to capture attention. WEIRD SCIENCE provides tools to capture attention. To keep us at equilibrium we have Dr. Wade Freeman author of the much acclaimed college text Chemistry: Science of Change. In a recent survey published in School Science & Mathematics on "Secondary Science Teacher's Needs," teachers ranked methods to motivate students as their number one concern and identification of sources of peer tested instructional materials as a high priority. WEIRD SCIENCE presentations provide both. Don't miss it!

DISCOVERING OPTICS WHAT IS OPTICS?

Optics is a special area of science that deals with the origin, movement, and detection of light. Light includes visible light, and the broad spectrum of electromagnetic radiation, ranging from the long wavelengths of microwave radio to the short wavelengths of x-rays. Today Optics is of growing importance in the field of technology and engineering. Everyday applications of Optics.

Optics uses range from lenses—such as those in glasses or contact lenses, cameras, binoculars, telescopes and microscopes—to the optical fiber that links two persons having a telephone conversation. Optics are also used in x-rays, lasers and the optical sensors in compact disk players and computer hardware and applications.

Everyday Optics goes beyond high technology to help us explore and understand the beauty of natural phenomena. What makes the colors and shape of the rainbow? Why is the sky blue and the sunset red? What makes a mirage?? All of these discoveries can be found in optical science. Optics: the science of light/light messenger.

Light is a form of energy radiated by the transition of an atom or molecule from a state of higher energy to a state of lower energy. The energy that an atom loses is carried away in the form of a packet of electromagnetic energy, a photon of light.

Light carrying an optical image travels through matter such as air, glass, liquids or crystals at a very high speed conveying vast amounts of information. For further information please visit: www.osa.org, www.optics.org, www. opticalres.com, www.micro.magnet.fsu.edu/optics, or www.sci-ed-ga.org

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Phone: 630-961-9811

Lee at: Lmarek@aol.com

You are invited to the

15th Annual K-8 Science Education Update Conference
Science & Technology for the Classroom

Friday, April 20, 2001

Western Illinois University Science Education Center

This conference is intended for teachers at the elementary and middle school level. We do our best to invite enthusiastic teachers representing the early childhood, elementary, and middle school levels. The conference includes:

- **Hands-On Science Activities**
- **Curriculum Resource Displays**
- **Activities Representing New Science Programs**
- **Teacher Presentations**
- **Science Materials Displays**
- **Science Children's Literature Displays**
- **State Education Agency Displays**
- **Over $1000 in Door Prizes**

- Over 20 presentations will be made by classroom teachers K-8 during the morning sessions. These 50 minute presentations will provide practical and classroom tested ideas for science activities and will include a variety of informational handouts and activities sheets.
- In the afternoon, we will again provide the popular **MINI-SHARING SESSIONS** where participants can rotate to tables of their choice to spend 15 minutes receiving information on a specific topic, demonstration or activity and receive a brief handout for reference. Time will permit participants to visit 4 or 5 stations of the 15 or more options at each of two levels \ (K-3) and (4-8).

A PARTIAL LIST OF TOPICS FROM LAST YEAR'S MEETING INCLUDES:

- Get "Buggy" in Science
- Jungle Journey (Rain forests)
- Kids and Atomic Particles
- Mouse Science
- Mars 2030 - An Interdisciplinary
- The Eyes Have It!
- Food & Fun
- Adopt an Insect
- New Recycling Activities
- Inquiry Can Be Simple
- Full Option Science System (FOSS)
- The Shadow Knows
- Building Groundwater into the Hydro-Cycle
- Children's literature and science
- Hands-On Primary Science
- Elementary Science in A Bag
- Engineering Towers
- Pipe Cleaner Chromatography

- **Note that your participation in this conference may be used toward your professional development goals. We will be providing documentation (ISBE Guideline (G)(ii)) at the conference for you to use in your professional portfolio. This conference addresses "state priorities, (2) Integrating technology into teaching and learning; and (3) Standards/Assessment/ISAT."**
- **Each school district should have a representative in attendance to take information back to share with others, including the many handouts and references distributes.**

SCIENCE UPDATE CONFERENCE REGISTRATION FORM

NAME _____ SCHOOL _____ DISTRICT _____

ADDRESS _____ CITY _____ STATE ____ ZIP _____

SCHOOL PHONE _____

Conference Registration Fee $25.00

Make checks payable to **Western Illinois University**

Circle one → **Payment Enclosed** **Payment to follow from the school district**

RETURN FORM TO: Dr. John B. Beaver, 1 University Circle-HH47, Western Illinois University, Macomb, IL 61455

309/298-2065 or 298-1777

email John_Beaver@ccmail.wiu.edu

Registration fee covers refreshments, lunch, and handouts.
Confirmations will be returned, if received by April 5th,with a campus map and parking information.

TOP TWENTY ENGINEERING ACHIEVEMENTS OF THE 20TH CENTURY

The National Academy of Engineering (NAE) press release announcing the list stated, "One hundred years ago, life was a constant struggle against disease, pollution, deforestation, treacherous working conditions, and enormous cultural divides unbreachable with current communications technologies. By the end of the 20th century, the world had become a healthier, safer, and more productive place, primarily because of engineering achievements."

The NAE provided leadership in developing the list. It worked in conjunction with the American Association of Engineering Societies and National Engineers Week.

The achievements were nominated by 29 professional engineering societies and selected and ranked by a panel of the nation's top engineers. To ensure its deliberations were unbiased, the committee, convened by NAE, worked in anonymity.

The Achievements list was announced during National Engineers Week by astronaut/engineer Neil Armstrong, who spoke on behalf of the National Academy of Engineering at a National Press Club luncheon in late February.

"As we look at engineering breakthroughs selected by the National Academy of Engineering, we can see that if any one of them were removed, our world would be a very different—and much less hospitable place," said Armstrong.

"Almost every part of our lives underwent profound changes during the past 100 years thanks to the efforts of engineers, changes impossible to imagine a century ago. People living in the early 1900s would be amazed at the advancements wrought by engineers," Armstrong continued. "As someone who has experienced firsthand one of engineering's most incredible advancements—space exploration—I have no doubt that the next 100 years will be even more amazing."

20 Greatest Engineering Achievements of the 20th Century

The achievements which have had the greatest impact on quality of life in the 20th century, as selected and ranked by a panel of the nation's top engineers.

1. Electrification
2. Automobile
3. Airplane
4. Water Supply and Distribution
5. Electronics
6. Radio and Television
7. Agricultural Mechanization
8. Computers
9. Telephone
10. Air Conditioning and Refrigeration
11. Highways
12. Spacecraft
13. Internet
14. Imaging
15. Household Appliances
16. Health Technologies
17. Petroleum and Petrochemical Technologies
18. Laser and Fiber Optics
19. Nuclear Technologies
20. High-performance materials

For more information about the Greatest Engineering Achievements, visit the web site www.greatachievements.org

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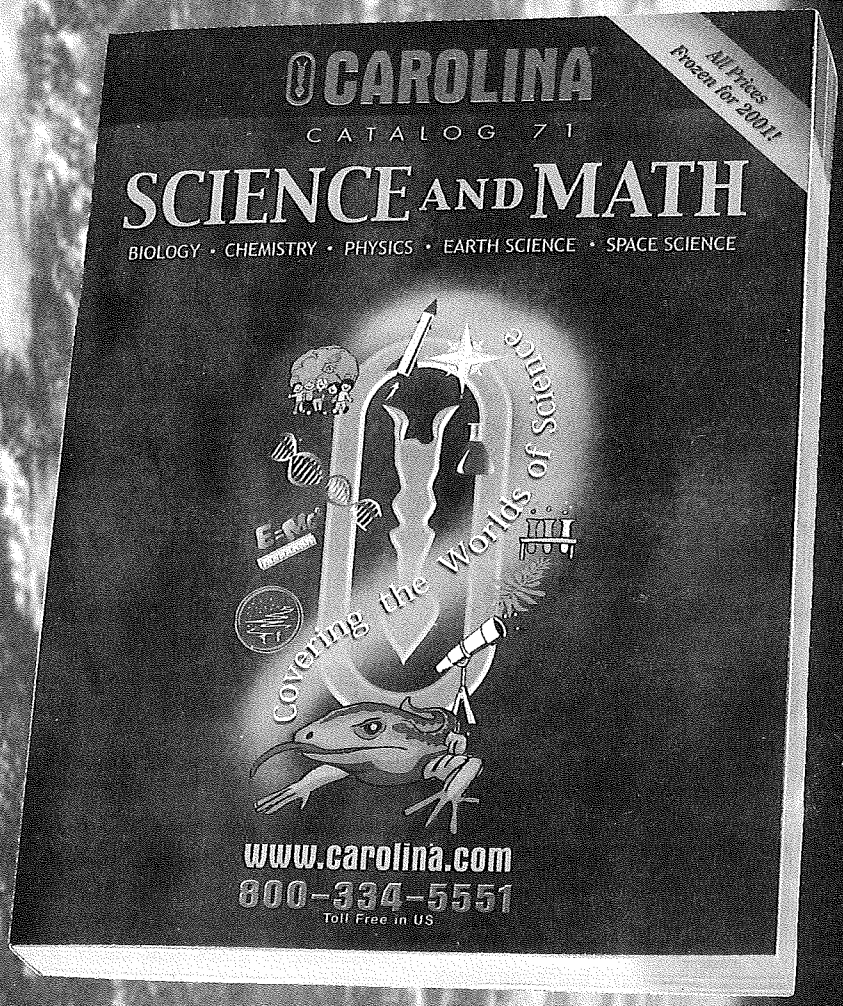

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COMPUTER SPECTRUM

American Museum of Natural History is a top-notch virtual science museum. Packed with educational activities, photos, videos and more on a range of topics. http://www.amnh.org.

Boston Museum of Science: http://www.mos.org.

The Exploratorium: http://www.exploratorium.edu.

Museum of Science and Industry in Chicago: http://www.msichicago.org.

Questacon, the Australian science and technology museum, is full of educational and entertaining features. http://www.questacon.edu.au.

The Franklin Institute Science Museum: http://sln.fi.edu.

Crystals

For geology or earth science teachers introducing crystals, the following URLs provide a fairly complete introduction to crystal shapes and surfaces, including those of snowflakes!

Natural minerals/crystals
http://galleries.com/default.htm

Surfaces of crystals
http://afinl.geology.utoronto.ca/html/body_images-cryst-O.html

Snow crystals
http://snowflakebentley.com/begin.htm
http://www.public.asu.edu/billjay/w.a.bentley.html
http://www.lpsi.barc.usda.gov/emusnow/
http://www.cco.caltech.edu/-kgl/gallery.html
http://metsun4.geophys.hokudai.acjp:20080/crystal/gallergy.html

Astronomy - astronomy buffs can check out the Society for Amateur Scientists web page at http://earth.thesphere.com/SAS/.

If you click on Science groups, you can link to various SAS groups, including astronomy, earth science, holography, rocketry, etc.

Global Warming on the Internet
There are many sites on-line that discuss global warming. The Resource Center of EOHSI does not promote any of the sites listed below, nor can we guarantee that they will be "active" when you visit. EPA's Explorer's Club
http://www.epa.gov/kids/

Earth in the Balance
http://www.worldbook.com/fun/wbla/earth/html/earth.htm

EcoKids Online
http://ecokids.earthday.ca/pub/splash.cfm
A site for kids about the planet and its animals, including: games, news, facts, discussion area, educator's learning guide with activities and additional links.

EduGreen
http://edugreen.teri.res.in/
Life on earth, energy, air pollution and water through calendars, stories, maps, multi-media resources, related links, interactive features, e.g., games, quizzes, networking.

Global Learning & Observations to Benefit the Environment
http://www.globe.gov/
Students and teachers from over 6,500 schools in 80+ countries work with research scientists to study the global environment. Students' observations are reported through the Internet. Scientists use data in their research and provide feedback to the students.

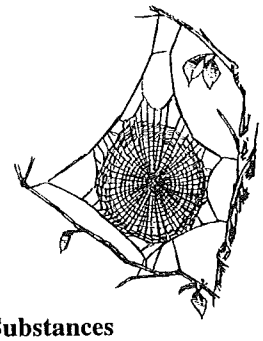
Global Warming Focus on the Future
http://www.enviroweb.org/edf/
Learn about the history of the issue, examine problems related to the recent atmospheric changes and how to reduce emissions of gases that cause global warming.

Meet Professor Polar Bear
http://www.yoto98.noaa.gov/kids.htm
Find answers to questions on global warming. Weekly questions section and quiz.

NOVA Online
Warnings from the Ice
http://www.pbs.org/wgbh/nova/warnings/
Explore how Antarctica's ice has preserved the past going back hundreds of thousands of years. See how the world's coastlines would recede if some or all of this ice were to melt. Site for kids; includes a guide and resources for educators.

ThinkQuest
http://www.thinkquest.org/
Thousands of websites created by students for students about a wide variety of topics.

US Global Change Research Information Office's "It's Elementary!"
http://gcrio.org/edu/elementary/itselem.html
Designed by a teacher "specifically for teachers to access, view and print lessons" on such topics as: Air Quality, Acid Rain, Air Pollution, Carbon Dioxide, Greenhouse Effect, Ozone, Global Change, Science Projects and Student Activities.



Toxic Substances
Have you ever wondered about chemicals or substances you use in your classroom. The ToxFAQs: Hazardous Substances Factsheet produced by the Agency for Toxic Substances and Disease Registry is a series of summaries about hazardous substances. The webpage includes an alphabetic index for the chemicals presented. It also has molecular models of some of the chemicals and Links and resources to other online resources:
http://www.atsdr.cdc.gov/toxfaq.html

Some Sites to Check Out

National Audubon Society
http://www.enature.com/

Science Fun
http://www.learnlink.emory.edu/peep/index.html

Earth's Biggest Environment Search Engine
http://www.webdirectory.com/

Odyssey of The Mind
http://www.angelfire.com/pages0/ArvidOM/index.html

Integrated Science
http:www.sa.ua.edu/sa/ccet/ishome.htm

Integrated Science The Environment
http://www.sa.ua.edu/SA/CCET/Enviro.htm

Illinois Science Olympiad
http://www.webmasterworks.com/olympiad/index.html

NASA Homepage
http://www.nasa.gov/

Middle School Science - Lesson Plans
http://www.harlingen.isd.tenet.edu/midscile.htm
http://www.kcmetro.cc.o.us/pennvalley/math/eisen/96/midsci.htm

Windows To The Universe
http://www.windows.umich.edu/

Science that Can Be Done in the Home
http://www.her.nsf.gov/her/her/scihome.html

Earth Science Labs
http://www.math.montana.edu/~nmp/

Galileo
http://www-hpcc.astro.washington.edu/scied/galileo.html

CSRnet
http://www.csrnet.org/csrnet/teachresource/mscienc.htm

The 6 Virtual Biomes
http://gopher.mobot.org/MBGnt/vb/index.htm

Wetlands Education System
http://www.epa.gov/grtlakes/seahome/wetlands.html

NASA Education Resource
http://ceps.nasm.edu:2020/RPIF/RPIFSOURCES/RPIFsources4.html

NASA Observatorium
http://observe.ivv.nasa.gov/nasa/core.shtml

Abrams Planetarium Skywatcher's Diary
http://www.pa.msu.edu/abrams/diary.html

Athena Earth and Space Science
http://inspire.ospi.wednet.edu:8001/
Earth Science Teaching Resources http://www.usgs.gov/education/

Earth System Science Educ. Resources
http://www.ems.psu.edu/RelatedWebSites.html

Geophysics
http://www.geophys.washington.edu/

The Heart: An Online Exploration
http://sln.fi.edu/biosci/biosci.html

Frog Dissection
http://curry.edschool.Virginia.EDU/go/frog/menu.html

Interactive Frog Dissection
http://curry.edschool.Virginia.EDU/go/frog/

Electronic Desktop Projects
http://vflylab.calstatela.edu/

Newton's Apple
http://ericir.syr.edu/Projects/Newton/

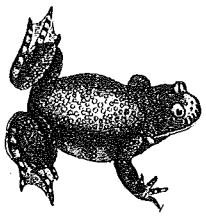
California Museum of Paleontology
http://www.ucmp.berkeley.edu/

The Big Mac Index

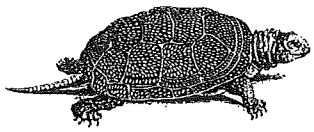
The Economist has published a Big Mac Index for 13 years. They use the price of a Big Mac around the world to analyze the purchasing power of local currencies and to predict, in a light-hearted way, where particular currencies may be headed. You may wish to do some reading to help students discuss this issue critically. See the articles at www.economist.com/editorial/freeforall/focus/big_mac?index.html

Frogs

If your class studies frogs, an excellent resource is located at the Exploratorium in San Francisco
http://www.exploratorium.edu/frogs/index.html
The site includes links to pages with more information than most people, even teachers, want to know about frogs. The page also leads to resource pages for making rainsticks and to a page with frog sounds.

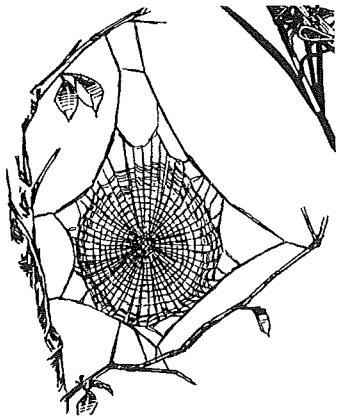


Lessons Every Educator Should Know About Technology in the Classroom, booklet that features 10 classroom technology tips. See the Educational Testing Service website: www.ets.org/aboutets.zing/lessons.html



Through the **Sea Turtle Restoration Project**, you can become a steward of the environment by adopting a nest of sea turtle hatchlings. When you adopt a nest, you pay $35 and receive a certificate of adoption, a fact sheet about the turtles, a photograph of your hatchlings emerging from their nest, and a one-year membership in STRP. Adoption funds support sea turtle conservation work. See
www.seaturtles.org/store.html.

The Comic Book Periodic Table
Robert Swanson
There are a couple of guys at the Chemistry Department at UK with too much free time - or perhaps they've been dabbling in some original compounds. Either way, Chemcomics is an archive of comic book pages from the '60s and '70s that involve or mention the elements. One could search with the list, but it's much more fun to use the interactive periodic table on the home page to see how your favorite element made the big time. While a few elements aren't involved, and aside from the obviousness of "Metal Men", you'll be surprised to see how scientific (sort of) those old comics you've got lying around in your attic really were. This is good fun. Take a break.
http://www.uky.edu/Projects/Chemcomics/



Anatomy Teaching Modules
http://www.rad.washington.edu/AnatomyModuleList.html

Watch Over Washington
http://www.wa.gov/ecology/wq/wow

Exploring the Environment
http://www.cotf.edu/ete

Earthquake preparedness
http://fema.gov/kids

Chem 4 Kids
http://www.chem4kids.com/

Organizational and Weather Links
http://www.seawfo.noaa.gov/nwr.html

Geography Mapping - Topozone: if you use maps in your classroom, check out the maps provided online at http://www.topozone.com. The site contains every USGS 1:100,000, 1:25,000, and 1:24,000 scale map for the entire United States. You simply type in a place name and state in the search box, click "search."

A second geographic resource is http://terraserver.microsoft.com/default.asp from the miscrosoft server. Terraserver includes USGS topographic maps, USGS Topo and Ortho Photo maps, Spin-2 Imagery maps, and USGS and Spin-2 Imagery maps. It also includes a location Advanced Find feature AND a link to Famous Places.

ESRI, Environmental Systems Research Institute, at http://www.esri.com, sponsors online geography-related classes at their virtual campus, http://campus.esri.com/index.cfn?theme_usa. The online campus offers free modules to introduce their geography software AND its business and industry uses. Teachers are entitled to a 40% discount for online classes on the use of ArcView, ArcAnalyst, etc. ArcExplorer is a free viewer for ArcView files, downloadable at:
http://www.esri.co/software/arcexplorer/aedownload.html.

Image Processing

The Center for Image Processing Education, accessible at:
http://www.cipe.com has developed instructional **Image Processing and GIS** technologies for teaching about science, math, and technology. They have for-sale teacher resource books of activities, background, lessons for teachers K-14. Free sample lessons are available at http://www.cipe.com/Software/SoftIPLessons.html
Most of their lessons take advantage of the freeware NIHImage and ScionImage for playing with and extracting data from images, whether it is an image of a cell or a flower!

"Riverweb"

http://www.ncsa.uiuc.edu/Cyberia/RiverWeb/
http://www.hsus.org/programs/research/animals_education.html

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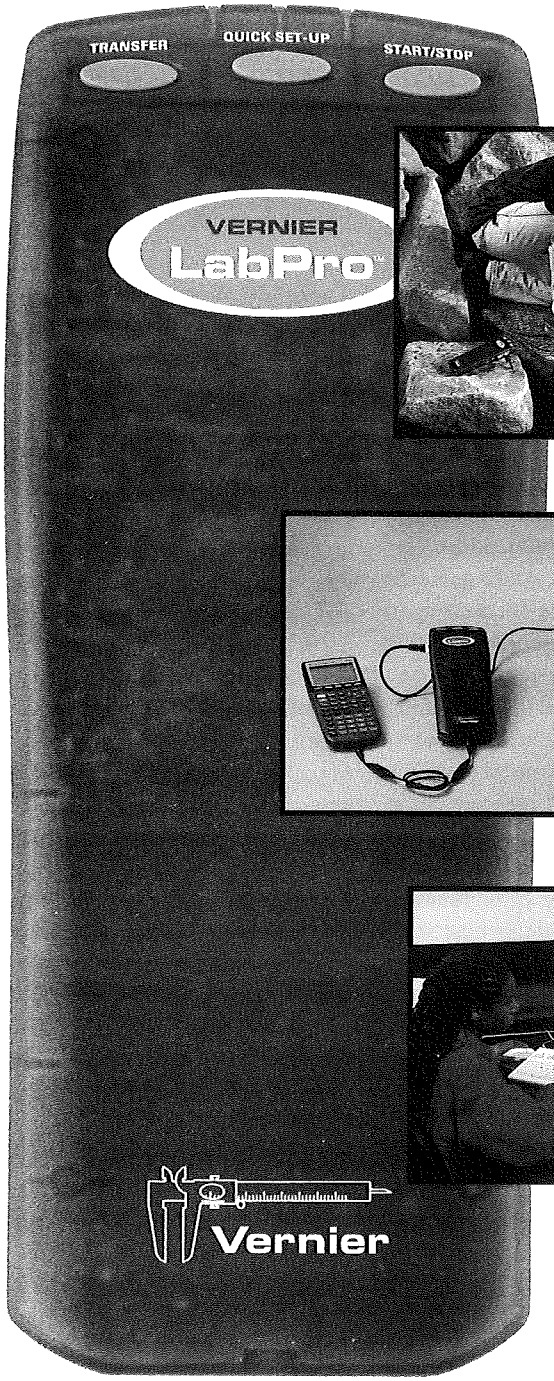

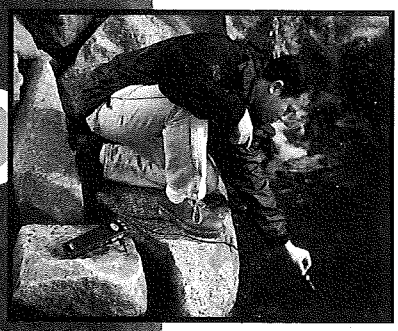

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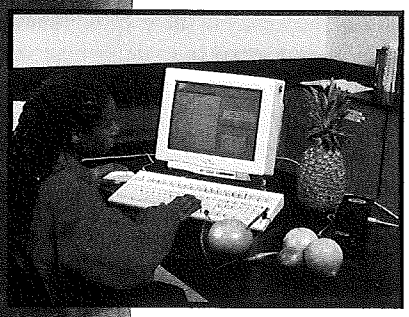

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OVERCOMING SLEEP DEFICIENCY OF HIGH SCHOOL BIOLOGY TEXTBOOKS WHILE IMPLEMENTING SCIENCE STANDARDS

"It's raining, it's pouring
The old man is snoring"

The above nursery rhyme does have some truth, in that men snore more frequently than women (Lipman, 1996). Typically, individuals spend about 1/3 of their lives sleeping, and when an individual's sleep isn't restful and restorative, a condition known as sleep deficit occurs (Coren, 1996). Sleep deficit according to Carskadon (1999) results in reduced memory, lowered alertness, reduced creativity, impaired motor skills, reduced disease resistance, more frequent accident involvement, etc. The January, 1999 issue of *Phi Delta Kappan* focused upon adolescent sleep needs and school starting times. Carskadon (1999) noted that adolescents normally need more sleep than adults. Typically, adolescents go to bed at later hours and wake up later except on school days. She reported that the timing of sleep-wake cycle, which is controlled by circadian timing system, seems to be delayed during puberty. Wrobel (1999) reported on some Minnesota schools that delayed school starting times so as to be more compatible with teen-agers sleep cycle.

According to Murphy (1996), 20% or more of the U.S. population is affected by some type of sleep disorder. Because of this frequency in the U.S. population, we decided to review current high school biology textbooks to determine what sleep concepts and sleep disorders (like snoring) are covered. Dinges (1996), a sleep researcher, considers it essential that sleep and related disorders should be a part of the school curriculum. Carskadon (1999) points out that teen-agers know little about their sleep needs and information about sleep. She considers this topic to be essential to the school curriculum. The eight textbooks reviewed are listed in Figure 1.

One of the challenges for biology teachers is to implement a broad array of the content standards of the *National Science Education Standards* [National Research Council (NRC) 1996]. There are eight content standards (unified, inquiry, physical science, life science, earth and space science, science and technology, personal and social perspectives, and history and nature of science). The purpose of studying life science at the high school level is to "... most productively develop student understanding about life (NRC, p. 176)."

In this study, eight high school biology textbooks were reviewed for their content regarding sleep disorders (Figure 1). Only 4 of the 8 high school biology textbooks reviewed included any information about sleep or snoring. The Kendall-Hunt textbook had the most extensive presentation about sleep. This textbook had a full page emphasizing the Reticular Activating System (RAS) and sleep. The Prentice-Hall (a) textbook had about one-fourth of a page containing a brief overview of sleep. Holt (b) had three sentences about the reticular formation and sleep as related to the study of the central nervous system. Only the Glencoe biology textbook had information about snoring, although no information was provided on sleep. The Glencoe resource was also the only textbook that had an activity regarding sleep and/or snoring. This experiment required students to design an experiment to determine whether snoring has a genetic basis or not. After examining these eight high school biology textbooks, we concluded that, overall, there is an information deficit concerning sleep in the examined textbooks. Because of the very limited amount of information about sleep, a review of various resources on sleep for high school classes was conducted. The remainder of this article focuses upon background information about sleep, snoring, sleep apnea and application of these topics that facilitates the use of the *National Science Education Standards* (NRC, 1996).

Sleep

Sleep is a normal, active part of life (Dahl, 1999). During sleep, the body is incapable of any purposeful action or thoughts. According to Dinges (1996), sleep provides a restorative function to the brain. The opposite of sleep is wakefulness. For some people, going to sleep is very easy, and for others, very difficult. In the process of going to sleep, the cerebral cortex becomes relatively inactive and the person becomes "unconscious."

The RAS is composed of the brain stem, medulla, pons and hypothalamus. When sensory input reaches the RAS, it must be filtered, and certain stimuli are transmitted to the cerebral cortex. The RAS responds to sensory input by sending a message to the cerebral cortex that causes the individual to be in a state of wakefulness (Beardsley, 1996). The RAS responds to various stimuli in different ways — the intensity of a stimulus does not cause RAS to pass on the stimulus. For example, a person can sleep through a severe lightning and thunderstorm while a creaking step will cause the same individual to become wide awake. Serotonin, released from blood platelets, is thought to be involved in controlling states of consciousness and inhibiting the RAS, causing one to become sleepy. Sometimes intense activity by the cerebral cortex activates the RAS and keeps an individual awake. For example, a child who is excited has difficulty going to sleep. Melatonin, a pineal hormone, regulates the circadian timing system. Thereby, also influencing the RAS's impact.

There are two different types of sleep — slow wave sleep and rapid eye movement (REM) sleep. Slow wave sleep (non-dreaming) consists of four stages. The first stage is preparation for sleep, typically 5-10% of total sleeping time. The second stage, where an individual is in slightly deeper sleep, represents about 50% of total sleeping time. Occasionally, there will be sudden brain activity while pulse rate, breath rate, and temperature becomes lower. The heart beats at a lower rate while the individual will have some muscle movement during the third stage. The fourth stage is considered a deeper sleep and tends to decrease with age. It is during this stage that sleepwalking and bedwetting occurs. These two later stages represents 5-10% of a night's sleep.

During REM sleep, a person's pulse and breathing rate increases while blood pressure fluctuates. REM sleep is deeper than slow wave sleep, and the individual is harder to wake up. Named for visibly rapid eye movement behind closed eyelids, REM sleep is also the phase when there can be up to 45 minutes of dreaming. Typically, an individual will have three to five dreams per night. Unless interrupted, each dream will last longer that the previous dream. Dreams are only remembered when one is awakened during REM. During REM sleep, males frequently will have erections. A person will spend 25% per night in REM sleep. Sleepers drift in and out of REM four or five times each night. The pons (bridge which carries impulses from one hemisphere of the cerebellum to the other) is thought to be related to REM sleep. If a person has prolonged absence of REM sleep, she/he may suffer temporary memory impairment. After normal REM sleep, the memory returns to normal. The sleep cycle described above is normal whether one is a baby or senior citizen, although, as age increases, less REM sleep is needed (Wauquier, 1993). Research, summarized by Dinges (1996), notes better school performance occurring after a good night's sleep. Eight to nine hours or more of sleep is best for 12 to 18 year olds (Carskadon, 1999).

Table 1: Sleep and Related Concepts Found in Eight High School Biology Textbooks

	Kendall Hunt	Glencoe	Prentice Hall (a)	Holt(b)
Brain activity/regions associated with sleep	X		X	
Body's reaction to sleeping	X			
Slow wave sleep				
Rapid eye movement sleep		X		
Sleep is an active state				
Dreams				
Normal amount of sleep				
Sleepwalkers/bed wetting				
Snoring/Causes		X		
Difficulties/Disorders				
Insomnia				
Narcolepsy				
Reticular Activating System (RAS)	X		X	X
Influence of alcohol on RAS			X	

It has been estimated that 49% of the adult population (1995 Gallup survey for the National Sleep Foundation) has difficulty going to sleep (insomnia). Several conditions result in insomnia including stress, irregular schedules, consumption of alcohol and caffeine, and eating or exercising too close to bedtime. Albert (1996) recommends that the bedroom should be quiet, dark, and have good air circulation. A warm bath, drinking warm, mild or herbal tea, or light reading helps the body prepare for sleep.

What is the difference between sleeping and napping? Sleep involves going through both slow wave sleep and REM sleep during a typical eight-hour interval. Naps are natural and considered to be a daytime occurrence. Dinges (1996) indicates that all individuals tend to get sleepy about 12 hours after the middle of the previous night's sleep. Dinges identifies this as around noon for "early risers" and 3 P.M. for "night owls". The desire for a nap is greater on days when failure to meet sleep needs has occurred. Dinges recommends a maximum of a 30 - minute nap; otherwise, individuals go too deeply into the sleep cycle. He also considers napping a biological need, which has been discouraged in the United States, while siestas are socially acceptable in other societies.

Snoring

Snoring is caused by the vibration of throat tissues while inhaling. The vibrations occur at the soft palate, uvula (teardrop-shaped tag of flesh), or both, against the back of the throat or base of the tongue. The vibration is due to an intermediate blocking (alternating opening and closing) of the air passage, making it difficult to inhale air. The intensity of the snoring is due to how fast the tissues are vibrating and the volume of air going through; consequently, snoring is considered abnormal breathing while sleeping.

During normal breathing (through the nose with your mouth closed), the base of the tongue is moved forward. However, during snoring, breathing occurs with the mouth open, which results in the tongue being positioned further back, frequently pressing the uvula against the back of the throat. As a result, air flow is restricted. A snorer starts breathing through the mouth when there is low air flow through the nostrils.

There are several medical conditions which result in a narrowing of the nasal air passage. These conditions include obesity (fat stored in the throat region); improper jaw alignment; enlarged tongue, tonsils, adenoids, and/or uvula; and/or prescription drugs which can cause relaxing of the throat muscles while sleeping (i.e. hypertension medication, antihistamines, nasal sprays, etc.).

Everybody snores at some time or another. The most common recommendations to reduce snoring are sleeping on the side so gravity will not lower the jaw causing the mouth to open; losing weight; avoiding alcoholic beverages, which tends to relax throat muscles; and stopping smoking, which tends to result in nasal congestion. Medical procedures such as surgery for deviated septum or jaw alignment are sometimes necessary.

Sleep Apnea

Sleep apnea is the sudden (sometimes often) cessation of breathing for 10 or more seconds while asleep. During apnea, the airway becomes blocked and no air flow occurs, but the person tries to breathe. The chest expands to allow more air, but due to the blockage, no air passes through. During the brief time when breathing stops while sleeping, the oxygen level in the blood is decreased. The heart, brain and other vital organs are deprived of needed oxygenated blood. These incidences could lead to high blood pressure, heart attack, and/or stroke. The person has a brief awakening, which temporarily stops the apnea. This awakening causes the throat tissues to contract and open the air passage. A loud snore happens when the air passage opens. This cycle is repeated over and over again in the same night. Consequently, the individual is unable to have restful sleep provided by completion of a normal night of the sleep cycle.

Fig. 1: BIOLOGY TEXTBOOKS REVIEWED FOR THIS STUDY.

BSCS Blue. (1996). *Biological Science: A Molecular Approach*, 7th edition, Lexington, MA: D.C. Heath.

BSCS Green. (1992). *Biological Science: An Ecological Approach*, 7th edition, Dubuque, IA: Kendall/Hunt.

Biology (a). (1995). Englewood Cliffs, NJ: Prentice-Hall.

Biology, Living System. (1994). New York, N.Y.: Glencoe, Macmillan / McGraw-Hill.

Biology: The Study of Life (b), 6th edition. (1995). Englewood Cliffs, NJ: Prentice-Hall.

Biology Principles and Explorations (b). (1996). Austin, TX: Holt, Rinehart and Winston.

Globe Biology. (1990). Menlo Park, CA: Globe Brook Company.

Holt Biology, Visualizing Life (a). (1994). Austin, TX: Holt, Rinehart and Winston.

There are three types of sleep apnea. Obstructive sleep apnea is caused by the narrowing of the upper airway while one is asleep. Typical obstructive apnea patients are overweight men in there 40's and 50's who have short, muscular necks. Central sleep apnea occurs when the muscles used for breathing do not receive the message from the brain to breathe. This neurological form of the disorder is less common but extremely dangerous, as it could, if left untreated, result in heart attack or stroke. The third type of apnea is mixed — a combination of obstructive and central where the patient experiences both types.

Once the symptoms of sleep apnea are suspected, a physician should be consulted. A polysomnography, commonly known as a sleep study, will be performed in a sleep clinic. During the night's sleep, approximately thirty electrodes and wires are attached to such places as the chin, forehead, scalp, legs, and area of the eyes. A recording keeps track of all the different physiological changes that occur during sleep. When the results are analyzed by a doctor, they will show how long it took the patient to get to sleep, the heartbeat and breathing rates, the pattern of sleeping, and how often the breathing is interrupted (Lipman, 1996). Because sleep apnea patients are aroused so often, rarely do they fall into REM sleep, resulting in the feeling of continuous fatigue during the daytime.

After the type of sleep apnea is diagnosed, there are several options for treatment. For obstructive apnea, surgery is often helpful. Correcting a deviated septum (irregularity in the nose) often helps in breathing. To open up the airway in the throat, a surgical procedure called UvuloPalatoPharyngoPlasty (UPPP) could be performed. This involves removal of the uvula and the soft palate at the back of the throat. It cures about 85% of snoring cases and about 50-60% of sleep apnea cases (Wilkes, 1989). Recently, lasers are being used to remove these tissues during an office visit.

Three non-surgical techniques can also be prescribed — the CPAP, the BiPAP, and the BiPAPS/T. The CPAP (continuous positive airway pressure) is a device used to pump air down the airway, in order to keep breathing passages open. The entire CPAP system consists of a nasal mask connected by a hose to a compact, computer-controlled machine. This machine does not breathe for the patient; it simply provides constant air pressure to keep airways open. The BiPAP (bi-level positive airway pressure) machine uses two levels of pressure while the individual is breathing. Instead of a continuous pressure, as in the CPAP, the BiPAP method uses one level of pressure for helping to inhale and a lower level of pressure for exhaling. The BiPAP machine is calibrated to meet the individual's breathing rate so that normal sleep is promoted. Another model of the BiPAPS/T supports the individual's own breathing, but if a breath is not taken in a pre-set time, the machine "kicks in" and provides the necessary breath without waking the person. Use of the machine nightly almost always gives the sleep apnea patient immediate relief from sleeping problems.

Science Standards

Even though topics of sleep, snoring, and sleep disorder are very limited in biology textbooks, their inclusion in the curriculum can facilitate the implementation of the *National Science Education Standards* (NRC, 1996). The topics of sleep and related disorders are applicable in addressing the Life Science standards, specifically the behavior of organisms. This standard focuses upon students developing an understanding of responses to internal change and to external stimuli (e.g. RAS). The *National Science Education Standards* acknowledges that high school students lack a clear understanding of the human nervous and endocrine systems. Studying about sleep and related disorders can remediate student's limited background.

In the Personal and Social Perspectives, there are two standards that can be addressed when biology students study about sleep. The first standard is personal and community health where "understanding of biological consequences can...influence decisions about health practices" (NRC, p. 187). This includes both short- and long-term effects. The second standard is natural and human-induced hazards where the "needs for humans to assess potential danger and risks" (NRC, p. 192) (i.e. failure of students to address personal sleep needs, ignoring symptoms of sleep apnea, etc.).

The polysomnography and machines that address sleep apnea are examples of how "technology is driven by the need to meet human needs and solve human problems" (NRC, p. 193), thereby, addressing understanding about science and technology. This standard is one of the components of the science and technology content area. Thereby, illustrating ways that science has used technology to better understand the science of the sleep cycle. It is imperative that future citizens of the 21st century be able to distinguish between science and technology.

Summary

Because a person could spend up to one-third of the day's hours sleeping, the importance of normal sleep patterns is undeniable. High school biology students need to have accurate information about sleep and sleep disorders. Carskadon (1999) recommends that high school students know about genes that control their biological clock, brain mechanisms that control dreaming, sleep and breathing problems, and sleep disorders. Being constantly fatigued during the daytime might indicate the presence of sleep apnea. Left untreated, the danger of high blood pressure, memory loss, stroke, and heart attack means that sleep interruption should not be taken lightly. For this reason, it is necessary to include information about this serious disorder whenever discussing sleep in high school biology classes. Snoring may not be just a loud nuisance; it may indicate sleep apnea — a condition that can be treated before more serious medical conditions result. A general resource (Pascualy & Soest, 1994) on sleep apnea will allow students to share information with family members and will hopefully minimize the impact of this condition.

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SURVEYING THE SCHOOL SITE RECOGNIZING UNSAFE CONDITIONS AT YOUR SCHOOL

- Is the school safe for you and your students?
- Does anyone care about safety at your school?
- Doesn't the school district look out for safety interests?
- Don't administrators, know what the safety problems are?
- Aren't schools inspected regularly for hazards?
- Am I doing someone else's job by being concerned about safety issues?"

Generally these questions are answered with a simple, "No"' Schools, unlike industry, are not routinely inspected for safety by federal and state agencies. The fire department inspects schools but usually only for access to exits and the presence of up-to-date fire extinguishers. The workers compensation bureau and insurance underwriters usually inspect schools for conditions that may affect the working conditions of the maintenance or janitorial staffs. No agency is known for its attention to safety details in the classroom. So it's really up to teachers and administrators to know about classroom safety.

Elementary instruction, particularly math and science, is evolving from the lecture method to hands-on teaching strategies. Science, math, art, and social studies, now use manipulatives, take field trips, and do projects that require more than just paper, pencil, and worksheets. Students are working in groups, moving about, conducting experiments, gathering data, and using more instrumentation and technology. Teachers need practical guidelines for evaluating safety in an active learning environment.

Class size, an important safety factor.

Class size and classroom management are important with regard to safety. According to the NSTA Position Statement (NSTA)on Laboratory Science the number of children assigned to each class should not exceed 24. The square footage (total area in the classroom) compared to the number of students in the class is used to determine the ideal number of students in a classroom. Why is 24 a magic number? Twenty-four is the number of students that will safely fit in a standard size classroom of 1000 to 1300 square feet. The National Science Teachers Association recommendation for junior high and high school science labs is 45 square feet per student. Several states have building codes requiring 50 square feet per student in industrial arts shops where students are using tools and equipment. The NFPA Uniform Fire Code (NFPA) requires 50 square feet for industrial arts (vocational education) classes, and 20 square feet per student in academic classes. A simple calculation yields 22 to 26 students per classroom depending upon the total area.

Teachers need to be aware of space/area related problems when implementing an active curriculum. Problems become obvious when we ask a few questions. Is there room for students and the teacher to move safely? Can the teacher get to students who might need help or assistance in an emergency? Can you see all the students in the class at all times? Is there adequate table space for student work? Is there accessible and secure storage for supplies and materials? Keep these questions in mind when you are deciding on student desk placement, the number of students that will be in your room, and where to put your desk.

Monitoring the students.

Tables, number of students, and square footage are measurable and easily determined. A more subtle factor is the teacher's awareness of what students are doing. The teacher's attention may be efficiently divided among just so many active students. It takes time to refocus one's attention on each student or group of students. The greater the number of students who are in the room, the more likely that some off-task behaviors will go unnoticed. For example, an elementary teacher was conducting a science experiment that required heating water in a test tube with a simple alcohol burner. During the activity the teacher was helping students at the back of the room, meanwhile other students at the front of the room started a fire in one of the metal wastebaskets. The teacher noticed that the fire was not large and nonchalantly took a fire extinguisher off the wall at the back of the room and removed the safety pin. He announced, "Don't worry, don't panic! It's just a small fire. I'll put it out." As he was walking toward the fire through a crowded aisle, he tripped, fell, and triggered the fire extinguisher. The chemical powder from the fire extinguisher hit a student in the face, temporarily blinding the student. Other students panicked and ran for the door. In the subsequent rush a student was pushed to the ground, trampled, and suffered severe head injuries. The teacher should not have been so casual and definitely should not have relied upon students to maintain order in an emergency. He should not have pulled the pin on the fire extinguisher until he was ready to use it. He should have instructed his students to move away from his path to the fire. He might have told the students to evacuate the room in an orderly fashion. The teacher in this story is probably one among many educators who have not had training in the use of fire extinguishers or emergency procedures.

Storage and organization of materials.

While large class size may limit a teacher's ability to watch all of the students, there are other conditions that could interfere with a teacher's attention to safety in the classroom. Location of storage areas and organization of materials are important in the "activity-based" classroom. There are generally two types of storage. One is a centralized storage with a common preparation area used by many teachers. The other is localized storage in each classroom.

Centralized storage requires moving materials to classrooms. If equipment, chemicals and glassware are being moved there is the possibility of breakage and spilling hazardous substances in the hallway. The advantages of centralized storage include elimination of duplication, increased usage, and easier security and inventory control of materials. Localized, in-room storage must be tamper proof, secure, and accessible by the teacher. If a teacher needs something from a storage area then the line of sight to students should not be obstructed. If students get things for the teacher they should not be sent for hazardous substances, or be sent to a storage area containing hazardous substances. Teachers should be suspicious of students who are too anxious to get into storage areas. Safety and school security often go hand-in-hand. For example, balances and some chemicals were stolen from an elementary school storage area. Students knew the school had materials for experiments. One elementary student unlocked a window and put some balances and the chemicals on a ledge near the window. Later that evening the window was opened

from the outside and the materials were taken. If the students were injured in the process of playing with the chemicals the school might be held liable. It is the school's responsibility to ensure that potentially dangerous materials are not accessible to unsupervised students.

Tables, chairs, floors and work space.

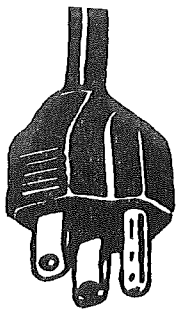
Teaching requires desks or workspace for the students and teacher. There is more flexibility in lesson selection if the classroom is equipped with flat-topped tables, as opposed to individual student desks. One-piece student desks often have smooth, tilted writing surfaces. These are not suitable for using bottles and other kinds of materials and equipment needed for activities. Plastic and glass containers will often slip from a tilted surface, fall and spill their contents onto the floor. Slippery floors constitute a hazard.

Carpeted floors have problems of their own. Spills may not be easily wiped up, chemicals may become trapped in the carpet and may constitute a longterm hazard. For example, if a teacher broke a mercury thermometer, with subsequent mercury contamination of the carpet, then the mercury could become an unseen health hazard. When you walk through a school be alert to location and use of carpeted areas. Look for flat topped tables in activity areas. Is there enough space to support the number of desks in the room and still allow free access to all students?

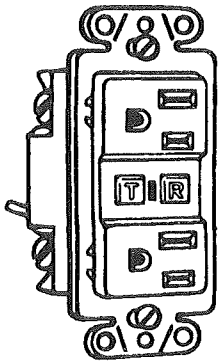
Indicators of compliance with modern building codes.

A teacher should have some knowledge about the safety features that are part of the building itself, i.e., the construction of the building. As a new or prospective teacher you may want to know if the school building is built according to modern codes. For example, handicapped children should be given access to all the activities in the classroom. Accessibility for handicapped students and teachers is a legal requirement in new and remodeled school buildings. You should find handicapped accessible drinking fountains, toilets, walkways. In science rooms there should be at least one lowered desk,, and an accessible sink fitted with extended-arm faucet handles. Doors may have been widened and access ramps or elevators provided. In older buildings there is less likelihood that handicapped access was a concern. Adequate access and freedom of movement is safer for all students, especially during an emergency.

Teachers need to be aware of architectural safety features such as, adequate number and proper placement of three-prong electrical outlets.



OSHA codes require three-prong plugs on electrical devices, and no daisy chained extension cords (several extensions connected together). There should be finger guards on fans, no octopus plug-ins on outlets, and no cheater plugs that allow three-prong cords to be plugged into two-prong outlets.



Electrical outlets should not be near a water supply. If the outlet is near a water supply there should be a GFI (ground-fault interrupter) as a safety device to prevent electrocution.

Ventilation.

Adequate room ventilation is important because chemicals may be absorbed directly into the body from the lungs. The lungs have a very large internal surface area. This lining of the lungs is moist to allow oxygen and other gases move quickly into the bloodstream. Chemicals in the air you breathe can also pass quickly into your bloodstream. Molds, fungi, bacteria, spores, and other microscopic particulates constitute other hazards in any enclosed environment. Radon is a radioactive gas that is common throughout much of the nation. Radon seeps into buildings from underlying rock formations. It is a national concern because radon is a leading cause of lung cancer. Adequate ventilation reduces the risk from cancer causing radon.

If an area in the school contained residue from broken mercury thermometers or broken fluorescent tubes there may be a hazard from mercury vapor. Mercury vapor can be inhaled and is toxic in very small amounts. When the concentration of mercury is small then students may not be in immediate danger, however, there is still a danger to the teacher who works in the room for years. A person may suffer chronic, long term, poisoning by mercury vapor. Inexpensive mercury vapor test cards are available from most chemical supply companies that allow you to determine if dangerous levels of mercury vapor.

Volatile solvents such as duplicator fluid, paint thinners, spray paint, fingernail polish remover, acetone, and various cleaning solutions may contribute harmful chemicals to the air. Chemicals found in new carpeting may vaporize and cause allergic reactions. In some older buildings formaldehyde, a carcinogen, may be released from insulating materials.

Ventilation or Recirculation?

In all the above cases of air pollution adequate ventilation dilutes the concentration of the harmful chemicals and improves the overall air quality. Often there is confusion about the meanings of "recirculation" and "ventilation". Recirculation refers to the unrestricted cyclic flow of room air. Ventilation is the removal of existing room air and the intake of replacement fresh air. Recirculation may be energy efficient but not healthy. Schools often sacrifice air quality for heat or cold retention. In the short term money may be saved by recirculation of building air. Those savings may be lost over the long term in increased health care costs. If there are contaminated rooms and the air is just recirculated then pollutants are spread throughout the entire building. Rooms with contaminated air should have a separate air removal system that prevents airborne materials from entering the whole building.

How will you know if the building has a sealed air circulation system? If there are no windows in the school or windows cannot be opened then there is very likely a centralized recirculation system. The easiest way to determine how the air in the school is kept fresh is to ask to ask the janitor or maintenance foreman. As a case in point, there's a rural school that replaced a roof during the summer. The roofing contractor found a rusted, corroded vent opening on the roof. He assumed that the vent was not functional so he sealed the vent and roofed over the opening. When school started in the fall the elementary science teacher was demonstrating a simple chemical reaction that released noxious fumes. She turned on the exhaust fan in the fume hood. Smoke

poured into the room. It was immediately obvious that no smoke removal was taking place. She had to evacuate her classroom and open the windows. Subsequently the school reopened the roof vent and installed a new exhaust fan that would take care of the problem in the future.

In another school a teacher wanted to spray paint a student project. She looked at the label on the can of spray paint. The label specified that the paint should be used with adequate ventilation. She thought that only one can of paint would create no problem. So she painted the project, allowing the paint to dry in the room. The odor did not seem "bad", and she noticed no ill effects. Her fourth grade students did not complain of any discomfort. However, the spraypaint label listed xylene as a component. Xylene is a toxic substance that is hazardous in small amounts. Generally speaking, a good rule for exposure to toxic fumes or vapors like xylene is, "If you can smell it, it's too dangerous." She should not have exposed herself or students to the fumes.

A story that illustrates the value of our sense of smell as a protecting device involves natural gas. Natural gas can be either piped or bottled and it is usually treated with a foul smelling chemical so that most people can detect a gas leak. One can smell the gas-additive's odor at extremely small concentrations. That means that it takes very little of the chemical to be detected by the average person's nose. The odor detection limit is well below the amount of gas that must be in the air to cause an explosion. We can be protected from a gas explosion if we open a window when we smell the gas additive. In some rare situations after remaining idle for several years bottled-gas odor additive will be absorbed by its metal container. Explosions have occurred because there was no gas odor, even though a gas leak had filled the room with flammable gas. So, we should be cautious because an odor may not always be a protection against hazardous substances in the air. Some toxic substances don't have an odor, for example, carbon monoxide and radon have no odor.

Important safety equipment

There are certain items that you need in your classroom in case of an emergency. Fire extinguishers are the most obvious piece of safety equipment. For most school situations there are three classes of fire extinguishers in common use: Class A (for ordinary combustibles such as wood and paper fires); Class B (for flammable liquids and gas fires); and Class C (for electrical fires). The label on your fire extinguisher shows which type of fire the extinguisher is rated for. For most classrooms the ABC type (dry chemical), 10-15 pounds capacity, fire extinguisher is suitable. If you have computers in your classroom then a carbon dioxide fire extinguisher might be the one of choice as it would not damage the electrical circuitry. The Carbon dioxide fire extinguisher is not suitable for paper or wood fires (wastebasket fires). You should not have to go more than 25 feet to get a fire extinguisher. The fire extinguisher should be placed near a door so that someone entering the room during a fire will have ready access to the extinguisher.

Classrooms and storage areas should have smoke alarms. In newer facilities alarms are wired directly into the central alarm system and/or telephone. In older buildings individual alarms may be battery operated. These stand-alone alarms are useless on a weekend or evening when the building is empty. Even during class time if there were a fire it would be important that the alarm be sounded in a central office. A teacher may need additional help in order to put out a fire in the classroom and manage the children.

In case of an electrical fire, teachers should know the location of the master electrical control panel. The light switch on the wall may shut off room lights but it won't disconnect the wall receptacles. If a student were being electrocuted by a short in a cord then a teacher must not touch the student. If you touch someone being electrically shocked then you become part of the circuit. Instead of grabbing the victim you should shut off the electrical power to the room. If your classroom does not have an emergency shut off switch then switch off the correct circuit breaker in the electric panel. Electric control panels are often situated in the hallway, in isolated closets or electrical rooms. A teacher must know where the panel is located and know which circuit breaker switch controls the classroom.

The Telephone as a Safety Device

Another frequently overlooked safety device is the telephone. Communication during an emergency is very important. Rapid contact with emergency help, such as 911, may save a life. Classrooms should have telephones, especially if teachers are working alone after regular school hours.

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National Fire Protection Association (1991). Fire Protection for Laboratories Using Chemicals. NFPA, 45. 5

NCREL EXECUTIVE SUMMARY
THE NEED FOR ISSUES-DRIVEN FUNDING REFORM

A cost-effective school funding system allocates resources to the goals that are most important to the state. In order for policymakers to tie their school funding systems more closely to the goals and aspirations they hold for their state's schools, they must first clearly identify the goals they believe their state should seek. Only then can-they infuse more data-driven decision making into their debates on the relative value of the available funding options.

Currently, this process too often operates in the reverse direction. State policymakers are asked to weigh costly policy options (e.g., vouchers, systemic reform) *before* they have gone through the systematic analysis needed to answer the critical questions, What are we trying to do here? What issues in our state do we most want a school funding solution to address? Do these proposals directly address our issues?

There is a real need in each state in the NCREL region to:

- Gather critical information about the definition and nature of the state's school funding problems as well as possible solutions.
- Develop a process for monitoring the overall effects of changes it makes to the state's school funding system.

State policymakers can do this by using an issues-driven school funding process that provides legislators with comprehensive analyses of past, present, and future funding formulas. This process is firmly rooted in two critical assumptions:

- The analysis should provide an *objective* set of standards that staff from all political parties and interest groups can use to monitor the effects of past-and potential-school finance legislation.
- The analysis should avoid *telling* policymakers about off-the-shelf solutions that can be crafted to fit the specific problems they face. Instead, the focus should be on (a) listening as in-state stakeholders describe the extent and nature of each school funding issue, (b) systematically analyzing these issues to determine what the problems are, and (c) feeding this analysis back to these stakeholders to ensure that it reflects accurately their thoughts.

The initial step in this process is to gather data from in-state stakeholders about their goals for their state's school funding system. This information-gathering process is varied to fit the decision-making culture of a particular state. For example, in State A, which has a lengthy tradition of bipartisan efforts to improve school funding, the information gathering involved a bipartisan working group of legislative staff that developed a set of school finance goals. In State B, where discussions of school finance have been particularly contentious, goals were developed from a series of anonymous individual interviews with stakeholders from government, education, and business. Neither of these states' goals is the "correct' approach. The path a state chooses depends on the destination it most wants to reach.

To infuse more data-driven decision making into the school funding process, decision makers need to use a common set of measures to inform them about progress made towards the goals identified in that state. School finance researchers have developed a rich set of measures that can be used to quantify the adequacy and equity of state school finance systems. In identifying such a common set of objective measures, the focus should be on developing calculations that:

1. Measure a policy object rather than using traditional statistical procedures that may have no clear policy meaning.
2. Complement each other in providing different types of information on a number of major aspects of adequacy and equity. For example, while some measures take all children into account, others focus on particular types of children (e.g., those in low-wealth school districts, minority students, children living in poverty).

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SCIENCE ON THE FRONT LINES

As a student, it can't be easy to go to a school that is constantly under fire for low standardized test scores, and high truancy rates. It must be awful to pass through metal detectors, positioned like border patrol checkpoints, in the main lobby. Knowing that 1/5 of the students won't finish school, is another burden altogether.

It seems as if everyone who has voice has criticized the Chicago Public Schools for their poor performance compared to the state average. Many Chicagoans feel that the problem is with the schools, while others think that the students themselves should shoulder most of the blame. Whatever the problem is, many groups have offered to help. There are several outreach programs out there on front lines, trying to make a difference. The Chicago Police sponsor the We Care Role Models program, bringing law enforcement officers, and other community professionals into the classroom. The Chicagoland Chamber of Commerce sponsors the Youth Motivational Program (YMP), asking business leaders to encourage the students with stories of success.

I have been a part of and continue to participate in these programs, but I add a unique twist. As a tall skinny 24-year old, I don't look like the picture of success. I stand before a tough audience of 30 or more students, and I ask, "Who here is interested in science?" A hand or two *might* go up. "No problem," I say as I light off a small piece of nitrocellulose paper. There is a bright white flash and the paper is gone. A collective 'whoah' comes from the class. "Anyone interested now?" I ask again. A few more hands go up, and several of the students are smiling.

I go on to do several demonstrations, talking about the importance of each. *I tell stories of my days as a basketball cheerleader, and how that is a lot like an unstable chemical compound.* I teach them science again, methodically, asking a lot of questions. All the while, I can see them getting more and more interested. At the end I tell them, "Science is not hard. Keep studying it, and you will be amazed with you what you can do. If you want to learn more, talk to me after class."

Students always approach me afterward, shake my hand, and say thank you. Several of them ask about a specific demonstration, "Tell me again how that worked." Others have more specific questions, "Where is a good place to go if I am interested in Astronomy?" Teachers come up and ask how to do certain demonstrations, "My 8th graders would love that."

When I leave, I have no idea if those students will ever consider studying science any harder than they already are. I don't know if they'll forget everything I have said or if they will in fact rethink science in a new light. I do know, however, that they got to see some very exciting science. I also know that if I hadn't shown it to them, they might never have seen it, or ever even thought about it.

At the beginning of 2001, I started my company, Science Theatre Productions. With it I tour the Chicago Public Schools doing science demonstrations for the students. My motives are simple and pure. I want to give the students a chance to see some interesting and exciting experiments, in the hopes that they might get interested enough to continue their studies with a new vigor.

I do this work because, judging by what I have seen, a majority of the schools don't have the resources or the time to prepare such an elaborate demonstration show. As a result, their students are missing out on the very experiments that could get their students interested in science. This proliferates the long-term problem of minority under representation in the sciences. I firmly believe students everywhere deserve the chance to see these demonstrations and have their interest piqued.

Several of the schools I have visited were on academic probation, which is a mentally difficult position to be in. When I come in, I can see labs that are severely lacking in materials, with old books and bare walls. The teachers seem frustrated, and the students seem constantly annoyed. It actually feels tense just walking into the building. Using demonstrations, I try to get the students excited about a subject that usually seems so arcane and symbolic. My experience has shown me that anyone, regardless of age or ability can be interested in science for at least one hour. So for one hour, I have these students thinking about science, and how it relates to their everyday life. For the entire period, they really like it.

With colored flames and glowing solutions, I hold their attention, and make them realize that they know a lot more science than they think. I pour a solution from one beaker to another and students watch it change colors as I talk about acids and bases. A student throws an egg into a bed sheet, while I explain why it will never break. My demonstrations are simple, but effective.

In 1997, I was studying at the University of Limerick. While I was there, I told some local science teachers about demonstration shows I used to do. They asked me to come by and perform. Their students were utterly captivated, and the teachers were overwhelmed by the response. Before I knew it, teachers from one end of

Ireland to the other were asking for a demonstration show. I made an agreement with the University, and toured Ireland doing science demonstrations. In the evenings, I held teacher seminars, showing them how to integrate demonstrations into their lessons.

In virtually every school I visited, there was an increase in the number of students electing to take chemistry. This was a huge improvement, and the science teachers were delighted. At the end of my tour, the University of Limerick brought on a full time graduate student to continue my work, and combine it with a pedagogical survey.

My experience in Ireland showed me students needed to see what their books and teachers are talking about. By simply showing them some simple demonstrations, I motivated them to continue studying in science. I knew that I had to try the same thing in Chicago.

So far I have performed for several thousand students throughout Chicago. Most of the students I see are 6th grade and up, and they find science challenging. After showing them a series of 12 or more demonstrations, they are enthralled, and ask when I am coming back. I have seen students cut class to attend the show a second time. While I don't condone that behavior, it speaks volumes of their interest. Several teachers have contacted me a week or more after a show to tell me that their students were still talking about it.

In each school I visit, I am trying to make a difference. In one south side school, Burnham Academy, I will be performing the demonstration show as a fundraiser for their science program. I will perform several small demonstrations for the students during the day and encourage them to come back that same evening with their parents. All of the proceeds will go to the school.

I don't know what this work will lead to, although I do have some hopes. I would like to see more students electing to study science in college, and possibly choose it as a career. This may, many years down the road, create an increase in the number of minorities in the sciences. I feel that there are several directions this work can take me in, considering Illinois' dedication to education. For the time being, I am out on the front lines, doing what I can to get as many students interested and excited about science as possible.

MINI IDEAS

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WORM WATCHING

Earthworms, nature's plowmen, provide inexpensive, low maintenance specimens for classroom observation. These wiggly creatures are very beneficial because they loosen and enrich the soil. On the average, there are 50,000 worms in an acre of land and they process tons of soil every year. Worms do not have jaws or teeth, but draw soil into their mouth by muscle action. The worm extracts food from the soil and castings containing undigested nutrients are deposited on the surface, thereby helping to fertilize the land.

Each student, in a classroom, can establish and care for their own worm farm with some everyday materials. First, of course, worms are required. An adequate supply for classroom study can be found in almost any neighborhood by digging in gardens or looking under rocks, logs, or boards. Worms can also be found by searching lawns with a flashlight at night after a soaking rain. They can also be purchased from a bait shop.

Students should be cautioned that the collection of these animals should be done with concern for the safety of the worms. Loosen-the soil around the worm before pulling it out of the ground to avoid pulling it apart. It is not true that worms will regenerate lost parts.

Once collected, the worms should be kept in a container with lots of soil so they have a place to hide and eat, until they are ready to be transplanted to the individual worm farms. The soil should be kept moist. Dry soil is deadly for worms. It is important to keep the soil moist because it is through their moist skin that worms absorb oxygen found in the air spaces throughout the soil.

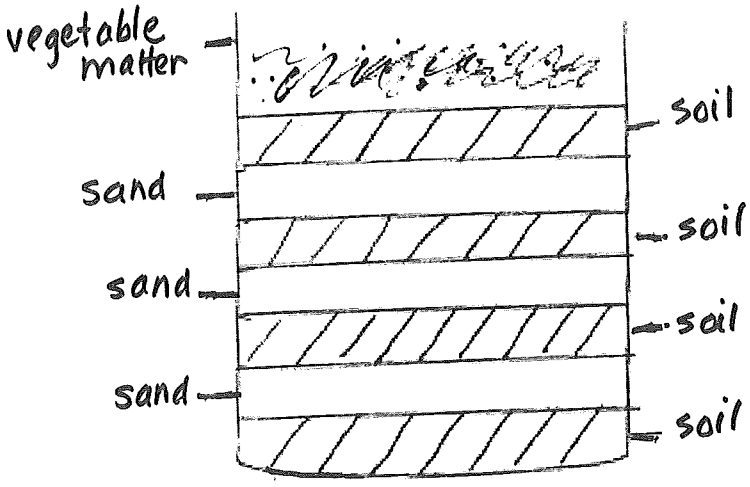
Making a worm farm is very easy.

The materials needed are:

1. A two liter plastic soda bottle.
2. Sand.
3. Fertile soil.
4. Dechlorinated water. Tap water which has set for at least 12 hours since chlorinated water will harm the worms/
5. A dark cloth or construction paper.
6. Vegetable matter in the form of dried leaves, apple peelings, etc.

Procedure:

1. Take the label off the two liter bottle.
2. Cut the top off the bottle at the beveled edge.
3. Fill the bottle with alternate five centimeter layers of soil and sand to about five centimeters from the top.
4. Moisten the layers as they are laid down.
5. Add the worms. A farm this size should accommodate approximately 10 worms.
6. Add vegetable matter in the form of leaves, lettuce or apple peelings, etc. on the top of the last layer.
7. Put a dark cloth or construction paper over and around the bottle since worms like it dark.



In no time at all, students will be able to observe the tunnels their worms have constructed. They can also do external anatomy observations and experiments concerning light and touch on their worms. But most important of all, they will learn how to care for and respect these little creatures.

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HUNTING FOR ASTEROIDS, COMETS, AND NOVAE

Empower your students with the tools and techniques that could make them famous and maybe save humankind from extinction!

You have heard of Comet Hale-Bopp and the meteor that may have killed the dinosaurs. Well, thanks to the Internet, digital cameras, and image processing software, just about anyone has a chance of discovering the next comet or an asteroid headed toward our planet Earth—hopefully in time for us to try to send a rocket to deflect the killer rock. And all this without a telescope!

Thanks to my alma mater, the University of Illinois in Urbana, nightly pictures of the sky are available to anyone with an Internet connection. The astronomy department has a camera lens attached to a sensitive CCD chip that takes fantastic shots of the stars. The pictures are automatically uploaded to their Internet site called Stardial. One image is taken every 15 minutes in a strip just below the celestial equator. Images from the past three years are available at the site.

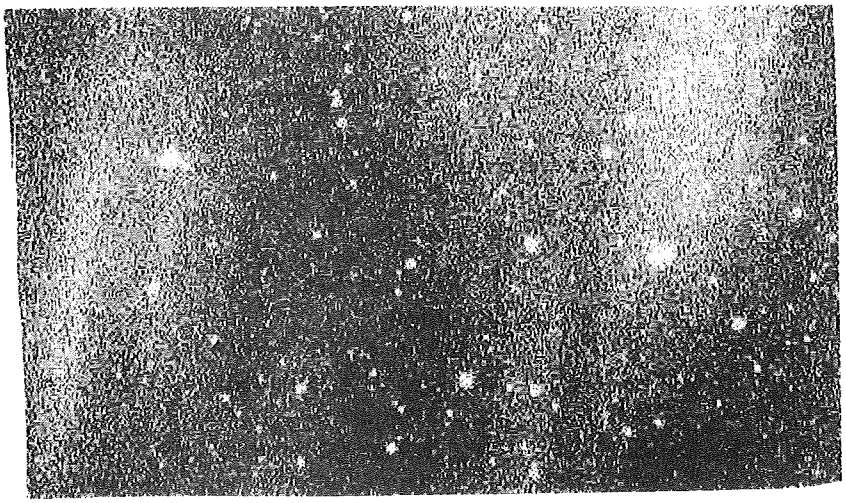
Using Stardial in the Classroom

I captured students' attention by discussing the dinosaur extinction and by showing several videos about asteroid impacts and dangers. Then I had each student in my astronomy class choose an area of the sky that Stardial imaged. Steps for using Stardial are detailed starting on page 44.

Students checked their area each clear night and compared the new images with older ones to find any differences.

Over the course of weeks, several objects were found. Most turned out to be airplanes or satellites. Two unknown objects were found and tracked for several days. Our project and two students were featured at the Tech 2000 exhibit at the state capitol, on a Chicago talk radio show, and on the evening news of a Chicago television station.

The objects were compared to an asteroid database and were later found to be known asteroids. We will keep looking!



Benefits of the Project

This project builds many skills in astronomy. Students learn to use the coordinate system of the sky (right ascension and declination) and the brightness scale of the stars (magnitude). The size of the images and speed of the motion of the objects are measured. Retrograde motion is shown on some of the images. Students also get the opportunity to explore the creation of digital images of the night sky with CCD cameras.

The project also builds computer skills. Students practice visiting Internet sites by typing in the web addresses. They learn to download images and convert them from one format to another. Other skills include saving and opening files and digital image processing, animation and aligning, measuring, and enhancing the images.

Perhaps the most important benefit is that the work of a scientist is highlighted. Students learn patience—many thousand images may need to be checked before a discovery is made. Surprise! The work can be borrowing! Students learn to face disappointment when they think they have a discovery and it turns out to be a known object, not a new one. They come to appreciate the persistence needed by scientists. Students see that there may be no immediate results, and a project may take years to complete.

At the same time, they begin to imagine the thrill of discovery and being the first person to see a new object. They enjoy collaborating with other scientists. They begin to realize that sometimes important discoveries are made by accident.

Stardial has been, by far, the best resource I have ever used for motivating my astronomy students. Stardial images provide the chance to do real science and make a real discovery. Students know that perhaps their discovery could even save humankind from extinction (like the dinosaurs) by spotting a killer asteroid in time to send up rockets to push it off course. These are all real possibilities, and my students get very interested and excited about them.

With the real-time images of Stardial as motivation, my students are learning all about astronomy as well as computers, image processing, and the Internet.

Welcome to Stardial

What is Stardial?	Data Web, Select, FTP, Charts
What's new?	Recent Images Last Night, Tonight, Latest
Highlights	Activities Assignments, Projects, Publications
History	Rewards
Help	Astronomy Resources Simbad
E-mail	Links Weather
Guestbook Sign, View	Participants

Search Stardial for Go

Steps for Using Stardial

Here are the steps, using a Macintosh. (Windows is similar, but not identical. Steps to use with that operating system are inserted as needed.) Please note that other software and hardware differences may affect the steps you need to use. Also be aware that web sites do change over time. For help in making this Stardial activity work for you, email the author: derickson@latinschool.org

1. Download the pictures.

Using the WWW browser Netscape, connect to the Stardial site (www.astro.uiuc.edu/stardial). Download two images from the same place in the sky that were taken on different days. Two images with the file names of 01060530 and 01070530 would be good to download and compare.

Note that the first four digits of the picture's file name tell you when it was taken (0106=January 6). The next four digits tell you the picture's location in the sky (0530=05 hours, 30 minutes RA). RA is similar to longitude, but it is on the celestial sphere, not on Earth.

Stardial images are quite large in sky area—about 8 x 5 degrees, but only about 50K in file size. They do not take long to download in the JPEG format. If the image is all white (6K size), the sky was cloudy on that date. Try another image with a file size around 25K.

Here is the path to two images, taken on clear nights, that you can use for your first try:

- Start Netscape and go to the site: www.astro.uiuc.edu/stardial
- Click on Web (under Data), then jpg/ then RA/, then 0530/, then 2000/, then 0106.jpg.
- This will display an image of stars.
- Now save this image: File/Save As, choose Format Source (change Text to Source).
- Now do the same for the 0107.jpg image.
- *For Windows,* save images with the.bmp extension, choosing All Files in the pull-down menu.

2. Convert the pictures to a usable file format.

(If the JPEGs open in NIH Image, you can skip this step. A Quicktime converter on your Mac may allow them to open directly in NIH Image.)

For Macs, the images are in a JPEG format. The image processing software you will use does not open JPEG so the images must be converted to a PICT or TIFF format.

- Open the first image in JPEGView 3.3.
- Save As and choose the PICT format.
- Do the same for the second image.
- *For Windows,* use an image manipulation program (such as Paint) to open your.bmp files and Save As true bitmap images. Save in 256 colors.

3. Set memory requirements and open the images.

The National Institutes of Health has a freeware program called Image that can download from rsb.info.nih.gov (then click on NIH Image/ImageJ, then Downloads, then nih-image162_fat.hqx). Or for Mac and PC, you can get the program from www.cipe.com (then click Software/ Images, then NIH Image Software or Scion Image Software). The Scion site requires you to register before you download, which will not cause a problem for you. Use your school's address if you wish.

- Set the Memory Size of Image to 10000K, Do this by clicking once on the Image icon and then File/Get Info/ Memory.
- Set the Preferred Size to 10000.
- Set the Image Buffer to 3000K. Do this by starting the program and then accessing Options/Preferences.
- Set the Undo and Clipboard Buffer to 3000.
- Quit the program.
- Start Image.
- Open the two PICT or bitmap images.,

4. Make a stack from the two images.,

You will put one image on top of the other in a single file called a stack.

- Menubar/Stacks/Windows to Stack

5. Align the images. (You can skip this step for your first try).

The two images may not be exactly stacked, so we need to register (align) them.

- Go to the Menubar/Stacks/Register and follow the directions that appear on the screen. (A fiducial point is a reference star that appears in both images.)
- After you do Stacks/Register and click Register, click ONCE on the exact center of a small star near the upper left corner of the image. REMEMBER WHICH STAR.
- Then click TWICE quickly on a small star in the lower right corner. REMEMBER WHICH STAR. (Do not move the mouse between the clicks, and they need to be two fast clicks.)
- The next image (slice) will appear. Do the same clicking on the same stars. This will align the two images.

6. Blink the two images.

Now that the images are aligned, we can blink them to check for differences. Show the two images, alternating between the two rapidly. Any object that is on one image, but not the other, will blink.

- Menubar/Stacks/Animate.
- Change the rate using the number keys on the keyboard, 1=slowest.

7. Check the identity of blinkers.

If you find a blinker, it could be a nova, asteroid, comet, satellite, or...??? Email the date, time, and location to another observer and ask that person to confirm your findings. My students and I can try to confirm findings with others who find objects. The software program called Starry Night (www.siennasoft.com) plots many known asteroids and can be used to identify asteroids you find. Or search for asteroids on the Internet to find ways of reporting your finds. It may be a known object, or, if you are lucky, a brand-new find.

Another activity using Stardial is finding and plotting the light curve of variable stars. The AAVSO has a nice program called (Hands-On Astrophysics (www.aavso.org). The Stardial site has more activities, and students can think of additional activities as well.

* Dennis Erickson teaches astronomy, electronics, and computer literacy in grades 6-12 at The Latin School of Chicago. A life-long amateur astronomer and ham radio operator, his current project is sharing the wonders of the night sky and educating the public about light pollution and its solutions.

Tim Sears
Reprinted from the KSTA Journal
Fall 2001

MIRROR, MIRROR ON THE...

Investigation 1

Materials: 4 small plane mirrors, clay for supporting the mirrors, table or desk.

How many different ways can you arrange the 4 mirrors so that you can find someone on the opposite side of the table from you?

Conditions: The searcher and the searchee must each keep their chins somewhere on the edge of the table. The searcher must move each mirror around until s/he can see the searchee in the mirror closest to the searcher.

All 4 mirrors must be used in the search. (To check if this has been done, move each of the mirrors slightly, one at a time, after the hider has been found. If a mirror is really being used, the searcher will lose sight of the searchee as the mirror changes position.

How many different arrangements of mirrors can you discover? Take turns playing searcher and searchee. What happens if you place your heads in different positions on the table? Record the different arrangements you find. Discuss why this works and how the searcher is able to find the searchee.

Investigation 2

Materials: 4 mirrors with clay supports, stickers in 4 different colors

Place the stickers on each of the 4 mirrors. Use a different colored sticker for each body part. Make 2 eyes, a nose, 2 ears, and a mouth. Use 4 stickers to construct the nose. Use 4-5 stickers to make the mouth. The stickers can overlap.

How can you arrange the mirrors so that you will see a complete sticker face in the mirror nearest you?

You must keep your chin on the edge of the table at one end.

The face you create must be similar to a normal face. How many different arrangements of the mirrors can you make? What kinds of funny faces can you make? What is happening in this investigation?

Investigation 3

Materials: 4 mirrors with supports, ruler, and 4 different colored stickers.

Find the exact center of each mirror. Place a different-colored sticker in the middle of each mirror.

Condition: You must keep your chin on the edge of the table at one end. You must see only 1 sticker in the mirror closest to you. You may change the position of both your head and the mirrors until 3 stickers are lined up behind the fourth sticker.

How many different alignments can you make?

How was this investigation similar/ different than the first 2 investigations? What are some discoveries about light, mirrors that you made from these investigations?

Investigation 4 – Mirror Mazes

Materials: 3-4 mirrors, 10 cardboard squares (you may use more as you progress in the investigation, clay for supports, flashlight, crayons or markers.

A troll lives in a large cave. He guards a treasure chest of precious jewels. The troll has built a maze to prevent you from getting to his jewels. Of course, the troll does not like light and will be blinded temporarily if light shines on his face. The object of this investigation if for the treasure hunter to shine a light through the maze, temporarily blind the troll, and get the precious jewels. You may use a flashlight and mirrors to help in your quest.

One person will be the troll, the other the treasure hunter.

The troll builds a maze using the cardboard barriers. Start easy. There must be a space of at least 2 inches wide between the cardboard barriers.

The troll has a self-portrait drawn on a piece of mat board. This is to be located at one end of the maze.

The treasure hunter must place the flashlight on the floor at either comer of the maze on the side opposite the monster. The flashlight must not be moved.

Using at least 2 mirrors the treasurer hunter must direct a light beam through the maze in such a way as to shine it on the troll's face. The 2 mirrors can be moved.

Change the difficulty by adding more barriers and more mirrors.

Investigation 5

Design an investigation where you will have to find a person or object around a barrier. What about those hard to see places? What occupations would need a mirror to see around barriers?

Investigation 6

Can you think of some examples of transparent mirrors? In what ways are windows like mirrors? In what ways are windows different than mirrors? What materials could you use to investigate transparent mirrors?

Cathie Plaelin
Reprinted from the KSTA Journal
Fall 2001

THE MAGNET GAMES

During the Olympics, my third graders and I studied each event. At the same time we were working with magnets in science. Every kid loves to play with magnets and see how much they will pull or hold. Every kid also loves to compete with his or her classmates. The two seemed to fit perfectly and the first Magnet Games were held.

Day 1

The unit on magnets began with groups of three students exploring the room, minus the computer screen because of potential damage, for objects attracted to magnets [1]. Their findings were recorded in their research notebooks in two columns, one labeled "Yes" and the other labeled "No". One thing their exploration taught them was that some objects held magnetism after the magnet was taken away. This would be a valuable tool in the competition. After the exploration, each team wrote a generalized statement describing the objects that were in each column, such as "Metal things stick to magnets". Later these generalizations were classified by defining the attracted metal as steel or iron. Older students doing this activity would probably make more specific statements.

Day 2

The students brought mystery objects from home concealed in brown paper bags. They were encouraged to be tricky. The bags were stapled shut and labeled with random numbers. The group then tested all the bags with magnets to determine whether the contents fit into a "Yes" or "No" column. The testing methods varied, but most tried to pick the bag up with a magnet. Several bags had been recorded under both "Yes" and "No". After all the results were tabulated, the bags were opened and tested by the student who had brought the object. Several of the objects did in fact fit both statements due to multiple materials in the bag, such as a pencil with an iron ring holding the eraser.

Day 3

Training for any event takes patience, trial and error. The same was true for the Magnet Games. Six events were outlined:

EVENT #1 - Picking up the most tacks with a cow magnet. A cow magnet is a strong, cheap magnet inserted into the stomachs of cows to protect them from passing foreign objects into their intestines. They are available inexpensively from farm supply stores. A package of small tacks was placed in a dish to be picked up. The tacks were to be picked up with:
- single downward motion. This eliminated the use of
- stirring motion or scooping of the tacks. The tacks had to be held above the dish for 5 seconds before they were counted.

EVENT #2 - Picking up the most safety pins with a magnet of the students choice. The safety pins were placed in a dish, but the contestants could choose the magnet from 4 different types available for this event. As in EVENT # 1, only a single downward motion was allowed, and the pins had to be held for 5 seconds before counting.

EVENT #3 - Picking up the most paper clips with a magnet of the students choice. The same procedure was employed as in EVENT #2, but small paper clips were substituted for the safety pins.

EVENT #4 - Longest chain of paper clips using a magnet of the students choice. The paper clips could not overlap each other or the magnet more than half their length and were to be suspended from the magnet for at least 5 seconds. Success in this event was increased for those that noticed that paper clips are not flat.

EVENT #5 - Longest chain of tacks with a cow magnet. The same procedure was employed as in EVENT #4, but tacks were substituted for paper clips.

EVENT #6 - Longest chain of magnetic balls pulled at least 15 cm. A starting line was taped onto a table with a finish line 15 cm. The chain was to start intact behind the starting line and remain intact crossing the finish line. Three attempts were allowed.

After each event was explained, all contestants were given a chance to practice individually before signing up for their two best events for the actual Magnet Games. The practice areas were set up around the room, and the students were free to practice all events before deciding in which to participate. During this time, different techniques were tried, abandoned, copied, and perfected.

Days 4 and 5

The Games Begin

The students competed in preliminaries for each event. The three best students in each event advanced to the finals. In some events it was necessary to change the variables to break ties, such as extending the time requirement for holding the objects. The entire competition took about 2 hours over 2 days, and involved 21 students. All students received silver participation medals for their efforts. The medals were poster board circles covered with aluminum foil. On each medal the inscription read "2000 Magnet Games". The medals were hung on ribbons. No individual awards were given. The final results were sent home and recorded in the class record book.

The fascinating part for me as a teacher was watching the concentration during the competition, and the planning prior to it. Several students had developed strategies that showed a deeper knowledge of magnetism. For instance, some put the objects in and "0" shape before making the down and up movement, thus exposing more of the magnet's surface to the objects. One student in particular impressed his classmates in the longest chain of tacks competition by picking up a huge pile first. His competitors had all placed tacks one by one to form a chain. This student took his mass of tacks and systematically removed those that were not part of the length. Then, as a result of his training, he used some of the extra tacks to add to his chain length since they had become partially magnetized. He created a chain of 11 tacks, 4 more than his nearest competitor.

In the future I hope to be able to spread out the competition over a longer time frame. Depending on the class, number of students and patience, an hour of competition is too long. This makes management of the non-participants a problem. Individual practice kits to be checked out for home practice is something I have also considered. This would allow their newly developed techniques more secrecy.

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Shoreline, WA 98155

Repriinted from WSTA Journal

CHEMISTRY ADAPTATIONS OF SOME OLD IDEAS

My goal is to highlight some demonstration ideas that are not new but to give some possible new adaptations. I originally came to chemistry from years of doing demonstrations in science centers. When I started teaching chemistry I also did demonstrations for the students. It occurred to me that the demos would be more meaningful if the students had the experience first hand. I began adapting my favorite demos into labs. I still do demos but reserve those for things that are unsafe, expensive or have equipment limitations.

At Shorecrest High School we have 105 minute periods and my lab adaptations are designed for these time slots. I have selected activities that can be completed in a 50-minute time slot. This may work well for most schools. You should be able to find many of these listed in chemical demonstration books.

I would love comments on ways you might use these ideas and lab ideas you have come up with. Enjoy! Feel free to contact me if you have questions.

Activity 1: Galvanizing nails

Background: This is an easy demonstration in which you supply power to a nail and dip it in a solution. Like magic the nail is coated with zinc. It is great for teaching about oxidation-reduction and/or electrochemistry. You can go as far as you wish; for example, weighing before and after and calculating the number of atoms deposited.

Preparation: If you have a long period you can have the students make the solutions. If not, you can make them. This is a good exercise in molarity because the solution contains three ingredients with different molarities. I have the students make 50 ml total and we use 50 ml beakers for the lab. The zinc plating solution contains three reagents. They are: 0. 15 M in ammonium citrate, 0. 50 M in ammonium chloride and 0.35 M in zinc sulfate heptahydrate. You will also need pieces of zinc for the second electrode, clean iron nails (I use small finishing nails), 9 volt (walkman) batteries, and wire to hook it all up.

Procedure: Pour the galvanizing solution into a beaker. Attach a zinc strip to the (+) terminal of a 9 volt battery via a connector wire. Connect a clean nail to the (-) terminal the same way. Place the nail and the zinc strip into the galvanizing solution. Observe the nail and remove when it is done.

Applications: I ask the students to figure out what is going on and sketch the full electrochemical cell with the electron path and all half reactions (note that there is also water electrolysis happening!). I also have students try to figure out what roles the reagents play which are in the solution by making the solution themselves and experimenting with the amounts of reagents. Finally, I have students attempt to design a silver plating cell and attempt to plate copper with silver. Other applications are: looking at reaction potentials, comparing cells and other types of electrochemical processes. I usually have the students tape a nail in their lab book. Please share ideas you may have!

Activity 2: Fizzy Bag

Background: This is a great all-around inquiry experiment. You can use it with students who know little chemistry as an exploration into ' how to take apart an experiment and figure out what is happening. You can also use it with chemistry savvy students as an analysis problem. The possibilities are endless! You will need sodium bicarbonate, anhydrous calcium chloride and universal indicator. I also have used phenol red, basic phenolphthalein, basic phenolphthalein and bromothymol blue as alternative indicators. I have actually gotten away with doing the same experiment twice just by changing the indicator. The first time I put the chemicals into

containers labeled A, B, C and have them figure out which combinations cause which observations. The second time I do it I have them labeled as Baking Soda, Snow Meltz, and Phenol Red and have them figure the reaction mechanism and products. You will also need zip-lock sandwich bags, spoons, medicine cups, and an assortment of labware.

Procedure: Place one teaspoon of calcium chloride and one teaspoon of sodium bicarbonate in a zip-lock bag. Fill a medicine cup with indicator and carefully lower it into the zip-lock bag without spilling the indicator (you do not want to mix the ingredients until the bag is zipped). Next, zip the bag without letting the indicator and powders mix. Once the bag is zipped, shake the bag to mix the ingredients and observe.

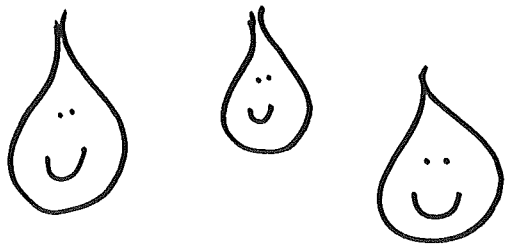
Application: As I mentioned, one use has been to do the activity at the beginning of the course, before the students know chemistry, as an exercise in observation (there is fizz, color and temperature). Sometimes I give the names of the reagents used and ask students to separate, purify and identify the products. This teaches separation technique and looking at possible reactions. Sometimes I do not give the names of the reagents and ask the students to try and figure out what the starting materials are and which is responsible for the observations made. Sometimes I do it in a zip lock bag and sometimes in a beaker.

It is interesting to note that in my district students do this experiment in elementary school without indicator. Then, they do it in middle-school with phenol red and again in 9th grade with bromothymol blue. When I do it in chemistry I use a beaker and universal indicator. The students very seldom connect it as the same reaction they have done previously in zip-locks.

Activity 3: Golden Pennies

Background: I have used this experiment as an illustration of alloys (brass) and oxidation-reduction (zinc to Zn+2 to zinc). Sometimes I have used it to measure how many atoms of zinc have plated as part of teaching moles. You do need a sensitive balance for this, It is also a good study of chemical reactions and change (chemical vs physical). Students really enjoy this experiment and often bring in foreign coins to change to gold. I have them tape a silver and gold penny into their notebook. You need a solution of 3 or 4 M potassium or sodium hydroxide, mossy zinc (the larger the chunks the better it works), and pennies (solid copper works best). You need to really caution students about the danger of hot base solutions and to use a cover glass. You will also need a set up to heat a solution. I like to use hot plates 'for better control. The solution does not have to boil - just be hot!

Procedure: Place some 4 M potassium hydroxide in a 250 ml beaker. Add a few chunks of zinc metal and cover with a watch glass. Heat the solution to hot but NOT to a boil. While the solution is heating, clean some pennies in a solution of table salt and vinegar. Place the clean pennies into the hot base solution and observe. When the pennies are silver, remove them and quench in cold water. Take the silver pennies and gently heat them over a Bunsen burner flame



until they are gold. Quench in cold water again I and voila, gold pennies.

Application: As an extension I also do an experiment with copper clad, zinc pennies (post 1982). 1 have the students nick the edge of the penny to expose the zinc and then drop it in 6 M hydrochloric acid overnight. The HCl dissolves the zinc inside leaving the copper skin. The task is to tell me how many grams, moles, atoms and what percent Cu and Zn the penny is made from. Have students research the US Mint stats and compare (www.usmint.gov).

Activity 4: Petri dish Precipitates

Background: This was originally shown to me as an overhead projector demonstration to illustrate molecular motion. Indeed, it does look cool projected but the students really enjoy doing it. I use it sometimes to teach molecular motion by varying the temperature of the water, You can also consider the size and geometry of the molecule with advanced students. Other times I use it to help teach the idea of solutions and ions. Plastic petri dishes work fine. Use wood splints to dispense the chemicals.' Pick your favorite precipitate reactions or use mine.

Procedure: Half fill a Petri dish with water. Make sure the dish is over a white colored surface (e.g., paper towel). Gently, so as not to stir or disturb the water, place small amounts of powder at opposite ends of the dish and observe. Do not disturb the dish while you wait. This one takes a few minutes. For the powders, try these combinations: Cobalt Chloride + Sodium Phosphate, dibasic Ferric Chloride + Potassium Thiocyanate, or Ferric Chloride + Potassium Ferrocyanide (optional: Potassium Iodide + Lead nitrate) As a variation, try Ferric Chloride + Potassium Thiocyanate + Potassium Ferrocyanide placed in the Petri dish at equal thirds of a circle distance from each other.

Application: Beforehand I have students try mixing dry powders first, then the powders in the Petri dishes as above, and finally make a solution of the powder and introduce it into the Petri dish with a dropper. There are also applications in dispersion rates and interfaces. Of course, students have to write balanced chemical equations for all reactions. Often I just give them the powders and have them try all possible combinations after predicting the outcomes (using solubility and precipitate color data). I will often coordinate this experiment with the last day of class before a holiday break and choose appropriate colored precipitates. Unfortunately, although lead and mercury precipitates work nicely, you have to be willing to properly recover and dispose of the waste. The experiment is essentially micro-chem so the waste is minimal.

OPPORTUNITIES

Illinois State Geological Survey.
Phone *(217)333-4747* or *244-2427*
TDD *(217) 782-9175*
http://www.isgs.uiuc.edu

WELCOME TO OUR FREE, ALL-DAY FIELD TRIPS FOR SPRING 2001

Each year, you're invited to join scientists from the Illinois State Geological Survey on four field trips—two in the fall and two in the spring. Each trip is designed to acquaint you with the geology, landscape, mineral resources, and biodiversity of a different part of the state. Along the route, we'll stop frequently to give you time to explore a special area, talk with geologists and other experts, or simply to admire the view. You'll also have opportunities to collect rocks, minerals, and fossils.

People of all ages are welcome. We ask, however, that grade-school groups be supervised by at least one adult for each five students, and that high-school groups be supervised by at least one adult for each ten students. The trips are especially helpful to teachers of earth science classes.

A guidebook explaining the geology, topography, and other features along the route and at the stops is given to each participant. A list of guidebooks from previous field trips is available for use in planning your own class tours or private outings.

On the day of the field trip

Plan to arrive at the starting point to register before 8:15 a.m. There is no preregistration; you must sign up on the morning of the field trip. In order to enter pits, quarries, mines, and other private property, everyone must sign a liability waiver. Landowners request this procedure for their protection.

Tours are held rain or shine. Wear comfortable clothing and walking shoes and bring along sun-blocking lotion. Bring a hard hat and safety glasses, if you have them. You may wish to wear them in some places we visit. We strongly advise that you bring insect repellent because some places we visit are located in areas of dense vegetation. Bring a packed lunch and drinks, and arrange for your own transportation. The day-long trip ends about 5:00 p.m.

At the starting point, field trip leaders will direct you to park in line so that the caravan can start out quickly and smoothly after registration. Drivers should begin the tour with a full tank of fuel. If you're touring on a bus, we recommend only mid-sized (12,000 lbs g.v.w.) or smaller school buses for safe travel on some roads and bridges.

The Illinois State Geological Survey, a division of the Illinois Department of Natural Resources, has studied and mapped the state's geology and mineral resources since 1905. The ISGS also collects, stores, and distributes great quantities of geologic data for basic and environmental research. Major achievements of the 1990s include

- three-dimensional geologic maps and models, products of a state-of-the-art, computerized geographic information system,
- new workshops, teaching materials, displays, and special-purpose field trips added to the four major trips per year-all part of a growing commitment to geoscience education and outreach for the people of Illinois.

For information about ISGS research and service or details of the 2000-2001 field trips, contact the Illinois State Geological Survey.

TECH CONNECT GRANTS

The **Electronic Industries Foundation's Tech Connect Grants** support creative technology-based math and science classroom projects through its TechConnect grants program. The average award is $2,500, and no award will exceed $5,000. The funds must be used to support the classroom project; they may be used to purchase classroom technology equipment, related teacher-training or technical support, or classroom supplies or to pay for field trips.

Eligibility is extended to disadvantaged schools in urban or rural locations. Applications will be accepted anytime for awards granted in spring and fall. The initial contact should be a letter outlining plans. For additional details, contact Marcie Vorac, Awards Coordinator, e-mail: mvorac@eia.org; www.eia.org/eif/techconnect.htm.

RAINFOREST WORKSHOP PROVIDES CORNERSTONE IN TEACHER LEADER DEVELOPMENT

Unique, active, and fun!

The AMAZON Rainforest Workshop July 5-13, 2001 is a professional development opportunity for teachers to work side-by-side with scientists in one of the most biologically diverse environments in the world.

- Join author/illustrator Lynne Cherry and a spirited faculty of specialists in ornithology, botany, marine biology, and entomology.
- Receive academic credit.
- Enter a $1000 workshop scholarship drawing. Deadline is April 2

Full land cost for the workshop is $1898. Budget airfares, optional Andes extensions are available. For workshop and funding information call Frances Gatz 800-669-6806, email: fgatz@earthlink.net or check our web site WWW.TRAVEL2LEARN.COM

GARDEN OF THE GODS RECREATION AREA
Shawnee National Forest
April 14 and May 12, 2001
Saline, Gallatin, Pope, and Hardin Counties

Garden of the Gods Recreation Area is located within the Shawnee Hills of southern Illinois. Participants will view many interesting rock formations, including those given names such as Camel Rock, Anvil Rock, and Devil's Smokestack. These rock formations and cliffs at the Garden of the Gods are composed of sandstone deposited 320 million years ago during the early Pennsylvanian Period. Overlying these sandstones, in the northern part of the field trip area, are the later Pennsylvanian coalbearing shales, siltstones, and sandstones formed about 300 million years ago. In the southern part of the field trip area are exposures of older limestones and shales deposited during the Mississippian Period about 340 million years ago. Throughout this time, Illinois lay close to the equator and near the shore of a shallow tropical sea. The Mississippian bedrock layers that we will examine during the field trip hold abundant marine fossils.

This area of southern Illinois lies south of the subdued topography of the glaciated till plains of the Illinois Episode of glaciation. The hilly topography—hence the name *Shawnee* Hills—is a result of tectonic uplift and the absence of glaciation. Within the Shawnee National Forest are large natural ecosystems relatively unchanged by human activity. As we hike the trails in this unglaciated area, you will experience some of Illinois' unique biodiversity, including sandstone glades, upland forests, and deep mesic (wet) ravines where distinctive relict northern plant species have persisted since preglacial times.

Meet before 8:15 a.m. at the parking lot of the U.S. Forest Service office in Harrisburg. To reach the office, take U.S. Route 45 south out of Harrisburg and turn left onto Illinois Route 145 and 34 South. The Forest Service office is located on the right side of the road.

EEAI 2001 SPRING WORKSHOP/ANNUAL MEETING

Mark your calendars now for *Saturday, April 28, 2001*. On this date, Dickson Mounds State Museum near Lewistown, IL will be the site of the Environmental Education Association of Illinois' ***2001 Spring Workshop and Annual Meeting***. All EEAI members as well as any other interested persons are encouraged to attend. There will be workshops for both formal and non-formal educators, highlighting exciting programs that YOU can replicate in your region.

The day's events start at 8:30am and end at 4:15pm. There is a $10 registration fee that includes your lunch. **Registration deadline is April 13, 2001.** (to be included in the catered lunch) If you have not received a registration brochure and wish to, please e-mail Pat Sullivan at sullivan@inx.net or call 217-322-2865 and make this request. Please include a mailing address.

Dickson Mounds State Museum, having undergone many changes and renovations in 1993-94, is one of the major on-site archeological museums in this country. Come and learn more about the museum's interpretive exhibits, state-of-the-art multi-media productions, and the exciting hand's-on programs that trace 12, 000 years of Indian experience in Illinois. Time will be scheduled into the day's events for participants to tour this fabulous Central Illinois facility.

Don't miss this chance to network with other environmental educators from across the state and meet and discuss issues with the EEAI Board members. Hope to see you there. Bring along a friend, too!

Keynote Presentation: Peter Wenz
Author (University of Illinois-Springfield)

Wenz will discuss his latest book ***Environmental Ethics Today***. Though many people think of ethics as abstract and unrelated to **their** everyday lives. He will lead interactive discussion on how essential ethics really are. He will explain how the development of an environmental ethic actually supplies us with the "tools" needed to weigh critical options in our personal lives and public policy.

Concurrent Sessions

Update on Certification Renewal for Teachers - Brenda Stoenecipher (Illinois State Board of Education-ISBE)

Update on Provider Approval for Non-Formal Educators -Linda McElroy (Illinois State Board of Education)

Illinois EcoWatch Network -Debbie Fluegel - (EcoWatch - Illinois Department of Natural Resources)

A Good Marriage-Steve Kolsto (Illinois Environmental Protection Agency-(IEPA) & Dave Kostka–Regional Environmental Center(Pecatonica,IL)

Hands-On Discovery at Dickson Mounds - Julie Barr (Dickson Mounds State Museum)

Bringing the Outdoors In and Taking the Indoors Out - Sue Brinner& Chris Richmond-Springfield Ball Charter School Parent volunteers will share

Self-Guided tours of Dickson Mounds State Museum

EEAI Annual Meeting /Luncheon

New EEAI Board Members will be introduced & current issues addressed

EEAI Awards Program will recognize the 2001 winners

Educator of the Year Awards (Formal /Non-formal)
Malcolm D. Swan Award

ILLINOIS COAL: ENERGIZING THE 21ST CENTURY

The Illinois Department of Commerce and Community Affairs Office of Coal Development & Marketing is looking for high school teachers of math, science (namely chemistry, but also earth, biological and environmental sciences), economics, social studies and perhaps English and technology to pilot and provide feedback for educational activities pertaining to coal.

Illinois Coal: Energizing the 21st Century is the name of the teacher's guide. Roughly two years ago, it was distributed to about 100 high school teachers throughout the state of Illinois (they will be receiving a simple survey to complete this spring). More teachers (throughout the state of Illinois, but especially in northern Illinois) are needed to try and evaluate these lessons.

To receive a free copy of Illinois Coal: Energizing the 21st Century, high school teachers can contact April Anderson at: teamnature@aol.com (847) 289-9760 or Barbara Antonini (in Coal Education) at bantonin@commerce.state.il.us

Illinois Coal: Energizing the 21st Century contains six modules:

Module 1 - Setting the Stage for Coal Formation
Timing the layers
The origin of limestone
The origin of coal
Module 2 - Characteristics of Coal
The nature of coal
Determining the chemical analysis of coal
Module 3 - Prospecting for Coal to Design a Mine
Estimating the Amount of Minable Coal in an Area Calculating the Minable Coal in an Area
Design a 3-D Model
Module 4 - The Economics of Illinois Coal
Concept Mapping
Coal & Our Economy
Illinois Coal & the Clean Air Act Amendments of 1990
Module 5 - Coal & Acid Rain
Acid Activity and Sources of Acid Rain
Module 6 - Clean Coal Technology
Background on Scrubbers
The Problem of Separation
Clean Coal for the Future

ILLINOIS URBANWATCH OPPORTUNITY!

The Field Museum and the Illinois Department of Natural Resources invites all high school science teachers to participate in the Illinois UrbanWatch program.

Through UrbanWatch, Illinois high school teachers and students conduct biological inventories of their local green spaces like schoolyards, city parks and community gardens. The Field Museum and state scientists use the data to identify long-term changes in urban biodiversity and natural areas. UrbanWatch provides teachers and students with an opportunity to learn about urban ecology and enables them to influence decisions concerning wildlife habitats, while helping scientists gather data on urban wildlife statewide. Through UrbanWatch, students are also contributing volunteer service hours to their local urban community.

An UrbanWatch workshop will be held on April 7th at the Medill Professional Training Center in Chicago from 9:00am 1:00pm. Graduate credit, a stipend, and professional development points are available to participating teachers.

Contact The Field Museum at 312-665-7443 to sign-up for the workshop. For more information contact:
Chris Molzahn
The Field Museum
1400 S. Lake Shore Drive
Chicago, IL 60605
Tel 312-665-7443
Fax 312-665-7433

ENVIRONMENTAL SCIENCE FIELD TEST OPPORTUNITY

The WorldWatcher Project at Northwestern University is recruiting field test centers for the 2001-02 school year. Teachers at these centers will implement Looking at the Environment (LATE), a new research-based environmental science curriculum with a focus on technology and scientific visualization.

Teachers will receive materials, technology, and professional development as well as the opportunity to collaborate with peers around the country. Field Test participants will also enjoy the opportunity to work closely with Northwestern University researchers in the development and evaluation of a modern environmental science curricula. In addition, a stipend, travel expenses, and the opportunity to earn graduate credit from Northwestern University will be provided.

Ideally, teachers involved in the field test should:

- Be able to teach at least two sections of LATE for the 2001-02 school year.
- Have access to Internet-connected computers (one for teacher use at home and/or work, and one for every three students in class once a week).
- Be able to attend a week long summer workshop July 30 to August 3, 2001, a national winter conference in January 2002, and monthly meetings with other LATE teachers in their local area.

A field test center will be a cluster of schools or school districts.
Ideally, each field test center will include:

- 4-5 teachers who meet the above criteria.
- A local field test coordinator, such as a curriculum coordinator or master teacher, who will coordinate local professional development activities, distribute materials, and serve as the primary interface between the project and the field test center teachers.
- A technology coordinator who can help install and maintain the software needed for LATE.

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e-mail: LM-Barden@wiu.edu

TO ALL ILLINOIS HIGH SCHOOL BIOLOGY TEACHERS

Do you want to learn more about DNA fingerprinting, lipid separation techniques, and a variety of other chemical separation techniques?

In June of 2001 two wonderful workshop opportunities are available to biology teachers in the State of Illinois who are interested in such skills as chromatography, electrophoresis, DNA fingerprinting, and much more. Members of the Department of Biological Sciences at Western Illinois University have been awarded Scientific Literacy funds by the Illinois State Board of Education to provide two workshops for biology teachers wanting to enhance their skills in molecular and cellular biology techniques, specifically chromatography and electrophoresis.

The first workshop will be anintroductory workshop on chromatography and electrophoresis and will be held June 18-22; the second workshop will focus on advanced chromatographic and electrophoretic techniques and will be held the week of June 25-29.

The primary objective of the workshops is to promote active learning through the use of problem solving and other higher order learning skills integrated into hands-on experimentation. If you are interested in learning more about these workshops, you may contact me at the above address.

MODELING METHOD WORKSHOP AT ILLINOIS STATE UNIVERSITY

An Eisenhower grant-funded *Physical Science with Math Modeling Workshop* will be held in Normal, IL, during June. Twelve two-teacher teams consisting of 8th/9th grade physical science and math teachers will participate in ten full days of workshop training on the campus of Illinois State University immediately after the end of the 2000-2001 academic year. The workshop will consist of 30 hours per week of classroom time, plus additional homework time. Teachers will participate in two days of follow-up activities during the early part of the 2001-2002 academic year.

Workshops will consist of hands-on, minds-on physical science activities that will serve to improve their instructional pedagogy by incorporating the modeling cycle, inquiry methods, critical and creative thinking, cooperative learning, and sound use of classroom technology. Teachers will improve their content knowledge in the study of motion using graphing and algebra. They will strengthen the coordination and articulation between algebra and physical science.

Stipends of approximately $500 will be paid for participating in the project. Graduate credit will be available (pending approval of CEU's), as well as credit for participation (pending approval of CPDU's). Graduate credit and on-campus accommodations will be available for a modest fee.

Carl Wenning, director of the physics teacher education program at Illinois State University, will serve as project director, instructor, and principal investigator. Also teaching the workshop will be Greg Hnilicka, physics teacher at Metamora High School, and Terry Oberhardt, eighth grade algebra teacher at ISU's Metcalf Lab School.

Details about this Eisenhower grant-funded project are available at the following URL: *http://www.phy.ilstu.edu/~wenning/modeling.html*. Additionally, applications and answers to questions may be obtained from Carl Wenning via phone at (309) 438-8756 or via e-mail at *wenning@phy.ilstu.edu*. Applications will be accepted until such time as all teams are selected.

EDUCATIONAL MATERIALS

Glenn Eaton, (415) 337-1100, x 106
Andrew Fraknoi (415) 337-1100 x 120
The Astronomical Society of the Pacific
390 Ashton Ave.
San Francisco, CA 94112
415/337-1100
FAX: 415/337-5205

New Book of Astronomy Teaching Activities and Resources Released by Astronomical Society of the Pacific

More Universe at Your Fingertips, a new collection of hands-on astronomy activities and resource guides for teaching astronomy in grades 3 - 12, has just been published by the non-profit Astronomical Society of the Pacific. Edited by veteran astronomy educators Andrew Fraknoi and Dennis Schatz, the 356-page loose-leaf format book focuses on inquiry-based, classroom-tested activities that teachers (and those working with them) can put to immediate work in their classrooms. The publication was developed by Project ASTRO, a National-Science-Foundation funded program linking volunteer astronomers with classroom teachers to improve the teaching of science in our schools.

The 27 activities (with detailed instructions) in the book cover such topics as: following the motion of the Moon, determining the reasons for the seasons, tracking and mapping the planets, searching for meteorites, discovering what killed the dinosaurs, measuring the Sun's rotation, finding stars that vary, fingerprinting cosmic light sources, sorting galaxies, and sending a message to possible alien civilizations. They were selected by a panel of mentor educators from among hundreds of astronomy and space-science activities published in the last few years. The resource guides include a topical index to hundreds of astronomy activities on the Web; a listing of books and articles about the exploration of the solar system; a skeptic's guide to astrology, UFO's, and other pseudo-sciences; and a reading list on astronomy and the environment.

Copies of book (order code BO123) are available for $24.95 (plus $5 for shipping and handling) directly from Astronomical Society of the Pacific mail order catalog or online store. Call toll-free at 1-800-335-2624 or order on the Web at: www. aspsky.org. Discounts are available for bulk sales.

An earlier volume, entitled *Universe at Your Fingertips*, has become one of the most widely used astronomy education resources in the world. Still available, it features 813 pages of activities and resource guides and has received rave reviews from educators and scientists. There is no duplication between the two books.

The National Council for Accreditation of Teacher Education (NCATE) and the American Federation of Teachers (AFT) took steps to upgrade the quality of U.S. teacher preparation last spring, as NCATE updated its **standards for accreditation** of education schools and AFT released a report containing recommendations for strengthening the nation's teaching force.

Copies of AFT's report cost $3.50; call 202-879-4400 to order. The report also can be found online at www.aft.org/higher_ed/reports/k16report.html.

Scientific American offers a special classroom subscription rate to students and educators. Call the Teacher's Kit hotline at 1-800-377-9414 to inquire about this offer and receive free hands-on, minds-on activities for the classroom.

Free Newsletter: Ideas for Growing Classrooms from the National Gardening Association. Call Ann Pearce or Eve Pranis at 800.538-7476; email: annp@kidsgardening.com

Nature Journaling: Learning to Observe and Connect with the World Around You tells children and adults how to study the natural world with the help of a journal. You can buy the book in hardcover for $30.40 including s/h by calling 1-800-827-8673 or visiting http://www.storey.com.

Single copies of "Multi-Hazard design for Earthquakes, Winds, and Floods," a publication of The American Institute of Architects that was funded by a grant from the Federal Emergency Management Agency. This pamphlet is free while supplies last. Contact Event-based Science Project, Montgomery County Public Schools, 850 Hungertford Dr., Rockville, MD 20850; 1-800-EBS-7252; e-mail russwright@fc.mcps.k12.md.us.

Campus ecology guide from the National Wildlife Federation Campus Ecology Program. The guide offers resources for greening the campus: information that is available through NWF resource packets, publications, and membership services. While geared toward the higher education campus, the material can also be applied to K-12 institutional settings. Contact NWF, Campus Ecology Program, 8925 Leesburg Pike, Vienna, VA 22184; 410-516-6583; http://www.nwf.org/campus.

Wind Energy Information Guide for middle school through college educators for the US Department of Energy. The guide describes wind energy and how it works, its uses, the environmental and economic aspects of wind energy, wind turbine design, and the US wind resource. Photographs and illustrations are included, and each chapter provides annotated references for further research. The guide can serve as a resource for science reports, projects, and fairs. Contact Document Distribution Service, National Renewable Energy Laboratory, 1617 Cole Blvd., Golden, CO, 80401-3393; phone 303-275-4363; fax 303-275-3619; e-mail sally_evans@nrel.gov.

Free Women's History Catalog now available from the National Women's History Project. Call (707) 838-6000.

Excellence and Accountability in Teaching, a Guide to U.S. Department of Education Programs and Resources, 74-page booklet. Contact Teacher Excellence desk, U.S. Dept. of Education, 600 Independence Ave. SW, Washington, DC 20202-0170; 202-260-4794; e-mail teacher_excellence@ed.gov.

Environmental education/action materials from Global Response. *Young Environmentalist Actions* bulletins (grades K-8) and *Eco-Club Actions* bulletins (grades 9-12) inform students of specific urgent environmental problems occurring in the world, scientific aspects of these problems, and local people and organizations that are working to protect their environment. Students then write personal letters to appropriate officials, urging them to make environmentally sound decisions. For sample bulletins, contact Global Response-Environmental Action and Education Network, PO Box 7490, Boulder, CO 80306-7490; 303-444-0306; fax 303-449-9794; e-mail globerreponse@igc.org; or see http://www.globalresponse.org.

Animals in the Classroom: A Guide for Elementary and Secondary Educators, which offers advice for helping students develop responsible attitudes toward animals. The publication addresses issues related to classroom pets, live animal studies, dissection, and science fairs. Contact the Center for Laboratory Animal Welfare at the Massachusetts Society for The Prevention of Cruelty to Animals, 350 S. Huntington Ave., Boston, MA 02130; 617-541-5081; e-mail ebirkholz@mspca.org.

BIODIVERSITY OF ILLINOIS, VOLUME III: PRAIRIE AND EDGE HABITATS CD-ROM

The new *Biodiversity of Illinois, Volume III: Prairie and Edge Habitats* CD-ROM is the third and final installment in the *Biodiversity of Illinois* series of CD-ROMs from the Illinois Department of Natural Resources' Division of Education. *Prairie and Edge Habitats* is designed to provide supplemental information about Illinois prairie and edge species and habitats for the educator and student. *Biodiversity of Illinois, Volume III: Prairie and Edge Habitats* contains 505 Illinois prairie and edge species representing mammals, birds, reptiles, amphibians, fishes, arthropods, flatworms, roundworms, flukes, plants, fungi, protists and bacteria. Species are accessible in a field guide format. At least one full-color image of each species is shown, although most have several photo options. For instance, the white-tailed deer is represented with photos of a buck, doe, fawn, buck in velvet, deer rubs, tracks and scat. Along with the photographic images, each individual species screen offers information about features, behavior, habitat, Illinois range, sounds (if available), classification and status (endangered/threatened; native/exotic). The sounds produced by 90 species are available for the listener. Sounds are also described in the text section for the hearing impaired. Descriptions and photographs of Illinois prairie and edge habitats are included on the CD-ROM. A section on biodiversity, what it is and why it is important, is available as are resources and references and an explanation of scientific names. Prairie burning is discussed and illustrated in the biodiversity section. The CD-ROM is searchable. Help is available on each screen. Information for each species, habitat and text section can be printed. The CD-ROM runs on both Windows® and Macintosh® operating systems.

Funding for *Biodiversity of Illinois, Volume III: Prairie and Edge Habitats* was provided by the Illinois Department of Natural Resources, the Illinois Chapter of The Nature Conservancy and the Lake County Forest Preserves. Funding was administered by the Illinois Conservation Foundation. The *Biodiversity of Illinois* series of CD-ROMs was developed for grades five through nine. One copy of each CD-ROM was mailed free of charge to each Illinois school which contains any of these grade levels on the following schedule: *Biodiversity of Illinois, Volume I: Aquatic Habitats* mailed in September 1999; *Biodiversity of Illinois, Volume II: Woodland Habitats* mailed in March 2000; *Biodiversity of Illinois, Volume III: Prairie and Edge Habitats* mailed in January 2001. For more information about the *Biodiversity of Illinois* series, contact the Illinois Department of Natural Resources, Division of Education, 524 South Second Street, Room 530, Springfield, IL 62701-1787 (217/524-4126; FAX 217/782-5177; teachkids@dnrmail.state.il.us).

Cindy Workosky (NSTA) 703-312-9248
Catherine Tramontana (AAAS) 202-326-7004

NEW TOOL MAPPING THE GROWTH OF K-12 SCIENCE UNDERSTANDING RELEASED BY AAAS'S PROJECT 2061 AND NSTA

Taking account of student learning from grade to grade is essential, especially in science, where key concepts, like the structure of matter, become more complex as students progress. Unfortunately, few tools exist to help educators visualize and plan for the growth of student understanding. In a first-ever joint publishing arrangement, Project 2061 of the American Association for the Advancement of Science (AAAS) and the National Science Teachers Association (NSTA) provide educators with an innovative tool that graphically depicts connections among key learning goals for students in kindergarten through 12th grade.

Atlas of Science Literacy presents a series of strand maps that illustrate how student understanding of key science, mathematics, and technology topics builds and grows from grade to grade. Each map displays the ideas, skills, and the connections among them that are part of achieving literacy in a particular topic, showing where each step along the way comes from and where it leads. In addition, each map is accompanied by a summary of the relevant research on student learning. Topics mapped include gravity, plate tectonics, flow of matter in ecosystems, natural selection, maintaining good health, communication technology, and statistical reasoning.

Atlas is one of a coordinated set of tools developed by Project 2061 to help educators understand and use specific goals for student learning. The nearly 50 maps in Atlas show connections among the learning goals established in Project 2061's publication *Benchmarks for Science Literacy (1993).* Content standards from the National Science Education Standards (National Research Council, 1996) drew substantially on the goals in Benchmarks and overlap with them nearly completely. The maps also continue the work of Project 2061's landmark document, *Science for All Americans* (1989), which provides a narrative account of the concepts and skills necessary for basic adult science literacy. Atlas complements these earlier efforts by making explicit the connections among learning goals that were only implied before. Both Project 2061 and NSTA see the publishing partnership as beneficial.

Atlas fits into NSTA's publishing agenda to bring quality education materials to science educators. NSTA Press, the book publishing arm of NSTA, develops more than a dozen books and other educational programs each year. Focused on the K-12 market and specifically aimed at teachers of science, NSTA Press titles offer a unique blend of accurate scientific content and sound teaching strategies. Development of the maps has been a painstaking process, based on more than a decade of study by scientists and K-12 classroom teachers. Project 2061 is at work on additional maps that will include learning goals from *Benchmarks for Science Literacy* not included in the current volume and illustrate more connections to already mapped learning goals.

In addition to using the maps and map commentaries to guide classroom teaching and curriculum committee work, educators plan to use Atlas as a tool in professional development and education reform efforts.

Copies of Atlas of Science Literacy are available for $49.95 from both AAAS and NSTA. Contact AAAS (item #00-12S) at the AAAS Distribution Center, P.O. Box 521, Annapolis Junction, MD 20701, 1-800-222-7809, or use the on-line order form at www.project2061.org/order/AtlasOrder.pdf. Contact NSTA (stock #PA001X) at 1-800-722-NSTA or visit the NSTA on-line Science Store at www.nsta.org/store/. Funding for Atlas of Science Literacy and for Project 2061 is provided by the National Science Foundation, the Pew Charitable Trusts, Carnegie Corporation of New York, Hewlett-Packard Company, the John D. and Catherine T. MacArthur Foundation, and the Andrew W. Mellon Foundation. **The AAAS** is a nonprofit organization dedicated to the public,s understanding of science and technology and to responsible scientific advancement across all disciplines. Project 2061 (www.project2061.org) is AAAS's long-term nationwide initiative to help improve science, mathematics, and technology education for all students.

The National Science Teachers Association (www.nsta.org) is the world's largest organization dedicated to promoting excellence and innovation in science teaching and learning for all. Its 53,000-plus members include science teachers of all grade levels, science supervisors, administrators, scientists, business and industry representatives, and others involved in science education.

ADDITIONAL RESOURCES

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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.

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 some "feed-back" 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:

- a typed or printed, double-spaced copy with standard margins.
- 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 ofthree or four sentences, home address, home telephone number (If there is more than one author, send all information for each), and e-mai 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. Materials submitted must reach the editor by the following dates: June 15, October 1, February 15. Materials, including photographs, will be returned only if accompanied by a request in writing and a self-addressed stamped envelope.

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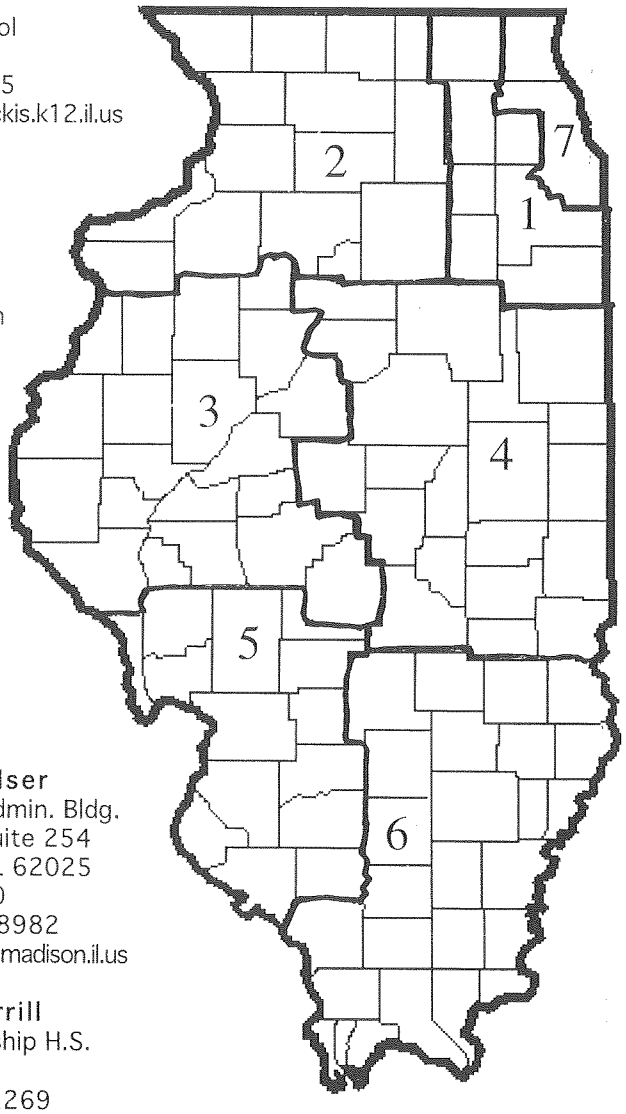

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ILLINOIS SCIENCE TEACHERS ASSOCIATION
2001 MEMBERSHIP APPLICATION

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Name	Day phone
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CHECK APPLICABLE CATEGORIES IN EACH COLUMN

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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 Physics	
o Other_____	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)**_____

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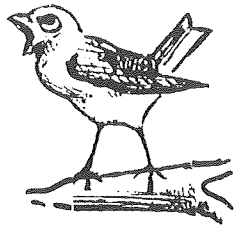

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