SPECTRUM

THE JOURNAL OF THE ILLINOIS SCIENCE TEACHERS ASSOCIATION

ISTA CONVENTION 2000 HIGHLIGHTS INSIDE!

FALL 2000

SPECTRUM

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

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ISTA NEWS

FALL PRESIDENT''S LETTER

ISTA and the Alliance for Illinois Education: Working Together to Promote Excellence in Teaching and Learning

Last month, eleven ISTA leaders participated in the third annual Alliance of Illinois Education Convention. The Alliance is an "umbrella" organization of fifteen statewide education associations representing teachers of science, mathematics, English, reading, social studies, foreign languages, fine arts, performing arts and physical education. The Alliance also includes several organizations representing staff development professionals. The Alliance's primary purpose is suggested in its mission statement:

Leading the Illinois educational community in creating a professional development system that guarantees excellence in standards-based teaching and learning for all.

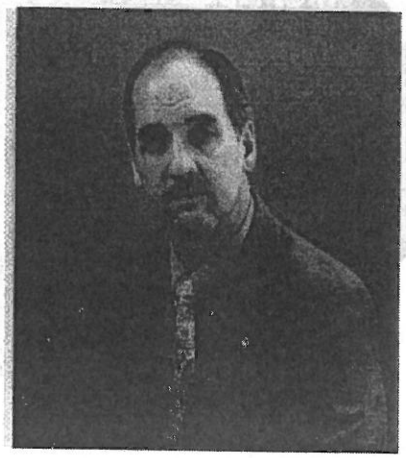
Unless you've been off visiting relatives on Alpha Centauri during the past several years, you are well aware of the growing expectations being placed on teachers by a host of local, state and national stakeholders. Teachers are being held increasingly accountable for both the performance of their students and their own continuing professional growth. Assisting their members meet these higher expectations is the challenge and the opportunity facing professional education organizations such as ISTA.

During the past several years, ISTA leaders have mobilized our organization to address such issues. Our strategic plan has identified the kind of activities that will keep our organization and our members informed and involved. The currency and relevance of our strategic plan's goals were confirmed during the recent Alliance meeting.

Following a presentation by Stephanie Hirsh, Associate Director of the National Staff Development Council, each participating organization was asked to prioritize their future activities based on NSDC's staff development standards. After hashing through these standards and trying to make their template fit our hopes for ISTA's future, it jointly occurred to us that our current strategic goals dovetailed neatly with NSDC's standards..."Duh!" While it was gratifying to see that our strategic plan matched so closely the mission of the Alliance, it reminded us that the effectiveness of any plan is measured by its impact, not its intentions.

As ISTA leaders work with other educators, inside and outside the Alliance, to help improve teaching and learning in Illinois' schools, it will be crucial to stay focused on the implementation of our organization's goals. It will also be imperative that we get our membership (that's YOU) involved in making our plan a dynamic and meaningful endeavor. In our conferences and meetings, our publications and our other outreach efforts, we must continue to inform you about our strategic goals and related activities and invite your participation.

Let's all take another look at the five goals that comprise ISTA's strategic plan...



As you can see, our goals are consistent with the Alliance's purpose. If we pledge to make these goals work for our organization and for all of our members, I believe we can fulfill ISTA's and the Alliance's vision of an educational system that *guarantees excellence in standards-based teaching and learning for all.*

Don

- **Goal 1: ISTA will actively seek to provide and support opportunities that meet the professional needs of our members.**
- **Goal 2: ISTA will support communication and networking opportunities for teachers throughout Illinois.**
- **Goal 3: ISTA will work to establish collaborative relationships with business and industry, professional organizations, state agencies, universities, and other entities.**
- **Goal 4: ISTA will act as a resource of information for funding sources, professional development opportunities and effective practices.**
- **Goal 5: ISTA will establish a political agenda and be a strong voice for Illinois teachers.**

HIGHLIGHTS OF CONVENTION 2000

We hope that you were able to join us on this exciting once-a-year opportunity to join the over 1500 teachers, principals, supervisors, and others concerned with effective science education throughout the state at the annual conference of the Illinois Science Teachers Association at Pheasant Run, St. Charles. The Preconference, "The Millennium Window: Science Leaders for the Future" featured Elliot Soloway from the University of Michigan speaking on integrating technology in the classroom. There were a variety of breakout sessions of interest to all K-12 teachers, curriculum supervisors and administrators. The exhibits opened with a ribbon-cutting at 10:00 AM Friday along with refreshments. Nearly 150 exciting workshops, demonstrations and other sessions designed to motivate and educate were held. In the exhibit area, over 150 booths offered the latest information on new science teaching equipment, textbooks, audiovisual aids, lab equipment, computer programs, supplementary materials, and other services and facilities to help make teaching and learning more effective. In addition, more than thirty Illinois state agencies organized a fantastic room full of free materials. If you were not able to attend, you missed a great opportunity!

Mark your calendars now for

ISTA 2001
Peoria Civic Center
October 11-13, 2001

Dinah Zike – Write Along! Science Literacy

Brian "Fox" Ellis – Fox Tales International

Professor Gizmo and His Amazing Science Presentations

Featured Presentation on Safety by Larry Flinn

The New Trier High School Connections Project: Art, Science, and Mathematics

Something for Everyone!

Over 130 Workshops for Everyone!

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- Chemistry, Physics, and Earth Science Sharathons

Graduate Credit Available

Preservice and New Teachers' Reception

Megacenter Hospitality Hour

Over 150 Exhibit Booths

Teacher Recertification CPDU's!

Over 200 prizes at the Membership Meeting

Awards and Town Meeting Luncheon

Thirty State and Federal Agencies with Many Freebies

The Space Shuttle Van

Live Raptor Exhibit

I-DNR Walk-Through Van

MANY THANKS TO THE 2000 CONVENTION COMMITTEE FOR ALL THEIR HARD WORK!

Julie Callan
Convention Chairperson
Highland Park High School

Rose Camillone
Program Chairperson
Homewood-Flossmoor High School

Warren Bjork
Glenbrook South H.S.

Gerry Munley
New Trier H.S.

John Buchanan
Evanston High School

Linda O'Connor
Elmhurst School District 205

Christ Forte
York High School

Earle Olsen
Downers Grove North H.S.

Bill Myers
School District 21

Scott Iliff
Glenbard South H.S.

Jim Slouf
Downers Grove South H.S.

Patrick LaMaster
Glenbrook North H.S.

Joyce Stemp
School District 21

Rich Mitchell
Andrew High School

Judy Tammi
Conant High School

Participating State Agencies

Once again state and federal agencies have lined up a wide array of free materials for you to take home. You won't want to miss it!

Eastern IL University — PLANIT EARTH-Environmental Education and Monitoring

IL Department of Natural Resources — Educational Services, Fisheries, Groundwater Education, Ecosystems Programs, Geographic Information Systems.

IL Department of Nuclear Safety — Radiation, Radon, Radiation Uses

IL Department of Public Health — Safe Chemical Storage in Schools, Environmental Lead Program, Laboratory Services

IL Department of Transportation — Transportation Engineering and Services

IL Environmental Protection Agency — Environmental Education, Lake Management Programs

IL Soil and Water Conservation Districts — Ennvirothon and Educational services

IL State Museum — Educational Services

IL State Water Survey — Hydrology

Southern IL University at Edwardsville — IL Rivers Project-Rivers and Groundwater Curriculum Materials

University of Illinois Extension — Worms and Soil

US Environmental Protection Agency — Teach with Data Bases-Toxic Chemicals

USDA Natural Resources Conservation Service — Grassland Conservation, Educational Services

US National Weather Service — Weather Safety in Schools and Meteorology Education

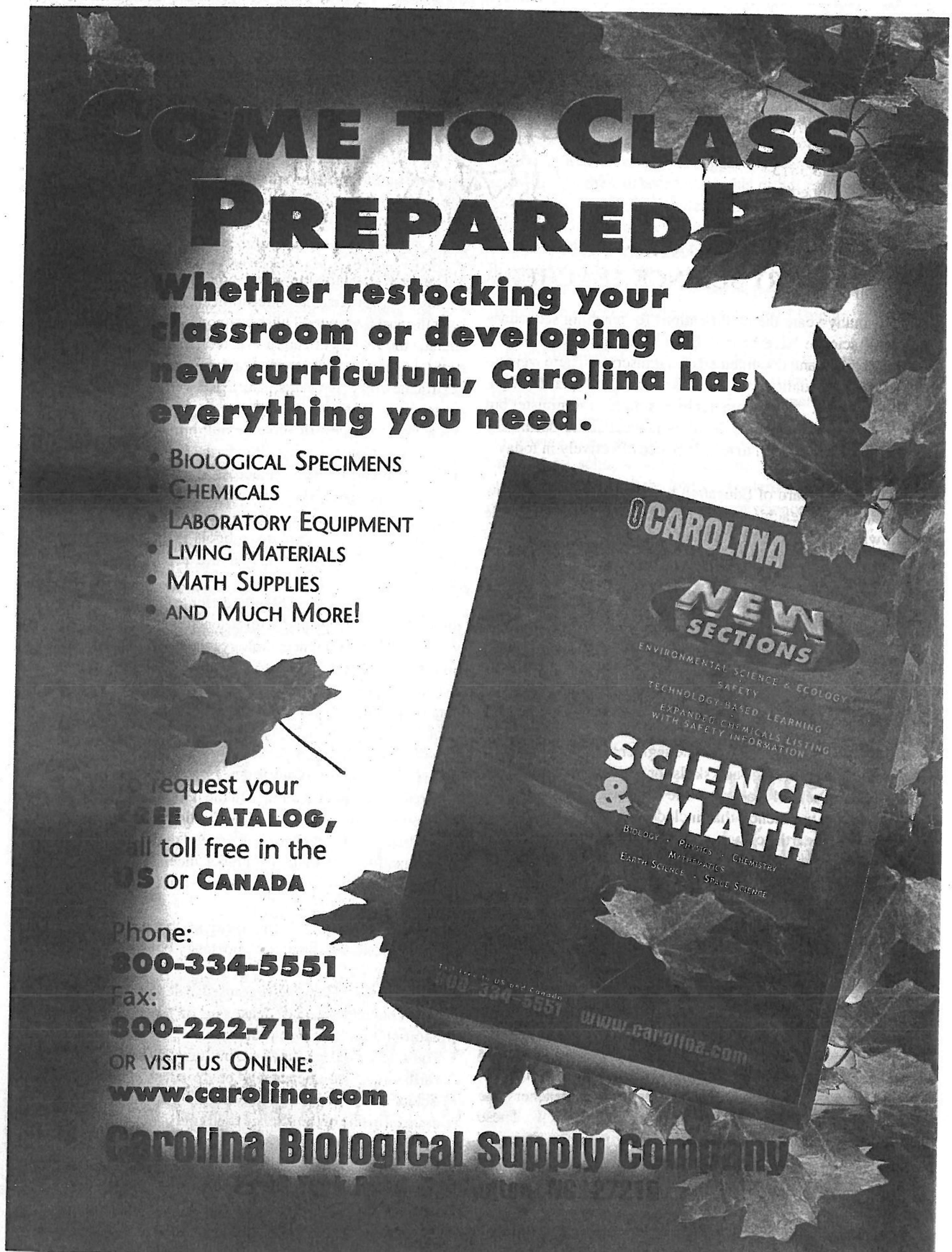
CHECK FOR MORE INFO ON THE CONVENTION AT THE ISTA WEBSITE

http://www.ista-il.org

THANKS TO OUR WONDERFUL EXHIBITORS!

The Exposition of Science Teaching Materials is an outstanding and integral feature of ISTA conventions. This year we had several walk-through trailers, a popcorn machine, the Space Shuttle, and over 150 booths featuring an amazing array of educational materials and opportunities. Listed below are those vendors who had booths at our convention this year.

Ag Tech at Teeple Barn
AIMS Education Foundation
AIMS Multimedia
American Guidance Service
American Nuclear Society
Amsco School Publications, Inc.
Anderson's Book Shops
Arbor Scientific
AT & T Cable
Biophilia
Bio Rad Laboratories
The Book Fair
Carolina Biological Supply Co.
CB-American Association for Laboratory Animal Science
Center for Mathematics, Science & Technology
Cricket Magazine Group
Curriculum Research and Development Group
Dairy Council of Wisconsin
Delta Education/FOSS
Earth Foundation
Eastern Illinois University
Environmental Education Association of Illinois
ETA/Cuisinaire
Facilitating Coordination in Ag. Education
Fermilab Education Office
Fisher Science Education
Flinn Scientific, Inc.
Forest Park Nature Center
Forest Preserve of Cook County
Fox Tales International
Frey Scientific
Garfield Park Conservatory
Getting Excited About Science
Glencoe/McGraw-Hill
GLOBE FEARON
Great American Opportunities
Great Source Education Group
Harcourt Brace Jovanovich, Inc.
Health World
High Touch-High Tech
Holbrook Travel
Holt, Rinehart and Winston
Illinois Assoc. of Aggregate Producers
Illinois Association of Biology Teachers
Illinois Beef Association
Illinois Clinical Laboratory Sciences
Illinois Department of Agriculture
Illinois DCCA - ILEED Project
Illinois DCCA - Recycling
Illinois DCCA - Coal
I-DNR/Division of Mines & Minerals
Illinois Farm Bureau
Illinois Junior Academy of Sciences
Illinois Pork Producers
Illinois Soybean Association
Illinois Science Olympiad
Illinois State Geological Survey
Illinois Water Environment Association
Institute of Food Technologists
Institute of Marine Biology
JBH Technologies, Inc.
Kendall/Hunt Publishing Company
Lab-Aids
Leica Microsystems
Loose in the Lab
The Markerboard People
McGraw-Hill School Division
MicroTech
Midwest Model Supply Co.
Museum of Science and Industry
NASCO SCIENCE
National Educational Computing Conference
National School Services
National Science Teachers Association
National Wildlife Federation
Nebraska Scientific
Ohaus Corporation
ORBIX Corporation
Partners for Agricultural Literacy
Pasco Scientific
Pigeon Press
Pitsco, Inc.
The Power House-ComEd
Prentice Hall
Qwizdom, Inc.
Raptor Chapter
Riverdeep Interactive Learning
Riverside Publishing
Riverside Scientific, Inc.
Sargent-Welch
Schoolmasters Science
Science Curriculum Inc.
Science Fair Supply Co.
Science, Math & Gifted Products
Science Topics LLC
SciTech Interactive Museum
The Scope Shoppe, Inc.
Scott Foresman
Showboard, Inc.
Space Explorers, Inc.
The Space Shuttle
SRA-McGraw Hill
SWIFT INSTRUMENTS, INC
Toyota Tapestry
UIUC Department of Crop Sciences
Vernier Software
Virtual Learning Systems
W.H. Freeman & Co.
Wildlife Prairie Park



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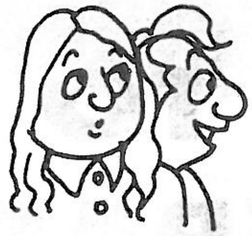
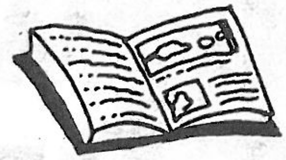




NEW STANDARDS FOR SECONDARY SCIENCE TEACHERS

For many years the qualifications for teaching secondary school science have been defined by the number of credit hours earned and documented on a transcript. There were no indicators of quality built into this definition of qualification, only quantity. The system has been simple to administer but has generally been considered as inadequate to define the qualifications needed to teach science effectively in today's schools.

The State Board of Education has recently approved new standards for teaching secondary science that define the knowledge and skills for teaching secondary school science rather than the number of credit hours earned. A state convened panel of secondary science teachers and university faculty developed the standards. The standards were displayed at two annual conventions of ISTA and were made available for public review on two occasions over the past 18 months. The standards that were approved can be viewed on the ISBE web site at http://www.isbe.net/profdevelopment/tcstandards.htm

At this same site the new standards for elementary school teachers are also displayed. One segment of those standards defines the knowledge and skills for teaching science for all elementary school teachers. The standards require a broad preparation in science that includes life science, physical science, and earth science.

All of the content area standards define what teachers need to know and be able to do to teach the content specified by the Illinois Learning Standards that define the science to be taught in K-12 schools. In addition, the content area standards are consistent with the teacher standards advocated by the National Science Teachers Association.

The content area standards for teaching science define the knowledge and skills of content as well as the knowledge and skills of pedagogy.

These new content area standards for teaching science, as well as content area standards for teaching other disciplines, are a companion to the general standards for all teachers, the Illinois Professional Teaching Standards (IPST). These standards can be viewed on the ISBE web site at http://www.isbe.net/profdevelopment/default.html

The new standards approval process is part of the new Framework for Teacher Education that has been evolving over the past few years. Other components of the Framework include the new certification structure, a support program for new teachers, and the process for the renewal of the standard certificate every five years. The ISBE web site also provides up-to-date information on these developments at http://www.isbe.net/recertification/Default.htm

The new Content Area Standards for teaching science include a broad preparation across all science fields for all teachers of science. The rationale for this move is threefold: knowledge in any one field of science is related to other fields of science; teachers in many schools teach more than one field of science; and some schools are developing integrated science courses.

The new Content Area Standards for teaching science also define the knowledge and skills to teach each of the following specializations in science: biology, chemistry, physics, earth and space science, and environmental science. Note that this list differs from the old system in that there are not separate standards for other areas previously listed such as botany, zoology, astronomy and general science.

In the previous system, secondary teachers earned endorsements for any and all of the science fields for which they met the credit hour qualifications. In the new system there is one endorsement for science. Qualifications for teaching the specializations in science will earn a "designation" for the specialization. At their September meeting the Board approved the following certification structure for teaching science:

- To earn the Science endorsement the individual must demonstrate satisfactory competency on the 19 core standards.
- All teachers of science are required to demonstrate satisfactory competency in at least one of the designations in addition to the 19 core standards.
- The science designations are biology, chemistry, physics, earth and space science, and environmental science.
- Science teachers assigned to teach Advanced Placement courses in one of the science fields must have a designation in that field.

The new system for defining qualifications for teaching science provides significant opportunities for improving qualifications for teachers of science, but there are several challenges for implementing the system.

All teacher preparation programs at Illinois universities that prepare teachers of secondary school science will need to align those programs with the new standards. As with all other content standards, the science standards must be in place on college campuses by not later than July 1, 2003. The teacher preparation programs for each of the specializations must demonstrate that the candidate demonstrates knowledge and skills in the 19 core standards that define the broad field of science as well as the knowledge and skills for the specialization. For example, the program for preparing a teacher to specialize in chemistry will also provide the future teacher with knowledge in biology, physics and earth science. While colleges traditionally think in terms of credit hours to define a teacher preparation program, the new standards define the knowledge and skills, not the number of credit hours.

Schools have more flexibility in how they assign teachers to science courses, and with this flexibility they have more responsibility to make decisions about the qualifications of teachers of science. With the single endorsement in science, the individual can teach any science course. The exception to this is the assignment to teach Advance Placement courses: these individuals must have the appropriate designation on their certificate. All teachers who earn the endorsement in science will have one designation, thus a breadth of science and a depth in one field of science. Any school can certainly hire and assign teachers to courses in the specialization that they have earned. But, as necessary to meet local needs, a school can assign this teacher to teacher other specializations. The teacher does have some preparation in all areas of science. This system allows small schools that must assign teachers to multiple science fields to have teachers with at least some preparation in all fields.

Teachers who currently hold certificates will find the standards a rich resource for suggesting areas of professional growth. As the teacher prepares his or her plan for professional growth for the five-year period, these standards will provide guidance on designing the program.

Agencies and organizations that provide staff development for teachers of science can also use the standards to develop and describe professional growth opportunities for teachers. It seems logical that funding agencies would require grantees to reference their projects to the standards.

Consideration of a request for a Multidisciplinary Science designation was rejected by the Board at the meeting where the other standards were approved. The panel that developed the standards for the above designations recognized the need to provide a designation for teachers of courses being implemented by schools across the state that integrate science education. Although the first 19 standards define the breadth of science content for all teachers of science, the Board was not convinced of the need for new designation.

At the September meeting of the ISTA Board, a motion was passed to establish a Task Force to work on suggestions for implementation of the new certification system for science. ISTA members who have an interest in working on this Task Force should contact the ISTA President.

Do you know an outstanding individual who is willing to make a real difference in science teaching in the State of Illinois?
Encourage them to seek election as an ISTA Regional Director!
Nomination Form is found on page 19 of this issue of the Spectrum.

CALL FOR PRESENTATIONS

SCIENCE IN THE SOUTH 2001

ILLINOIS SCIENCE TEACHERS ASSOCIATION ANNUAL CONFERENCE
SOUTHERN ILLINOIS UNIVERSITY — CARBONDALE
MARCH 9, 2001
DEADLINE FOR SUBMISSION: DECEMBER 1, 2000

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)

____
____
____
____

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

I. Type of Session
- o hands-on workshop
- o demonstration
- o lecture
- o other

II. Intended Audience
- o preschool
- o elementary
- o middle/jr.high
- o high school
- o college
- o teacher preparation
- o general

III. SubjectArea
- o earth and space science
- o chemistry
- o physics
- o biology
- o ecology/environment
- o science/tech/society
- o technology

IV. Science Goals (see back of form)
- o Goal 11
- o Goal 12
- o Goal 13

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

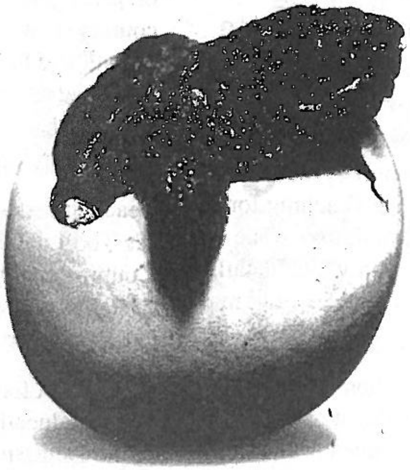
V. How many participants can you accommodate at your session?
o 30-50   o 51-80   o 81-150

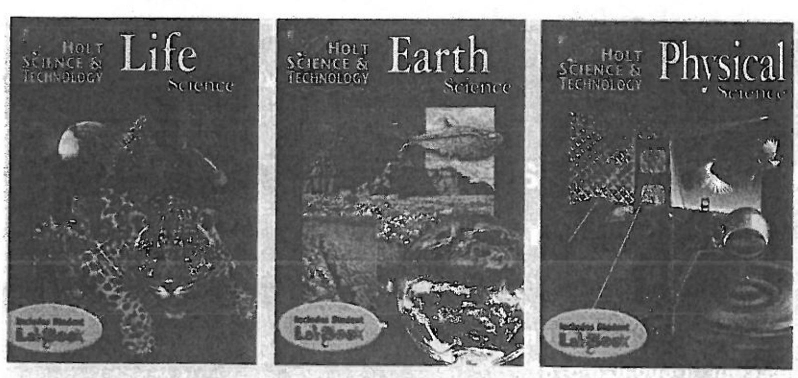
As a professional, nonprofit organization, the Association is unable to reimburse participants for travel or other conference expenses. ALL PARTICIPANTS INCLUDING PRESENTERS, ARE REQUIRED TO REGISTER FOR THE CONFERENCE. This form is not for commercial or non-commercial exhibits. It is only for educators!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

Signature______________________   Date______________________

SEND OR FAX SIGNED FORM TO:

Ken Robinson, Division of Continuing Education, Mailcode 6705, Washington Square C, Southern Illinois University, Carbondale, IL 62901-6705   Fax 618-536-7751





HOLT SCIENCE & TECHNOLOGY
Life Science
HOLT SCIENCE & TECHNOLOGY
Earth Science
HOLT SCIENCE & TECHNOLOGY
Physical Science

HIGHLIGHTS FROM THE NSTA LEGISLATIVE UPDATE

SEPTEMBER 27, 2000

Glenn Commission Issues Final Report on Science and Mathematics Teaching for the 21st Century

Recently at the Smithsonian Air and Space Museum, former Senator John Glenn released the final report of the National Commission on Mathematics and Science Teaching for the 21st Century (known as the Glenn Commission). The 48-page report provides a comprehensive plan which details a number of ways to improve the quality of science and math teaching nationwide.

This past year, the distinguished blue ribbon panel of chief executives, members of Congress, and educators who comprised the Glenn Commission met five times to hear from experts in the field about the best ways to address the challenges facing science and math education.

The recommendations made in the Glenn Commission report, which is titled "Before It's Too Late," are based on three goals:

1. Establish an ongoing system to improve the quality of mathematics and science teaching in grades K-12.

2. Increase significantly the number of mathematics and science teachers and improve the quality of their preparation.

3. Improve the working environment and make the teaching profession more attractive for K-12 mathematics and science teachers.

The Commission estimates the action strategies for achieving the three goals will cost more than $5 billion annually. "We as a nation must take immediate action to improve the quality of math and science teaching in every classroom in the country. If we delay, we put at risk our continued economic growth and future scientific discovery," said Senator Glenn. "Here we outline a workable, balanced strategy that builds on what has been learned in the last decade, improves teaching, and thereby improves student achievement."

Teachers are encouraged to download the full text of "Before It's Too Late: The Report to the Nation from The National Commission on Mathematics and Science Teaching for the 21st Century" from www.ed.gov/americacounts/glenn. A detailed synopsis of the appears on page 12.

The NSTA Legislative Update contains important information on education initiatives nationwide, on Capitol Hill, and at the Department of Education. It is sent every few weeks when Congress is in session or as events warrant. To join the free NSTA Legislative Update, send an e-mail to legnet@nsta.org. Please include your e-mail address, name, and state. If your address changes or if you want to unsubscribe, send a message to legnet@nsta.org.*** For more information on NSTA, or to become a member, visit our website at www.nsta.org

Jodi Peterson Editor, NSTA Reports! Director, Legislative Affairs National Science Teachers Association

What if your classroom was as big as our building?

The Science Club Network

gets 6th to 12th graders excited about science, boosts self-confidence and skills along the way. From designing electric cars to analyzing DNA, the Network has the perfect project for you and your students.

For more information, please contact Mary Lou O'Toole at (773)684-9844, Ext. 2421.

Learning Labs

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BEFORE IT'S TOO LATE : THE REPORT TO THE NATION BY THE NATIONAL COMMISSION ON MATHEMATICS AND SCIENCE TEACHING FOR THE 21ST CENTURY

Foreward by John Glenn

Executive Summary

I. The Problem: Our Students' Performance in Mathematics and Science Is Unacceptable The Recycled Message of TIMSS and NAEP: We Are Losing Ground

Why Does This Matter?

1. The demands of our changing economy and workplace

2. Our democracy's need for an educated citizenry

3. The links of mathematics and science to our national security interests

4. The deeper value of mathematical and scientific knowledge

II. The Time To Act Is Now

III. Toward a Solution: We Must Place Better Teaching at the Center of Mathematics and Science Education (1) Now, more than ever, America's students must improve their performance in mathematics and science. (2) The most direct route to improving mathematics and science achievement for all students is better mathematics and science teaching.

IV. What Happens in Most Classes

V. What Could Happen: We Need To Capture a Vision of High-Quality Teaching

VI. Three Goals What Can You Do--Checklists for seven targeted stakeholder groups (School Boards and Superintendent Team, Principals, Teachers, Parents, State Leadership, Higher Education Institutions, Business)

Goal One

Establish an ongoing system to improve the quality of mathematics and science teaching in grades K-12.

Needs Assessment: The Commission proposes that each state must conduct an immediate full assessment of the professional development needs, district by district, of K-12 science and math teachers. The assessment should also include (1) whether schools offer a full complement of math and science courses; (2) whether the quality of curricula, texts, and math assessments strongly supports high-quality teaching and learning; (3) whether the necessary materials and resources (labs and equipment) are available; (4) whether teachers are adept in using technology; and (5) whether teacher certification and recertification guidelines are sufficiently ambitious. The assessment should include as many stakeholder groups as possible. "To put this into perspective, collectively the states must plan to quickly reach the 1.7 million teachers nationwide who provide instruction in science and mathematics" (this includes elementary teachers). Based on the needs assessment, states should develop a system of professional development to address short- and long-term needs of teachers.

Summer Institutes

To address near-term needs, the summer institutes should provide content knowledge for out-of-field teachers, conduct discipline-based workshops, integrate technology into the teaching of math and science, introduce new teaching methods, and improve skills for teaching specific subject content by grade. Over the long term, the Commission urges states to tailor the institutes to teachers' demands and make regular institute attendance a part of teacher recertification.

Inquiry Groups

"All teachers need continuing, collegial contact; peer reinforcement; and input from experts to sharpen their skills and deepen their subject knowledge." The Commission calls for establishing building and district-level inquiry groups that will provide a venue for teachers to share ideas, gain the benefit of one another's teaching experience, engage in common study to enrich content knowledge, learn about technology, and design ways to incorporate standards into their teaching. Groups would continue throughout the summer and would be networked electronically. "Time for in-depth study through regular work with peer Inquiry Groups is a teacher's most valuable professional resource. It must be considered sacrosanct." Leadership Training: Many more potential leaders must be identified and trained. These leaders would facilitate inquiry groups and summer institutes.

Internet Portal

The Commission calls for an interactive conversational web resource dedicated to science and math instruction. This "virtual resource center" would be updated frequently and provide a one-stop-shopping learning network. It would include an online professional journal that encourages teachers to engage in publishable research and allows sharing of new teaching strategies; access to Web sites with real-time data; a dedicated database for teachers, which would include teaching ideas, lesson plans, student work, and other resources; interactive resources for conversations, meetings, and idea sharing; an outlet to distance learning courses in science and math for teachers and students; and interactive video, for observing teachers' pedagogy, mentoring practices, and online instruction.

Coordinating Council for Mathematics and Science Teaching

This nongovernmental collaborative body will bring together groups that have a stake in math and science education. The Council will monitor state and local progress on needs assessment, summer institutes, leadership training, and other initiatives. It will help schools and districts align their professional development with state curricula, teaching guidelines, performance standards, and assessments; collect and disseminate research on improving teaching and identifying best practices; and measure progress.

Rewards Program

"To increase the attractiveness of the professional development system, and to make clear that continual improvement in teaching methods is highly valued, all states and local districts must institute a program of recognition and rewards to deserving schools and teachers. Schools with exemplary professional development systems, and those that, most importantly, show improvement on rigorous assessments of student achievement in math and science, must be recognized with monetary rewards for their teachers and other staff, and through well-publicized showcase events."

Goal Two

Increase significantly the number of mathematics and science teachers and improve the quality of their preparation.

An estimated 240,000 middle and high school math and science teachers will be needed over the next 10 years. Of this total, nearly 70 percent will be newcomers to the profession. The Commission calls for an aggressive recruitment program to attract new teachers, accompanied by an aggressive, and simultaneous, effort to improve teacher preparation. Exemplary programs: Exemplary programs of teacher preparation around the country would be identified, and other institutions would be encouraged to replicate these programs. Exemplary programs would keep their status for five years, then undergo a new review. The Commission recommends that the exemplary status be required before two- and four year schools could qualify for federal scholarships that the Commission suggests be established for high school seniors (see below). Teacher Recruitment: Incentive-based strategies would be used to attract individuals from three targeted groups to teaching. Recent college graduates and persons at mid career with baccalaureate or higher degrees will be invited to compete for 3,000 prestigious, one-year paid fellowships that lead to certification as math and science teachers (see Mathematics and Science Teaching Academies). Fellows agree to teach for five years in district(s) with math and science teacher shortages. Federal loans (based on financial need) would be forgiven for college students considering math and science teaching as a career who agree to teach for five years in districts with math and science teacher shortages. The Commission recommends approximately 6,000 loans as the appropriate amount to address the current shortages of qualified teachers. 1,500 high school seniors will be competitively chosen to attend one of the exemplary preparation institutions on a full-tuition scholarship. These students must agree to teach for five years in areas with teacher shortages.

Mathematics and Science Teaching Academies: A new kind of research- and school-based preparation would be created to provide a year of teacher education for those with scientific and mathematical content knowledge. Fifteen Mathematics and Science Teaching Academies would be competitive selected in each of the 10 federal regions, with 5 more strategically located. Each academy will build on existing institutions and comprise an consortium of at least one higher education institution, neighboring school districts, business partners, members of the Eisenhower consortium, and others. The 3,000 competitively selected academy fellows (see above) will receive a one-year intensive course in effective teaching methods; training includes school-based internships that involve supervised teaching. Each fellow will receive a $30,000 stipend for the year. A $10,000 federal grant will be available to the districts that hire these fellows, with two provisos: The funds must be locally matched, and a districtwide induction program must be created for new math and science teachers.

Goal 3

Improve the working environment and make the teaching profession more attractive for K-12 mathematics and science teachers.

Society refuses to recognize the professional status of teachers. Turnover in the nation's teaching force is high. Many science and math teachers leave teaching because of "dissatisfaction with working conditions, such as lack of leadership, lack of classroom autonomy, lack of respect from students, poor support from administrators, overly large classes, and poorly equipped labs and classrooms." The number one reason cited by leaving teachers is "poor salary." The Commission calls for "energetic and sustained steps to break out of this downward spiral . . . state education agencies, school districts, and schools must move immediately and aggressively to make math and science teaching more attractive." It, suggests three action strategies: (1) having more and better induction programs for new teachers; (2) developing business/school partnerships that foster high-quality teaching and make the profession more attractive; (3) encouraging veteran teachers who demonstrate improvement and seek new challenges to stay in the classroom and be rewarded for their efforts.

Induction Programs

In addition to creation of induction programs for new teachers, the Commission proposes that new teachers have frequent formal interaction with master teachers. New policies should ensure that new teachers do not inherit the most demanding teaching schedules and the most challenging students and would exclude or limit extracurricular duties for new teachers.

Business/District Partnerships

"Acting with states, districts, and other stakeholders, business/district partnerships can take several steps to encourage teachers to stay in the classroom, continually sharpen their skills, optimize working conditions, and encourage widespread public support for mathematics and science education." Specifically, business/school partnerships can collaborate to provide facilities, materials, equipment, scholarship support, and other resources; help secure general community grants and incentives to schools; sustain induction programs for all K-12 math and science teachers; establish and run paid summer internship programs for interested teachers; develop release time programs that make a company's employees available to assist teachers; and serve as advocates for teachers seeking advanced certification.

Career-Long Incentives

"Mathematics and science teachers, like other professionals, ought to be fully able to advance through a series of career stages that reflect both their intellectual and professional growth; teachers who demonstrate improvement in their teaching must be appropriately acknowledged." For most teachers, the only opportunity for growth is to leave the classroom for a position in school administration. The Commission calls for more progressive salary structures, tied to increased levels of teacher responsibility and job performance criteria. All members of the local education community must provide recognition to teachers whose students show higher achievement on high-quality measures. Teacher Pay--The Litmus Test: While stopping short of specifically asking for a salary increase for science and math teachers, the Commission does conclude the salaries of teachers must be made more competitive. "Teachers in this country are scandalously underpaid, a fact that invariably affects the quality of teaching in our nation's classrooms. The fact is, many teachers experience their jobs as exercises in irony: They are expected to have high-quality qualifications and skills, but they are neither accorded professional status nor rewarded with a professional's salary. Creating high-quality teaching in mathematics and science education demands both." As mentioned earlier, this report can be found online at www.ed.gov/americacounts/glenn.

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You may also order copies toll free by calling 1-877-433-7827. To order the publication online, go to www.ed.gov/pubs/edpubs.html. Let us know what you think about the Glenn Commission report. Send your comments to Jodi Peterson at jpeterson@nsta.org.

ARTICLES

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CHARTING THE COURSE TOWARD STANDARDS BASED PROFESSIONAL DEVELOPMENT

The Journey of Professional Development

Becoming an exemplary science teacher is a journey, not a destination. The *National Science Education Standards* (NSES) uses this evocative metaphor of a journey to describe professional development for teachers in science as a continuous process stretching from earliest experiences in preservice education through the end of a professional career.[1] The Standards suggest that, to be effective in supporting the development of science teachers along the journey, professional development programs must do two things that more traditional approaches typically have not: 1) they must extend over longer periods of time and, 2) they must include a more diverse palette of strategies through which teachers may develop, test, refine, and integrate deeper understandings and enhanced abilities.

> Professional development activities must extend over long periods and include a range of strategies to provide opportunities for teachers to refine their knowledge, understanding, and abilities continually (*National Science Education Standards*, p. 71).

In the summer of 1998, a group of teachers from the Chicago Public Schools embarked on just such a journey of professional development called Bio-Lincs.[2] Funded by the Illinois State Board of Education, Bio-Lincs has been a three-year effort coordinated by the Lincoln Park Zoo with support from National-Louis University. The program was designed to respond to the NSES Standards for Professional Development by providing diverse opportunities for teachers to learn science through inquiry and integrate that knowledge with an enhanced understanding of the methods and techniques associated with best science teaching practices. Conceived as a sustained journey of professional development, the Bio-Lincs program would provide teachers the time and opportunity to describe, compare, contrast, and refine their own views of science teaching and learning and, in so doing, come to understand the nature of exemplary science teaching.

Sound Advice from the Cheshire Cat

"Would you tell me, please, which way I ought to go from here?" asked Alice.

"That depends a good deal on where you want to get to", said the Cat.

"I don't much care where", said Alice.[3]

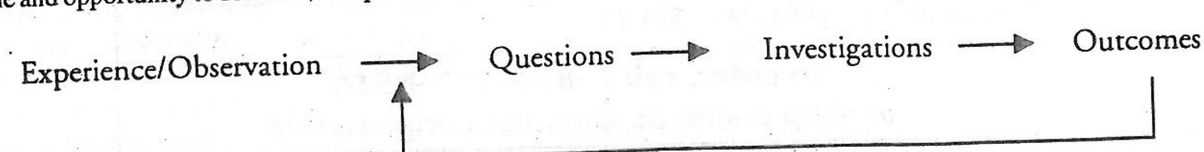
"Then it doesn't matter which way you go", said the Cat.

Surely, any successful journey, including Alice's adventures in Wonderland, requires a map with clear compass points or navigational headings that mark the way toward the ultimate goal or destination. The professional development journey toward exemplary science teaching offered by Bio – Lincs was no exception. Early on, teachers were asked to create that map by first establishing their own standard of effective science teaching as a benchmark against which they might make effective decisions about learning objectives, teaching strategies, assessment tasks, and curriculum materials and then chart their own progress in the program. This standard would serve to inform, guide, and shape ensuing activities and opportunities in the program as teachers undertook the work of developing, implementing, and integrating their own approaches to effective science teaching.

Developing this standard – our initial efforts at cartography - began with an assumption that the closer we can relate our teaching of science to the nature of science, the more effective we will be as science teachers. Our ability to authentically reflect the nature of science in the qualities and characteristics that describe the science teaching and learning occurring in our classrooms would significantly influence our success. Support for this assumption is found throughout the recent science education reform movement and is perhaps best articulated by the landmark documents of the American Association for the Advancement of Science (AAAS, see for example, *Science For All Americans*) and the NSES Science Teaching Standards. As the Bio - Lincs teachers began to reexamine their attitudes, values, and beliefs about science teaching, it seemed essential to know, like Alice, where we wanted "to get to" and that required that the journey begin with an understanding of the nature of science and scientific inquiry.[4]

So, what is science anyway?

In order to be able to align the teaching of science with the nature of science, it was necessary to first consider exactly what science is and what it implies for instructional practice. Through a series of activities, the participating teachers arrived at a definition of science as expressed by the diagram below:



Clearly, we thought, the world and our experience in it offer an endless source of stimulus and it is through our senses that those stimuli are observed. If we are paying any sort of attention, those observations frequently provoke all kinds of questions. Something is unknown, something is unclear, something is curious and that something can be phrased as a question ("Hey, I wonder, how does a seed grow into a plant?). It is those questions that capture our attention, spark our imagination, and, if we are motivated enough, offer a springboard for inquiry and investigation ("Let's plant a seed and see if we can find out?). As our investigations unfold, certain outcomes begin to emerge. Those outcomes may include some new knowledge, new skills, new attitudes, and even new observations and new questions ("I wonder if a seed can grow into a plant if I put it in my dark closet"). Such new questions add additional fuel to the process which can then lead to new investigations and outcomes.

We borrowed from the AAAS definition of science and proposed that science indeed is a process for producing knowledge. We were further heartened to discover that James Rutherford, as Chief Education Officer of AAAS argued that, "Science is not a list of facts and principles to learn by rote. It is a way of looking at the world and asking questions." While we acknowledged that the notion of science outlined above can only provide a generalized sense of what is, in reality, a more complex and frequently non linear process, its usefulness as a compass for guiding our journey toward great science teaching was undeniable.

Defining science as a process for producing knowledge became a significant landmark on our journey as it offered an unfettered road for the consideration of what exemplary science teaching might look like. Challenged to consider the teaching and learning of science in relationship to this definition, Bio - Lincs teachers then constructed the standard of exemplary science teaching practice stated in the chart below.[5]

This then, became the goal which framed the next phases of the Bio - Lincs journey. Suddenly, knowing where we wanted to get to made the way we chose to go matter very much indeed. As these teachers continued through the program, the standard of exemplary science teaching served as a reference point for their ongoing work which included: actively investigating a variety of instructional methods, exploring deeper science content understanding, developing instructional materials integrating core content and strategies, peer coaching and feedback, and ultimately testing these materials and methods in their own classrooms under the supervision and support of project staff. By extending the journey to include these critical activities delivered over a three year period, Bio - Lincs was able to provide the kind of continuous and diverse opportunities that seems essential for successful professional development.

Rethinking Standards Based Professional Development Models

By virtue of its wide ranging strategies provided over long periods of time, Bio - Lincs represents an approach to professional development that is consistent with the recommendations of the NSES. More traditional approaches, like those offered in workshop format ranging from a few hours to a few weeks, typically provide significant experiences on the journey toward becoming a successful science teacher rather than the journey itself. Such programs may introduce teachers to essential content, concepts, and methodologies. They may support and inform the development of effective teaching practices by offering the theory, content, and skills that are critical to the development of more complete and more comprehensive views of good science teaching. At best, they provide the entry point for rethinking, reinventing, and re-envisioning the way science is taught in the classroom.

And yet the extent to which these gains from traditional programs are maintained, implemented, integrated, and extended over time, that is, how what is achieved in these programs impacts, influences, and contributes to classroom teaching – and ultimately student learning – once participants exit the program is questionable. The instructional experiences that participants receive in such programs is a necessary – but perhaps not sufficient – component for the lasting and meaningful improvement of science teaching practices. A different approach to the professional development of exemplary science teachers is required if the vision set by the National Standards is to be realized.

> The current reform effort requires a substantive change in how science is taught; an equally substantive change is needed in professional development practices (National Science Education Standards, p. 56).

Concerns about the true, lasting, and meaningful impact of these more traditional programs have led to the development of an alternative model for professional development.

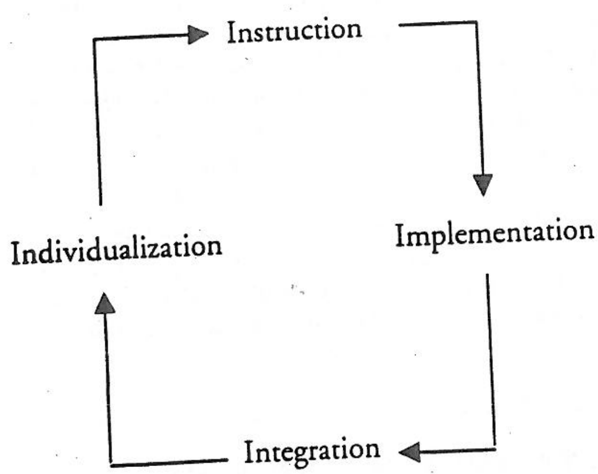
If our science teaching is to reflect the nature of science, then that implies that our teaching should be characterized by being or including ...

Hands on	Challenging	Active	Interactive	Creative	Safe	Fun
Discovery	Inquiry	Dynamic	Organized	Cooperative	Hypothesize	Messy
Experiential	Evaluation	Resources	Curiosity	Thinking	Experiment	Current
Stimulating	Mistakes are ok	Field trips	Prepared	Manipulatives	Fuzzy logic	Wow!
Documenting	Journaling	Systematic	Questioning	Enthusiasm	Teamwork	Observe
Application	Use senses	Process skills	Communicate	Interdisciplinary	Positive	Relevant
Informed	Student centered	Analytical	Varied assessment			

This new model describes a journey of four phases that encompass the familiar territory of instructional workshops but go beyond that to provide a more diverse range of strategies delivered over a longer period of time to shape the ongoing and continuous professional development of teachers. As teachers journey through these four phases, they not only learn more about science and science teaching, but are further enabled to generate, test, refine, and share new ideas and methodologies that advance their own efforts in the classroom. Those phases include:

1) **Instruction** – This is the territory prescribed by more traditional approaches to professional development in which teachers lay the foundation for change by developing requisite subject matter competencies, a meaningful definition and realistic standard of good science teaching, a commitment to the value 6f professional development, and a sound understanding of the elements of, and rationale for effective science instruction,
2) **Implementation** – In this phase teachers are then given authentic opportunities to develop, test, and refine newly acquired methods and techniques associated with exemplary science teaching from the previous phase in the context of the program and in their own classrooms. Microteaching and debriefing sessions, peer coaching with teamed, in school support, and supervised observation of teaching practice and guided reflection are provided so that teachers begin to develop the confidence and competence required in later phases of the journey,
3) **Integration** – This third phase involves supporting, encouraging, and nurturing the firm incorporation of the acquired understanding, methods, and techniques into the teacher's established repertoire through ongoing support and the provision of appropriate services for continued application over time. Teacher driven, collaborative activities like curriculum development, goal setting, and advanced training provide a forum for tailored applications and a conducive environment for continued professional growth and development. It is in this phase that teachers begin to describe themselves as science teachers.
4) **Individualization** – In this final phase, teachers are encouraged to expand their definition of exemplary science teaching in personally relevant ways. This may occur through creative and unique applications including the assumption of leadership and advocacy roles for the improvement of science education practices in their schools, districts, and at regional and even national levels. It is in this phase, that teachers' perceptions of themselves as science teachers expands to include the expression of leadership work within the program itself (as a master teacher, training facilitator, etc.) and in the school (as a mentor, etc.).

From a practical perspective, this kind of professional development model provides a useful framework for the design and delivery of teacher education programs that support the NSES Standards for Professional Development and responds to the call for substantive change. By extending the journey beyond the instructional phase to include sustained and diverse opportunities for the implementation, integration, and individualization of program content and goals, programs like Bio–Lincs are raising the standard for the professional development practices of exemplary science teachers.



1. National Research Council (1996). *National Science Education Standards*. Washington, DC: National Academy Press.
2. Bio – Lincs stands for Literacy Integration of Content and Strategies and focuses on the content themes of conservation, habitats, animal behavior, and urban nature and the strategies of hands – on learning, collaboration, problem – based learning and critical thinking.
3. Carroll, Lewis (1865). *Alice's Adventures in Wonderland.* Macmillan Publishing Company.
4. American Association for the Advancement of Science (1990). *Science for All Americans*. Oxford University Press. Bio – Lincs teachers actually expanded that definition by suggesting that science is a process for producing knowledge and "lots of other good stuff" to refer to a broader range of outcomes.
5. The ambitious list of characteristics was generated by Bio – Lincs teachers as a standard of what science teaching and lea National Research Council (1996). *National Science Education Standards*. Washington, DC: National Academy Press.

Nomination
For
ISTA Regional Director

Qualifications: The ISTA Elections Committee seeks Illinois educators who want to advance the improvement of science teaching at all educational levels. Qualified candidates wish to contribute to their profession, want a part in shaping science education in Illinois, welcome personal challenge, and work cooperatively with colleagues to achieve group goals.

Requirements: Nominees must be members of ISTA. Those elected to the Board in January 2001 will serve during the two-year period March 2001 through March 2003. The Board meets four times each year, usually in Champaign where the ISTA office is located. During calendar year 2001, the Board will meet March 3, June 22-23, September 15, and December 1. Regional directors must commit to energetically achieve a portion of the ISTA strategic plan, provide leadership activities in the region of the state they represent, and attend all Board meetings. To be included on the ballot, nominees must submit a biographical sketch by December 1, 2000. (The Elections Committee will assist nominees in the preparation of a biographical sketch.)

Please obtain prior consent of the nominee. You may nominate yourself. Print legibly.

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Home Telephone ______________________________

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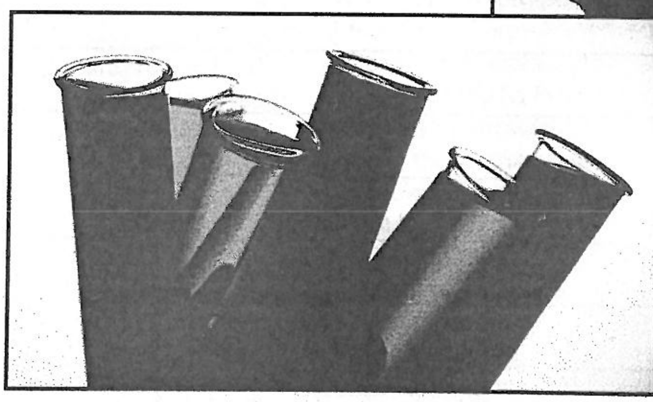

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E-Mail: kpriban@sd74.k12.il.us

Keith Hanson
Retired Teacher and Past-ISTA Regional Director
Danville, IL

Some Comments on Safety Articles

Attempts to Analyze the Situation

The classroom accidents described in the Safety issue of *Spectrum* (Winter 1999) appear to fall into the anecdotal category with the authors providing few details. I am not sure if that is an attempt to shield the public from copycat demonstrations or if the details aren't known to the authors. The methanol cannon article is a good example. Exactly what happened? Do we know anything about the cannon design, projectile, classroom setup and the like? And what about that container of methanol; what role did it play? Details help to identify and initiate appropriate courses of action to avoid repeats. Along with details we need statistics.

The statistics on accidents are generally missing or vague. Those available may or may not describe how bad is the situation out there in teacher/learner land. One article states: 'the data is disturbing'. I agree. They are disturbing because we need to make informed decisions about the classroom safety improvements which requires more data.

In the article Policy-Based Science Safety Programs, someone was commissioned to look at liability/judgments in Iowa schools. It isn't clear whether all the claims found are a result science activities.

In the study numbers of claims and judgments from lawsuits increased while the cost/claim and lawsuit dropped in a time of increasing medical costs. When I calculate, the average claim the claims dropped 8%, and the average lawsuit cost 14% less during this time.

	1990-1993	1993-1996
Claims	$2489.73	$2295.58
Lawsuits	$5899.01	$5055.76

Contrast these figures with claims/lawsuits nationally (from a study conducted by Jury Verdict Research, based in Horsham, Pa). This a direct quote from Claims magazine, May 2000, p. 14 - with permission from Randy Woods, editor <rwoods@claimsmag.com>. The study uses median figures which probably indicate the average is skewed.

In the study, the overall personal injury award median rose from $46,695 in 1997 to $50,000 in 1998, with median awards for most other liability types remaining below $1 million dollars. Median settlement figures were also up, from $30,000 in 1997 to $50,000 in 1998.

For the years 1992 through 1998, New York state reported the highest median compensatory award, $273,185, and Oklahoma the lowest, $10,000. Juries in New York state were the most likely to render million-dollar awards—in nearly a quarter of all litigated cases—while, at the other end of the spectrum, only 3 percent of Kansas plaintiffs received million-dollar awards, the study found.

Contrasting the two types of data, it appears to me the issue of safety is a concern, but it appears to me that incident by incident and school by school the cost is dropping. My question is how do we make it drop further and possibly cut the total number of incidents?

Teacher needs

Teachers need to know: How many claims and lawsuits were there last year? What were the conditions leading to the bodily injury/lawsuit claims? Was faulty equipment involved? Were inadequate room facilities a factor? Was it an error or faulty judgment of the teacher? Did student do something contrary to established rules? Was the teacher doing something known to be hazardous? How well informed and trained was the teacher:

Detailed information allows teachers to sort through the scary science legends, find out which are true, embellished or distorted. True or not, cautionary tales are the basis for designing safer activities. As teachers look for ways to set up new activities, additional training in safety education should help determine, not deter the development of exemplary laboratory programs.

Safety has its place, but let's get things in order. Science involves lab activities. Lab activities are a part of science. Safety is a component of lab activities. The science taught determine a need for activities while safety narrows the field of activities available. Let's work to get more activities in the classrooms.

Erwin Slesnick *
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WHO OWNS THE SCIENCE CURRICULUM?

Introduction

The owner of the curriculum is the individual, or group, who has the decision-making authority to create, implement and maintain instructional materials in science. The owner calls the shots on the science content, its organization, the methods of its instruction, and how, or if, it will be assessed.

The science curriculum is continually subject to forces that pull and push on its parts. Science curricula respond to crises of all types: threats to national security, or economic and political eminence; discoveries of wondrous new ideas about the natural world, and surges of anti-science fevers. When curricular change appears to be imminent new leaders vie for ownership. Usually one owner prevails. The owner may be one person. Curriculum development is often star-centered. Among the solitary stars were Liberty Hyde Bailey, Gerald Craig, and Jerrold Zacharias.

Liberty Hyde Bailey was a favorite. In the late Nineteenth Century he invented the elementary science curriculum named Nature Study. He was a botanist, working in agronomy at Cornell University. He had a gift for writing investigative activities for children to conduct in the field and classroom. Bailey received what I think is the first federally funded grant in curriculum development from the Department of Labor for strengthening children's bonds to the rural outdoors and thus holding them on the farm, and out of the crowded cities. Nature Study was the dominant elementary science curriculum from about 1890 to 1932 when the Thirty-first Yearbook declared it passé and dead.

When Congress gives money for curriculum development, does it also have ownership? The ownership of the biology curriculum in the 1960s and 1970s was difficult for me to establish. As director of the Biological Science Curriculum Study (BSCS), Bill Mayer was instrumental in displacing the authority of state textbook boards in controlling the biology curriculum in such influential states as Texas. In 1963 BSCS captured 93% of the market share. At first I thought Bill Mayer, or a democratically fashioned BSCS, owned the biology curriculum. Later I learned that it was the NSF, its Board of Directors, who called the shots, and distributed the funds. Even later when the Human Sciences Project got into some sex education, and MACOS encouraged students to discuss an Inuit practice of putting the elderly on ice floes, we learned that NSF gets its money from Congress.

Corporate or government ownership is often difficult to establish. However, I believe curriculum development in science, sponsored by NSF or AAAS, is also a star-centered phenomenon. In the middle of a successful sponsored program is an individual with the talents to conduct it all, better than any one else.

Ownership by Teachers Late Nineteenth Century

In the beginning, in the later half of the Nineteenth Century in middle America, many of the individual science teachers owned outright their curriculum. Science teachers taught whatever they chose ... whatever was attractive to the teacher, the pupils... using the resources of the community, the environment and industry. A pandemonium of courses taught, included orchids, gardening, hunting, machinery, farming techniques, animal care, etc.

Ownership by Universities - 1893

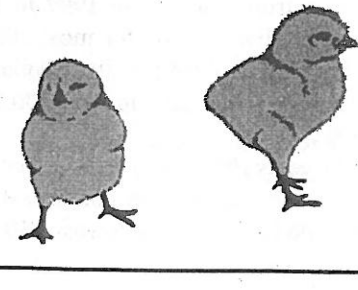
Students who went on to college to pursue science studies were considered to be unprepared for the modern college curriculum requiring professors to use their time teaching the elementary fundamentals of the traditional science specialties.

Addressing this crisis of the science curriculum, the National Education Association appointed a committee of ten, most of whom were university scientists, chaired by President Charles W. Elliot of Harvard to recommend in 1893 a standard curriculum for American schools grades 1-12. For science after a complex first issue, the committee recommended that physics be the course of study for the twelfth year, chemistry for the eleventh year, biological science for the tenth year, physical geography for the ninth year, and Nature Study for the first to eighth years. Syllabi and textbooks were to be written by university professors. In one fell swoop there appeared a new king on the hill of science curriculum......the university dons became the undisputed owners.

Almost immediately seeds for change in ownership were sown and germinated.

The Power of Textbook Publishers Late 1890s

The least complicated change in ownership occurred in the waffling recommendations about biological science. Rather than offend the botanists and zoologists, the committee allowed the tenth grade course to be a year of botany or a year of zoology, or a semester of botany and a semester of zoology, or, a year of biology. "Oy Vey", cried the textbook publishers. That means we have to produce five species of books. They trumped the costly options for multiple books, and produced the "unified" or "integrated" biology textbook. Perhaps it was here that the textbook publishers first took on the responsibility of curriculum ownership.



The First Unified Science-1900

The most profound challenge to the Committee of Ten's recommendations came at grade nine. In Europe such philosophers as Rene Descartes in 1629 and Herbert Spencer in 1854 wrote about the threats to scientific literacy with the fragmentation of the natural sciences into specialties, and the teaching of the specialties in the absence of developing big pictures of science. Their writings influenced the start of a movement in England for a unified science which they called "General Science".

The idea of a general science emerged at the turn of the Century at first in England, and then more passionately in the United States. Advocates argued to substitute a general science at the ninth grade for the recommended physical geography. General science was envisioned as the single course that would provide a holistic view of science for those ninth graders who would not study science further. It would also provide a big picture experience for other students with career goals in science before they became immersed in the science specialties.

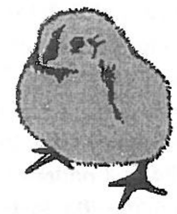
General science prevailed and became the common ninth grade course. It is still around with a small share of the market. Its owners were theorists- philosophers, university science educators with no apparent practical vision of what they were advocating. Typical of the writing of the time was this statement by Edwin Slosson on the philosophy of general science.

General Science is not a crazy-quilt, made up of patches torn from the various sciences. On the contrary, the various sciences consist of patches torn from the seamless robe of truth, which it is the object of General Science to present in its pristine unity, its natural integrity.

General science was launched in Springfield, MA in 1900. From the beginning it became little more than the crazy-quilt of patches, a hodgepodge of chapters from geology, biology, chemistry and physics textbooks. No effort was apparent to integrate or coordinate the topics. The owners of the curriculum did not have the skills to produce or market the curriculum. They are long dead, but their incompetent ghosts still own the curriculum.

Junior High Schools Move into Life Earth and Physical Science - 1920

The major curricular event in the early 1920s was the establishment of the junior high school. The population surge required more school buildings. New high schools were constructed making available for occupancy the old high school buildings. These became the new junior high school buildings to house grades seven, eight and nine. These old high schools came with science laboratories that inspired a recycling of the Committee of Ten high-school curriculum. The new junior-high-school courses are now known as life, earth and physical science. The junior-high-school curriculum is largely owned by textbook publishers, although during periods of the past 80 years the curriculum has had brief relationships with the Progressive Education Association and the National Science Foundation.



Gerald Craig Displaces Liberty Hyde Bailey - 1932

In 1932 the Thirty-first Yearbook of the National Society for the Study of Education recommended a principles of science curriculum and the end of Nature Study as invented and nurtured by Liberty Hyde Bailey and his successors at Cornell University. In its place for the elementary school, the yearbook recommended the acceptance of a discipline centered science curriculum invented by Gerald Craig, a teacher in the Horace Mann School in New York City. Craig's doctoral dissertation was the new K-6 curriculum that was published as the first modern elementary science textbook series. Craig owned the elementary science curriculum for about thirty years.

The Eight Year Study: 1934-1942 and Beyond

The Great Depression of the 1930s had a profound effect on the secondary school science curriculum. The economic crisis stimulated a reexamination of educational goals led by the Progressive Educational Association (PEA). The goal was to use science to free students from the restrictions of traditional studies, and encourage studies that related the natural world to their personal interests and experiences. Science occurred in two divisions of the school curriculum (1) the Core and (2) the Electives. The PEA (with much of its leadership centered at the University of Chicago) initiated the Eight Year Study (1934-1942) during which 30 schools across the country restructured their curricula after obtaining assurances from colleges that students would be credited for alternative courses. In the core curriculum students pursued multidisciplinary studies of problems of interest to them and society. The momentum was interrupted during World War II but afterwards some schools carried on. From 1957 to 1963 I taught with seventh, eighth, and twelfth grade core teachers units titled, "Am I Normal?", "Outdoor Education", "The Human Population Problem" The elective science was sometimes fully integrated or unified (Stanley Williamson at the Laboratory High School at the University of Oregon, and Victor Showalter and I at the University School at The Ohio State University). More frequently research studies were undertaken to develop and then measure the effectiveness of curricula that integrated the physical sciences. Robert Carleton was one of the researchers, and a writer of physical science textbooks. The owners of the PEA curricula were the dedicated and practical leaders of the Eight Year Study whose spirit, vision, and energy survived the depression, World War II, and the 1950s.

The NSF Era: 1956-1978

The trend toward integration collided with the Soviet successes in science and technology and all the security, political and economic hysteria it generated. NSF went into an emergency mode to establish a science education improvement program. The first batter to the plate was Jerrold Zacharias of the Massachusetts Institute of Technology. Zacharias sought to create a modern high school program in physical science - an integration of modern physics and modern chemistry. He assembled practicing physicists and chemists interested in curriculum reform to plan together a strategy for the development of an integrated physical science curriculum. The assembled chemist and physicists failed to agree to work together. Chemists subsequently obtained grant money to develop CHEM STUDY and the Chemical Bond Approach (CBA). PSSC retained its name, but became a pure physics curriculum.

For the twenty years after the launch of Sputnik, NSF was the primary owner of curriculum in America, and very influential in the rest of the Western World. In the beginning NSF concentrated on high school curriculum improvement. Thereafter NSF sought to create alternative curriculum structures in elementary and middle schools. Alternative philosophies of curriculum were given royal jelly. For example, at the elementary level NSF began by funding several dozen elementary ideas, but then only fully funded three programs with dramatically different philosophical foundations (see table below).

NSF's strategy in elementary school science seemed brilliant. Some wondered where they were planning to go from here ... perhaps to a single conciliatory curriculum.

At the middle-school level NSF supported science/social studies projects which addressed "survival" concerns of students. It was that excursion that marked the end of the golden age of NSF ownership of the K-12 science curriculum. Negative publicity resulted from the curriculum, Man: A Course of Study (MACOS) with study activities about Inuit practices of ice floe social security, and the Human Sciences studies on human reproduction and sexuality which encouraged students to investigate realms of knowledge previously inaccessible to them in schools. This contributed to NSF's retreat from pre-college curricular development.

Most federal projects failed to become sustainable because the academic owners overstepped their expertise, and their understanding of the nature of the pre-college school environment was naïve.

A Golden Age for Textbooks: 1980s-1990s

During the Reagan and Bush administrations federal programs in curriculum development receded. Most of the NSF programs had slid into oblivion. By default, textbook publishers resumed their ownership of K-12 science. Editorial research informed staffs in science what teachers, administrators, and the public wanted, and marketing held sway on what they would buy. The 1980s and 90s have been a golden age for publishers. As state frameworks were issued, the publishers were quick to interpret them and give them a creative spin. The curricula of the 80s and 90s are essentially the same layered cake curriculum recommended by the Committee of Ten for high school, with the added life, earth, and physical science for middle school, and the science discipline centered elementary curriculum developed by Gerald Craig.

In the late 1980s and early 1990s Bill Aldridge of NSTA and Penny Moore of University of California Berkeley each directed curriculum development projects that infused European curriculum structures. Moore is adapting the British York University Program into her curriculum project known as Prime Science. Aldridge modeled his project, Scope, Sequence and Coordination, after the Soviet/Russian science curriculum. A dominant feature of these curricula is that physics, chemistry, biology and earth science run parallel, enabling schools to integrate or coordinate. Some other current curricula in early stages of implementation are: The American Renaissance in Science Education (ARISE) directed by Marjorie Bardeen and Leon Lederman, and Active Physics directed by Arthur Eisenkraft. An interesting commonality among the four projects is that the directors of each are/were distinguished physics people. Eisenkraft reveals the rationale of the projects when he asks, "What is the most difficult physics problem in America today?" (answer) "In this day and age only 20% of our students take physics." Undoing the recommendation of the Committee of Ten in order to teach physics to students at grades earlier than twelfth is a common objective. Who owns this effort? Who is calling the shots? Where does the money come from?

The Standards - Today

Today a new owner of the science curriculum, a new king of the hill, has appeared. A national crisis was announced in a series of reports on comparative science and mathematics education, notably "A Nation at Risk" and The Third International Mathematics and Science Study.(TMMES). Economic survival in America requires

Curriculum	Philosophy	Leader
ESS	Experientialism	David Hawkins, Philosopher
SAPA	Social Behaviorism	Robert Gagne, Psychologist
SCIS	Academic Traditionalism	Robert Karplus, Physicist

eminence in science, mathematics and technology. American students must be encouraged and inspired to extend themselves toward mastery in science. They should be first in the world in knowledge, in problem solving, in technical skills. Teachers must be masters of their content, and highly skilled in the strategies of teaching.

The response to the latest crisis in science education has been for scientific organizations to establish national standards (and Benchmarks) which will help assure the development of exemplary curriculum. Additionally these national standards have been written for individual states and other jurisdictions to accommodate local situations.

Let there be no doubt, however, the creators of the several varieties of standards (with a commonality of about 85%) are now the owners of the science curricula in America. They define with unprecedented precision what the science content should be, how teachers should teach, how science teachers should be prepared in college, how students should be evaluated. If you have any doubts about the above truths, consider the evaluative procedures underway to rank individual curricula in accordance to their adherence to national standards, and the establishment of sanctioned consulting groups to guide curriculum writers in the science of using standards as the design criteria. Curricula are and will be rated comparatively against the criteria of the standards, as cars and refrigerators are rated and ranked by consumer reports.

Perhaps "ownership" is too simple a concept for the controlling authority of the science curriculum in the current milieu. Since standards are the products of deliberation of representatives of all our constituencies, is it possible that we are approaching the democratic ideal of joint ownership. Maybe science educators are transcending their differences and accepting the fact that we are all becoming owners of the science curriculum. I derive encouragement for the ideas of full professional ownership from the writings of William Schubert, a curriculum philosopher from the University of Illinois-Chicago.

Schubert says that we who are in the practice of curriculum are one of the following four types.

1)Academic Traditionalists: these persons believe that studying the established science disciplines, like the great books of the humanities, a is key to realization of literacy in science. They believe in depth over breadth, rigorous study, recruitment of the gifted for careers in science, devotion to the search for truth through research. Their first curricular concern is the science content.

Examples: Committee of Ten, NSF during early years of Sputnik crisis.

2) Experientialists: these persons are followers of John Dewey who said the (science) curriculum should be guided by the interests and past experiences of students. Students should have multisensory experiences (hands on) with phenomena which they intellectualize and bring forward to higher levels of application. Their first curricular concern is the learning readiness of the student.

Examples: Elementary Science Study (ESS), Progressive Education Association

3) Social Behaviorists: These creators of curricula will state precisely the goals and objectives in terms of measurable behaviors of the learners. The social behaviorist then designs the activities students are to carry out. Testing is then carried out to measure the realization of goals and objectives. The teaching/testing cycle is repeated until goals and objectives are achieved.

Examples: Science a Process Approached (SAPA) by AAAS for elementary, created and directed by Robert Gagne, most popular in large city schools where structure and accountability are prized. I've no examples of other entire curricula fully faithful to this curricular philosophy. However we all may have used programmed instruction as part of a larger curriculum, e.g. the population genetics program in the BSCS curriculum.

4) Conciliators: Schuster identifies a fourth and growing group of curriculum philosophers, who act through conciliation. They recognize that none of the pure positions can be always correct. In practice the conciliator favors the eclectic strategy of calling on other approaches as situations require. Conciliators now appear to recognize that none of the pure philosophies can prevail over the others.

Examples: Alfred North Whitehead *The Aims of Education (1929),* Audrey Champagne, Rodger Bybee, Victor Showalter, and most of the people I've ever worked with in curriculum.

Conclusion

As we enter the new millennium the standards group appears to be the new owner of the science curriculum. Despite their appearance of genuine community representation, and some evidence of philosophical conciliation, the ingredients for conflict and exclusion are still there. For example, remember the fractural disputes over the roles of technology in the science curriculum, in early drafts of the National Education Standards. And one cannot ignore the long-standing distrust scientists and educators hold for each other on matters of curriculum. It is critically important that curriculum ownership in science be conciliatory, and that we all stay involved together in the continuing process of curriculum reform.

*Irwin Slesnick received NSTA's Robert A. Carleton award in 1998. This article is the Robert A. Carleton Lecture that Slesnick delivered at the 1999 NSTA convention in Boston.

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EVALUATION IN A SCIENCE LITERACY PROGRAM: LINCOLN PARK ZOO'S BIOLINCS

Introduction

The "biological literacy integrates content and strategy" program at Chicago's Lincoln Park Zoo (BioLINCS) offers classroom teachers an opportunity to improve their knowledge of both science and pedagogical strategies. It's content component includes four distinct science themes, each coupled with a pedagogical strategy:

- Conservation/Hands-on Learning
- Habitat/Collaborative Learning
- Animal Behavior/Critical Thinking
- Urban Nature/Problem-Based Learning

Forty-three Kindergarten through 8th grade teachers from thirteen school teams, representing all regions of the Chicago Public School system, are currently participating in this two-year program, funded by the Illinois State Board of Education. Teachers receive eight semester hours of graduate credit in science education, suitable for science endorsement, from National-Louis University upon completing the BioLINCS program.

Teacher instruction begins when each of the thirteen participating schools sends a teaching team (3 to 5 teachers) to take part in an intensive two-week Summer Institute. Two National-Louis University professors, two full-time BioLINCS staff and a professional evaluator provide the core group who staff the Summer Institute kick-off to the program plus the multiple workshops and field trips teachers participate in during the next two years. The two full-time BioLINCS staff members also observe teachers in their classrooms and support teacher teams through regular in-school meetings.

The purpose of science literacy, staff development programs such as BioLINCS is to improve the skills and abilities of classroom teachers to teach science with confidence and passion. BioLINCS is no different than other projects in this regard. What sets BioLINCS apart is its attention to pre-instruction evaluation and an ongoing incorporation of teachers into the evaluative process.

The BioLINCS staff begins the evaluation process before teachers begin their instruction. This is a different approach from the traditional practice of formative followed by summative evaluation. Summative evaluation requires an analysis of all the information gathered *after* a program is completed and precludes the potential to adjust a program to meet the specific and often changing needs of its teachers. Because it occurs at the end of a program, a summative evaluation component is too often treated as an afterthought in science literacy programs.

Formative evaluation is an ongoing process or "dialogue" between teachers and program staff that can help shape the evolution of the program. This is especially important in a long-term program like BioLINCS, where theoretical expectations at the beginning of the first year may be dramatically different from experiential outcomes and new expectations as the teachers mature during the program.

A pre-instruction formative evaluation process can be used to increase program staff understanding of the teachers with whom they will be working as individuals. Familiarity with individual teaching styles helps program staff deliver appropriate feedback, resources and suggestions relative to issues specific teachers face. In addition, pre-instruction insights gained regarding individuals help prepare program staff to anticipate and plan for team dynamics.

Formative and pre-instruction evaluation are also important in actively engaging teachers in the actual evaluation process, fostering in them a new capacity for self-assessment. This knowledge, if incorporated correctly, leads to "change-ready" rather than "change-resistant" teaching teams. Teacher familiarity with their own style plus the styles of fellow team members can help to increase cooperation and collaboration. In addition, the individual teacher's assurance that the program staff know his/her background, strengths and particular situation can also help engender a trust in staff feedback and in a shared vision of what the program can offer.

The late Dr. Beverly Firestone of DePaul University was the BioLINCS evaluator. Dr. Firestone strongly believed in both pre-instruction and formative evaluation as the basis for increased learning and cooperation among both teachers and staff. Dr. Firestone was also a strong proponent of incorporating self and team assessment into the teachers' learning. Perhaps her most important contribution is the idea that those who "teach the teachers," University and Institution staff, first need to be taught how to be good evaluators of themselves, of the teachers and of the program. To this end, before the teachers ever set foot on Lincoln Park Zoo grounds to begin their instruction, Dr. Firestone trained a core evaluation staff. This group consisted of the university partner professor of record, the two BioLINCS full time staff members, the BioLINCS curriculum writers and BioLINCS volunteers.


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Formative Evaluation: Pre-Instruction

Dr. Firestone collected the data to better understand the baseline experiences, needs and hopes of entering teachers through a mix of formal, standardized and informal, customized evaluation instruments sent to the teachers. This "Reflection & Assessment Packet" was completed and returned by teachers before instruction (the Summer Institute) began. Instruments analyzed by staff included:

- MBTI "profiles" of each teacher. The primary standardized instrument used by Dr. Firestone, the Meyers-Briggs Type Indicator (MBTI) is a self-assessment exercise which indicates the personality "preferences" (type) of an individual through a series of questions. An Individual's type is represented by "scores" in four categories: Extroversion/Introversion, Sensing/Intuition, Thinking/Feeling and Judging/Perceiving.
- A teaching-reflection piece called the "Best Lesson Reflection," wherein teachers discussed their best lesson and why it was successful.
- A self-reflection piece called "Fingerprints of Teaching," wherein teachers discussed five characteristics of themselves that they brought to their teaching style. This instrument used the hand as a metaphor for both characteristics and the idea that a teacher's "fingerprints" affect students.
- A teaching style self-assessment piece called the "Quickee Questionnaire" which asked teachers to state preferences in the classroom (e.g."My classroom materials are organized in: A. Files or B. Piles"), choose metaphor for their teaching, choose metaphors for how their students viewed them, etc.

Information gathered from these teacher pre-instruction assessment packets has been used throughout the program. These pieces have been invaluable in helping staff get a better sense of both the common concerns and issues which might arise and the personal needs of each teacher.

The MBTI results alone proved extremely helpful in identifying personality types within each team and addressing the potential strengths and weaknesses of each team's makeup. For example, BioLINCS staff were able to determine before the first instructional meeting that a INTP (introvert, intuiter, thinker and perceiver) teacher in a particular team with three ESFJ (extrovert, senser, feeler, judger) colleagues might have a hard time getting her ideas across and feel overwhelmed by the other teachers. The staff discussed this dynamic with the team and offered strategies ("time-outs," talking in turn, soliciting input, note-taking, etc.) that would allow all members to work with their differences and embrace them as a strength rather than split the team. This resulted in better understanding and cooperation among the whole team.

The customized pieces in this packet helped staff to learn the teaching background of individuals and help them explore the science content areas and pedagogical strategies with which they were less familiar. In one case, a new teacher who had never tried collaborative work with his students team-taught a collaborative lesson with a more experienced teacher from his team. This evolution to a change-ready teacher occurred because BioLINCS staff knew what each teacher was comfortable with even though the two teachers had not worked together before the program began.

Four Levels of Formative Program Evaluation: Teacher Reaction, Learning, Behavior, Outcomes

As teacher instruction began at the Summer Institute Dr. Firestone and BioLINCS staff continued to implement a formative evaluation process that would carry through the rest of the program. The four continuing areas of interest to BioLINCS staff were:

- Teacher reaction to new content areas (science and pedagogical).
- Teacher learning in new content areas.
- Teacher behavior (i.e. "before and after" classroom styles).
- Teacher outcomes (i.e. success or failure with implementing new content, sustained delivery of content, etc.).

The instruments used by Dr. Firestone included individual and team surveys, focus-group questions, team contracts and extensive journaling. These instruments were both standardized and customized in nature and focused on revealing teacher data in such areas as teaching "style," level of self-reflection, personal strengths, individual concerns and needs and program expectations. The focus continued to be on both program assessment and self-assessment and goals.

An early aspect of this evaluation process focused on the *reactions* of teachers to the content and strategies of the curriculum (program knowledge) as well as their *reactions* to teammates and reflection/assessment (self-knowledge). Staff were able to interpret teacher reactions in the context of already established typologies and personal teaching histories/experiences determined prior to instruction. Staff also began to evaluate *learning* occurring in both program knowledge and self-knowledge as the program entered the school year with its attendant workshops.

Much of this evaluation was done by staff observation of the teachers in their classrooms. Staff began to look for *behaviors* in the classroom such as classroom management style and teaching strategies used. The staff also observed how program knowledge (*learning*) was being integrated into classroom teaching. This was accomplished by observing teachers implement lessons from the BioLINCS curriculum multiple times throughout the year, both individually and in teams. This part of the evaluative process included observation for:

- A baseline evaluation of each teacher to compare against future observations.
- Strategies initially used by teachers in their classrooms.
- Changes over time in both team and individual strategies used and content familiarity.
- Ways in which team members interacted.

Staff provided immediate verbal feedback (e.g., what worked, suggestions for improvement, resource ideas) following lessons plus a more in-depth written assessment at a later date. The assessment protocol was used as a guiding tool toward more comprehensive classroom practice; it should neither be considered a formal performance appraisal nor judgmental in nature.

Staff also met with each team midway through the year to conduct a mini-focus group to address any specific concerns or needs a particular team might have had. The responses of focus groups were later analyzed for commonalties among all the teams.

As the first year neared completion, the teachers met one last time with Dr. Firestone, to reflect upon the cost/benefit analysis of what had occurred during the past year. Using both verbal reflection/recollection and informal written comments recorded on chart paper teachers assessed how they had worked together as a team, how they had evolved as individuals and the impact of the program on their teaching. Staff members acted as recorders at this session and this summative data of the first year was later compiled to reveal patterns, commonalties and continuing needs to be addressed in a formative fashion during the second year.

The evaluation process has remained essentially the same in the second academic year with the addition that staff observers look for both qualitative and quantitative *outcomes* derived from the knowledge gained throughout the first year. Enhancement or additions to BioLINCS curriculum implementation strategies, confidence in content knowledge and presentation and student response and performance are all observed.

Conclusion Statement

The BioLINCS program has been fortunate to have an evaluator who was not only a colleague but also a fully involved mentor from the start of the program. There is no discounting the need for program staff to be familiar with the work their evaluator is doing. The two, staff and evaluator, should become as one, with the same goals and understanding. Staff must believe that what their evaluator is doing is important and invaluable. The only way to truly achieve this understanding is for the evaluator to walk the staff through the same exercises participants will do, teach them how to facilitate assessment on their own and enlist their support by investing in them the importance of the evaluation process. Perhaps the greatest gift an evaluator can give program staff is the credo "Know Thyself, Know Thy Instruments, Know Thy Participants."

Suggested Readings/References

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Nolinske, T. *Multiple Approach To Evaluation.* Paper presented at the Second Pan-American Congress on the Conservation of Wildlife Through Education

COMPUTER SPECTRUM

Weather Site:
www.speedsite.com/~temps

schoolyard experiments

Mike Schneider
Cahokia District #187 Web Page at:
www.cahokia.stclair.k12.il.us
Participate in Online Science Experiments at:
web.stclair.k12.il.us/splashd/experimt.htm

Over thirty-six different schoolyard experiments available Some of. them are very new and will probably need some additional refinement. Additional changes have also been made to improvethe proc ess. We also are offering a drawing as an incentive to get more onlineparti cipants. Those online participants who submit data this fall and/or next spring will be entered into a drawing next spiring. We have several field guide packets worth approximately $75 each that we will raffle off. Hope you and your students will participate in one of the online experiments.

IGA Reporter - GeoResources

Geographic Voyager, a 10-part VSH update of "Global Geography," is being prepared by the Agency for Instructional Technology and is expected to be available by December 2000.

www.mps101.com/cram includes an on-line subscription to the George F. Cram Company's new resource: Maps101. Black and white outline maps, history maps, daily current event maps, and lesson plans are included. Annual rate $300 per school; free 2-week trial.

World of Education offers "baskets" of educational materials representing cultures in a variety of environments: Village Craft Series Baskets, Mountain Baskets, and Rainforest Baskets. Each includes authentic artifacts, hands-on activities, teaching cards, Discovery Journal with reading and website lists. Contact Christine Peak at 847-526-8338; P.O. Box 278, Lake Zurich, IL 60047; email: worldofed@aol.com

"Earthshots: Satellite Images of Environmental Change" is a series of USGS on-line programs which describe landscape change by using before – and –after Landsat images.
http://www.usgs.gov/Earthshots

Environmental Defense Fund pollution ratings by state, county, and zip code. Identifies polluters and pollutants.
http://www.scorecard.org

Washington State University's world culture and history resource; on-line classes.
http://www.wsu.edu:8080/~dee/WORLD.HTM

Middle East Institute George Camp Keiser Library presents an on-line version of Cherif Bassiuni's book, an introduction to Islam for non-Muslim readers; maps, charts, photos.
<www2.ari.net/gckl/islam/introislam.htm>

Puzzles of the Earth is an interactive site which features physical geography topics. http://library.advanced.org/17701/

www.standard.net.au/~garyradley/GRAust.htm (Australia)

www.eduplace.com/geo/index.html (game based on national standards)
www.bcpl.lib.md.us/~lpeltijo/usmap.html (U.S.)
www.standard.net.au/~garyradley/SAmerQuiz.htm (S.Am.)
www.helpself.com/daily/geography.html (daily trivia)
www.quizsite.com/quiz/geograph/ (landmark locations)

Try www.ditto.com if you are looking for photos to download from the internet.

Christian Science Monitor. Excellent journalism: thought-provoking, admirably researched. Best source for international news. Five days per week, no weekend edition. $189/yr. Also available on-line www.csmonitor.com and maintains archives from 1980. Phone: 1-800-456-2220 or write to: The Christian Science Monitor, P.O. Box 37304, Boone, IA 50037-0304.

World Press Review. Monthly; offers perspectives from other cultures and societies by reprinting magazine and newspaper articles from around the world. $26.97/yr. Subscribe at World Press Review, P.O. Box 228, Shrub Oak, NY 10588-0228.

http://www.gsh.org
Global Schoolhouse Project
Utilizing the Internet and the most advanced technology of the day, the Global Schoolhouse provides its participants with opportunities for life-long learning. The Global Schoolhouse is a virtual meeting place w here people of all ages and backgrounds can collaborate, interact, develop, publish, and discover resources.

http://www.gsn.org/gsn/gsn.projects.registry.html
Internet Projects Registry

A central place to find partners and projects on the Internet, organized by the month they begin.

http://www.gsn.org/gsn/cuseeme.schools.info.html
CU-SeeMe Schools Directory

A listing of K12 around the world who have the ability to participate in CU-SeeMe videoconferencing and an archive of events schools can participate in.

http://www.gsn.org/gsn/www.contest.html

Educator's WWWeb Contest
A monthly WWWeb contest for teachers and students in which they can receive FREE software and instructional materials

http://www.gsn.org/gsn/k12opps.html
K12 Opportunities
A central, location to post announcements about free software, contests, conferences, training opportunities, and educational WWWeb sites.

MSTA—MONTANA SCIENCE TEACHERS ASSOCIATION NEWSLETTER

WHIRLING DISEASE
The following web site is continually being updated and provides more than just the whirling disease issue.
http://www.whirlingdisease.org

Web Sites for Inventors!

The Invention Dimension
http://web.mit.edu/invent/

Feature Stores about Inventors
www.discovery.com/past/stories/moreinventors.html

The Spirit of Invention links to many more sites:
www.dimensional.com/~janf/wtinvention.html

Inventure Place, The National Inventors Hall of Fame!
www.invent.org

EXPLORAVISION!!!!!!

Sponsored by Toshiba and administered by NSTA, the Exploravision Awards Program is the world's largest K-12 student science competition. For an application:
http://www.nsta.org/programs/explora.htm

Science Fair Ideas

Are you looking for some science fair ideas????? Check the following web sites Science Fair Idea Exchange:
http://www.halcyon.com/sciclub/cgi-pvt/scifair/guestbook.html

Science Project Guidelines
http://atlas.ksc.nasa.gov/education/general/scifair.html

Scientific History

Check out the web site at http://www.fi.edu to get a look into scientific history.

Nasa Educational Workshops

Do you want to attend some all expense paid workshops funded by Nasa?? Get info at:
http://www.nsta.org/programs/new.htm

Smithsonian Resource Guide For Teachers

http://educate.si.edu/resource/start.html

Duracell Competition

http://www.nsta.org/programs/duracell.shtml

Toyota TAPESTSRY Grants

www.nsta.org/programs/toyota.htm
K-12 science teachers
The Toyota TAPESTRY program offers grants Student Award Programs

Satellite Pictures of Earth

These are some great pictures of Earth found at http://www.terraserver.com

Check These Out

Waterford Press:
http://www.waterfordpress.com
This site offers free print-based instructional materials to support elementary natural science curriculum for elementary and middle school grade levels.

KidsConnect
http://www.ala.org/ICONN/AskKC.html
K-12 students looking for information on the Internet for a report or project can use KidsConnect to get help from a volunteer librarian, usually within a few days. From American Association of School Librarians (AASL), a division of the American Library Association.

IT'S A WILD WORLD ON THE WEB

http://dnr.state.il.us/orep/inrin/ecowatch/Forest Quality Indicator/index.htm
A web version of the Forest Quality Indicator page for Forest Watch.

http://www.museum.state.il.us/ismsites/dickson/
Dickson Mounds Museum, a branch of the Illinois State Museum and a National Historic Site, offers a unique opportunity to explore the world of the American Indian in an awe inspiring journey through 12,000 years of human experience in the Illinois River Valley. Visitors to the museum, in west-central Illinois, encounter innovative interpretive exhibits; exciting hands-on activities, archaeological sites and a variety of special events in a rural setting.

http://www.museum.state.il.us/RiverWeb/landings/Ambot/
The *RiverWeb* web site explores the Native American prehistory and early Euro-American history of the American Bottom, the broad expanse of Mississippi River flood plain I n the vicinity of St. Louis. Includes interpretive narratives exploring a series of themes; how-do-you-know sections focused on methods; rich archives of original images, texts, and data; and activities that challenge visitors to use all of components to address questions. Geared to teachers and high school and undergraduate students.

www.treeguide.com
Formerly the TreeWeb (University of Kentucky) provides a wealth of information on the natural history of trees.

www.rubythroat.org
A cross-disciplinary international science education project that involves students in study of ruby-throated hummingbird behavior and distribution.

http://www.gp.com/educationalinnature/index.html
A series of forestry-related supplements for grades 4-5 from Georgia-Pacific Corporation. Each unit contains teachers guides, activities, vocabulary words and extras.

http://www.water.org/WaterPartners
International has educational materials to increase awareness about the lack of safe water and the suffering and death caused by water-related disease.

AAAS CONFERENCE PROCEEDINGS ADVANCE DISCUSSION OF TECHNOLOGY EDUCATION RESEARCH

www.project2061.org.

Studying how students learn the ideas and skills needed for technological literacy should be at the heart of an agenda for technology education research. This is one of the recommendations set forth in the Proceedings of the AAAS Technology Education Research Conference. The proceedings continue the conversation about directions for technology education research initiated at the December 1999 conference. They are published online by Project 2061, the long-term science education reform initiative of the American Association for the Advancement of Science (AAAS). The proceedings provide an overview of the conference and bring together 17 papers by conference participants that reflect on the issues that were discussed. Funding for the conference and the proceedings was provided by the National Science Foundation.

Julie Parker
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IGA Reporter
Spring 2000

EXPLORING BIOMES USING INTERNET MAPPING RESOURCES AND TECHNOLOGIES*

Purpose: The main idea of this lesson is to help students feel comfortable using Internet mapping technology and resources. A secondary goal is to have students understand that geography is an excellent "tool" for exploring the world's biomes, ecosystems, and climates.

Investigative Question: What are the major world biomes, where are they located, and what impact has MAN made on them?

Geographic Element: Physical Systems; Environment and Society. Objectives: Upon completion of this lesson, students will be able to:

1. Explain what biomes are and how they interact with climate (National Geography Standard #7).
2. Locate and describe the characteristics of the major terrestrial biomes of the world (National Standard #8).
3. Compare a variety of biomes throughout the world (National Standard # 14 and # 15).
4. Describe the adaptive characteristics needed by plants and animals in different biomes (National Standard #8).

Illinois State Goal #17: Understand world geography and the effects of geography on society, with an emphasis on the United States. As a result of their schooling students will be able to:

Standard #17.A.4b Use maps and other geographic instruments and technologies to analyze spatial patterns and distributions on Earth.

Standard #17.B.4a Explain the dynamic interactions within and among the Earth's physical systems including variation, productivity and constructive and destructive processes.

Grade Level: 9-12.

Materials:

1. Computers and an Internet browser such as Netscape Navigator or Internet Explorer.
2. One copy of the *Biome Characteristic Chart* per student.
3. One copy of the *Internet Resource List* per student.
4. Large sheets of butcher paper or poster board.
5. Colored pencils or felt markers.

Connections: Earth Science, Physical Science, Meteorology, Technology, Biology.

Background: Biomes refer to broad geographic regions that are characterized by relatively similar climate, topography, flora, and fauna. These biomes are generally identified by their dominant plant life *(e.g.,* grasslands, forests). Biomes seldom have distinct boundaries. There are many different classifications of the world's biomes in varying degrees of detail. Generally they all include tundra, desert, forest, grasslands, or some subset of these. As with any attempt at regionalization, biomes share key characteristics (they are all more similar than dissimilar), however they are not homogeneous. For example, a polar biome is characterized by much lower temperatures than a tropical forest biome. But even with the polar biome, one can expect a range of temperatures (generally -40 degrees Celsius to -4 degrees Celsius). If you were high above the ground in a jet, you could identify these areas that would appear to be deserts, forests, or grasslands. You may find it difficult to determine where one biome begins and another ends as the two merge into areas of transition. Organisms that live in any given biome have features that have allowed them to adapt to the environment of that biome. Each biome has plants and animals that are uniquely qualified to survive there. Keep in mind there are species that can survive in a number of different biomes.

NASA Shuttle Images for Additional Exploration

<http://images.jsc.nasa.gov/iams/html/earth.htm>

Click on the mission number, then mags; (middle three numbers), then the last numbers to complete the photo I.D.

STS056-075-015	STS511-35-0003
STS060-085-OAE	STS039-612-038
STS045-152-105	STS61A-45-0098
STSIG-34-0060	STS052-80-064
STS064-112-093	STS043-151-263
STS052-152-006	STS039-612-038

Also try: **http://earth.jsc.nasa.gov**

Procedures:

1. Divide students into working groups. Assign each group a different biome to explore.
2. Distribute a *Biome Characteristic Chart* and an *Internet Resources List* to each student.
3. Have each biome group gather data using the Internet links on the *Internet Resources List* and the *Biome Characteristic Chart* as guides.
4. Each group should create a poster containing: a) a list of the key characteristics of their biome, b) a map depicting the geographical extent of their biome, and c) pictures or illustrations of vegetation, animals and landscapes found in their biome.
5. Students should present and discuss their findings through open-ended questions such as: a) What would the seasonal weather be like in the different biomes? b) Do different animals live in different biomes depending on the time of year (consider migratory bird species)? How can they survive in such different environments? c) Why are humans able to live in all biomes (consider cultural adaptations)? d) In what ways are humans changing biomes?

Enhancements:

1. Divide students into groups. Assign each group a continent to explore using ArcData Online website (see list). Have each group print a vegetation, landscape, and climate map for each continent. Print/trace each map onto an overhead transparency. Have each group present their findings through a discussion of the relationships between climate, vegetation types, and landscapes. Tip: Combining and overlaying transparencies will make the relationships more apparent.

2. Have students research a characteristic plant, animal, or ecological threat/disaster from any biome. in addition to preparing a short report, students should also delineate the plant or animal's range on a map, or map the geographical location of the threatened area or site of recent ecological disaster.

Internet Resources List

http://www.esri.com/data/online/index.html
ArcData Online. Online interactive mapping. Create your own maps of climates, soils, landscape, vegetation, and more.

http://members.aol.com.bowerman/ecosystems.html
Ecosystems/biomes. This page was created by a high school geography teacher in Pennsylvania. You'll find links for Internet adventures, biome current events, biome games and quizzes. A wonderful place to start your explorations.

http://www.kn.pacbell.com/wired/fil/pages/huntbiomes.html
An Internet treasure hunt for biomes. Scroll down to the section on Internet resources for biome links.

http://www.snowcrest.net/geography/slides/biomes/index.html
Biomes of the world. A map of the world's biomes and links to explore each.

http://www.runet.edu/~swoodwar/CLASSES/GEOG235/biomes/main.html
Major biomes of the world. A site at Radford University containing links to explore eight different biomes.

http://clio.marlborough.1a.ca.us/depts/science/biomes.html
Marlborough's Biomes Page. Internet links to 11 different types of terrestrial biomes and associated biome sub-categories.

http://www.fi.edu.tfi/units/life/habitat/habitat.htmI
Living Things: Habitats & Ecosystems. A "must-see" site for anyone (teachers and students) interested in ecosystems, biomes, and habitats. Hands-on activities, information on conservation, preservation, and endangered species.

http://geography.about.com/msub42.htm?pid=2820&cob=home
A subset of **geographyabout.com,** the mining company for geography on the Internet. This is a listing of links for biomes.

Biome Characteristic Chart

1. Average yearly temperature range:
2. Average yearly precipitation:
3. Latitudinal extent: (example: the polar biome ranges between ___ and ___ degrees N and S latitude).
4. Soil characteristics:
5. Characteristic vegetation:
6. Characteristic animals:
7. Adaptive features of plants to survive in this biome:
8. Adaptive features of animals to survive in this biome:
9. Ecological threats to this biome:
10. Recent/current environmental news regarding this biome (look for conservation efforts, disasters, human impacts, etc.).

* Adapted from a lesson plan prepared by S. Henderson, *et al* (eds) in *Global Climate-Past, Present, and Future,* EPA Report No. EPA/600/R-93/126, pp. 13-18, U.S. Environmental Protection Agency, Office of Research and Development, Washington, D.C. Editor's note: This plan first appeared in the Fall 1999 issue of *The OKAGE News,* the newsletter of the Oklahoma Geographic Alliance, and is reprinted here with permission. Thanks to Mary Ann Hanlin, who revised the original by replacing Oklahoma State Standards with Illinois Standards).

Dr. Louise Baxter
Central Washington State University
WSTA Journal, March 2000

TIME FLIES LIKE AN ARROW; FRUIT FLIES LIKE BANANAS....OR DO THEY?

Many students have seen fruit flies around grocery store produce. Have they ever noticed which fruit they fly around? Do fruit flies really like bananas better than other fruit, as purported? Here's a simple experiment - a take-off of the bottle biology experiments - that is easy to do and gives quick but informative results. Of course, it requires fruit flies. Vials of living fruit flies can be ordered inexpensively from any biological supply house. Teachers at the elementary or middle-school level can collaborate with high-school or college biology teachers to obtain fruit flies from leftover genetic experiments.

To introduce this experiment using an inquiry approach, ask students leading questions to elicit background information, a testable question, and a workable design. The teacher questions and student responses might go something like this:

Teacher Questions (Q)
Probable Student Responses(R)

Q: Who here has ever seen a fruit fly?
R: That's silly! Fruits don't fly!
Q: No. I mean who has ever seen an insect called a fruit fly?
R: (blank stares)
Q: Have any of you ever seen insects buzzing around over fruit in the grocery store?
R: Yeah
Q: What did they look like?
R: They're little tiny things
Q: If you saw little tiny flies, then they're probably fruit flies.
R: I've seen little flies in the house around my mom's plants.
Q: What color were they?
R: White.
Q: Those probably weren't fruit flies, but another small fly. Have you ever seen small flies around fruit in the house?
R: Yeah.
Q: Those were probably fruit flies. What kind of fruit did they fly around?
R: (Lots of different answers)
Q: There's an old saying, "Time flies like an arrow." Some pundit added a phrase, "Time flies like an arrow; fruit flies like a banana." Get. it?
R: (Long, pregnant pause ... followed by a smattering of groans and chuckling)
Q: What does this saying tell you about fruit flies?
R: That they like bananas.
Q: Then, why don't we call them banana flies?
R: Because they might like other kinds of fruit too.
Q: What kind of fruit did you see them hovering over in the grocery store or at home?
R: (Various answers, mostly guesses based on poor memory. Some students may say that they saw them hovering over apples at home)
Q: When they were hovering over apples at home, were other fruits present over which they also could have hovered?
R: No.
Q: So how do you know what kind of fruit they liked best?
R: We don't.
Q: Hmm. Do I see a good question we can ask about fruit flies?
R: Yeah! What kind of fruit do they really like!
Q: OK. That's a good question. But what do we mean by "like"?
R: What they eat.
Q: You mean, given a choice, what they eat?
R: Yeah.
Q: So you don't really mean what they "like" but what they are attracted to?
R: Don't know.
Q: O.K. So now we have a better question. "What kinds of fruit are fruit flies attracted to?" You see in front of you (alternatively, at the lab desks, or at the science station) some equipment. What do you think you could do with this simple equipment to test what kinds of fruit the flies are most attracted to? (Depending on the age group, you could have the bottles already set up, or just have the equipment for them to use. For this example, let's take the harder tract, and just have equipment available).
R: We could put some fruit in the bottom of a 2-L bottle, add some fruit flies, and see if they eat it.
Q: Do you mean put one kind of fruit or several kinds of fruit in the bottom?
R: Several kinds.
Q: How would you know which fruit they "like" better?
R: Which one they sit on.
Q: Good. That would be one way to do it. But since the fruit would be so close together, how could be sure it wasn't just chance that they were sitting on one kind of fruit, or that one fruit's juice hasn't slopped over into another's?
R: We couldn't.
Q: So what should we do with the fruits?
R: Separate them somehow.
Q: What if we put one kind of fruit in one bottle and another kind in another bottle?
R: That would work.
Q: What would we have to do then to see which one the fruit flies are attracted to?
R: Put the bottles together.
Q: How could we do this?
R: Tape the mouths together.
Q: Aren't we forgetting something?
R: The fruit flies!

Q: Right. I'll show you how to add fruit flies to the bottles by using a funnel. I'll put the fruit flies in to the bottles through the stoppered hole in the side. The reason we don't just dump them in through the top is because they tend to land on the juices of the fruit that you are going to put in there and drown.

R: Cool!

Q: So ... how many kinds of fruit would you like to test?

R: Well, there's five sitting on our desk, so we guess five.

Q: If you want to see which kind of fruit the flies are most attracted to, how many set-ups will you have to have? In your groups, figure out all the combinations you will have to have to determine the answer to the question.

R: (Students work together. The answer is 10).

Q: O.K. You put the fruit into the containers When you are ready, I'll come around and put the fruit flies into the bottles for you. [Alternatively, for older students, have them put the fruit flies in themselves after showing them the technique*].

*For this activity, I have found it easier and less messy to simply put the fruit-fly vials in a refrigerator and let the fruit flies slow down, rather than try to anesthetize them. However, high-school teachers may wish to give their students the opportunity to work on anesthetization techniques. Once the fruit flies have stopped flying around, I remove the rubber stopper from the 2-liter bottle, insert a large funnel, and tap in some quantity of fruit flies. The number in unimportant. Students are only looking for relative numbers of fruit flies that select each kind of fruit.

From this point on, students will need to create their own data charts to record the fruit on which the majority of flies are resting each time they are observed (see sample below). Because the fruit will mold fairly rapidly (three to five days) it is advised that the flies be observed several time each day for as long as possible. This. is a simple and quick task, so students can divide up the labor quite easily (e.g., for high-school students: before school, during class, during lunch, and after school).

After a few days of observation, it should become quite evident to students to which kind of fruit the flies are most attracted. Middle- and high-school level students can then explore the evolutionary significance of these results by asking significant questions, Examples:

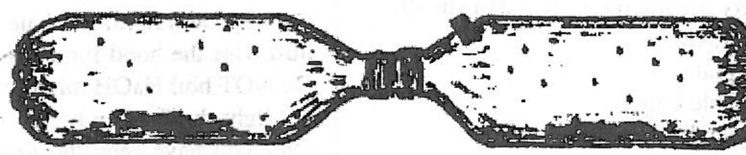
1. If fruit flies really select _[bananas]_, does that tell us anything about their place of origin? Where DO scientists think fruit flies originally came from?
2. What is it that the fruit flies are actually attracted to? Does one fruit provide more calories than another? Are vitamins or minerals essential to a fruit fly's life? Or, is it entirely a matter of which fruit is "juicier" (provides more water)?
3. Do fruit flies play any role in pollination of these particular kinds of plants?

Construction of the "Fruit Selection Chambers"

Each fruit selection chamber consists of two 2L plastic pop bottles, laid together on their sides and connected by a piece of duct tape (see drawing). To test the selective attributes of fruit flies for five fruits, a total of ten chambers will be needed which requires twenty 2L pop bottles, taped together at their necks.

1. Depending on the students' age and maturity,. the teacher may do the following procedures for the students or have the students do them for themselves.
2. Do the following either out-of-doors or under a fume hood. Use a Bunsen burner, gas stove, camp stove, candle, or other heat source to heat a needle (e.g., a dissecting needle or wide sewing needle). Then, poke several holes through each of the bottles so that air can get in to them.
3. Select a large funnel to deliver fruit flies in to the bottles. Find a heat-resistant instrument - like a test tube - that is the approximate diameter of part of the stem of the funnel.
4. Do the following either out-of-doors or under a fume hood. Heat the selected instrument and press it into the pop bottle near the neck of one of the bottles of each set. Later you will close the holes by inserting rubber stoppers or taping them.
5. Place the fruit fly vials in a refrigerator.
6. Select the fruits you wish to use. Put a chunk of fruit in to each pop bottle according to the chart below or a similar chart of your own design.
7. Using duct tape, tape the two bottles together at their necks.
8. Place the funnel's stem in the hole createdby the hot test tube or similar device.
9. Retrieve the fruit flies from the refrigerator. The flies should be cold enough that they are no longer flying around. Depending on how many vials you have, mentally divvy up the flies into ten batches. Quickly unstop the vial and tap a suitable number of flies into the funnel. Restop the vial, and blow into the top of the funnel to cause any clinging fruit flies to go into the bottles. Remove the funnel and stopper or tape the bottles closed.
10. Set the bottles in a safe place and record which fruit the majority of fruit flies are visitıng at any one observation.

Please note. Fruit flies are positively phototropic. They will move towards light. You could ask students to determine if this statement is accurate or not. But be sure the bottles are situated such that both sides receive an equal amount of light, or there may be another factor affecting the results!



Sample Chart for Recording Data

Bottles	Observations	1st	2nd	3rd
#1	Apple & orange	0	0	0
#2	Apple & pineapple	P	P	P
#3	Apple & banana	B	B	B
#4	Apple & pear	Pr	Pr	Pr
#5	Orange & pineapple	P	P	P
#6	Orange & banana	B	B	B
#7	Orange & pear	0	0	0
#8	Pineapple & banana	P	P	P
#9	Pineapple & pear	P	P	P
#10	Banana and pear	B	B	B

Rosa Hemphill
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THE ALCHEMIST'S DREAM - SORT 0F

Alchemy, in the Middle Ages, mixed experimental science with magic and secrecy. Alchemists, through careful observation and precise formulations, did discover elements, such as phosphorus (P) and hydrogen (H) and concocted chemical creations, some of which still cannot be reproduced today. Metals known to alchemists included lead (plumbum, Pb), copper (cuprum, Cu), silver (argentum, Ag), iron (ferrum, Fe), tin (stannum, Sn), mercury (hydrargyrum, Hg), and gold (aurum, Au), which were named in the vernacular of the time, Latin!

Alchemists used their own secret symbols to represent the elements with which they worked. For example, the Sun was assigned the element gold and had the symbol u. The Moon was assigned the metal silver, which had the symbol Ä, while Venus was symbolized by copper &. Today's element symbols may seem like a secret symbology to the beginning student, but are a bit more understandable if one remembers the Latin names for the elements. Alchemists also dealt with mixtures of metals called alloys. Bronze is a mixture of copper and tin while brass is a mixture of zinc and copper. An alchemist's dream, was to turn a base metal, such as lead, into the noble metal, gold.

Today, you will don your alchemist's goggles and apron to transmute the lowly copper coin of our realm the penny—into a noble metal. Your first purpose is to transmute your penny into shiny "silver," and then, with a wave of the magic tongs, to "gold."

The secret **materials** are listed below...

6 M sodium hydroxide (NaOH), 20 mL
Zinc (Zn) dust, 0.2 g
Water (H_2O), ~ 100 mL
Penny (preferably with your birth-date)
Beaker, 200 mL
dish
Glass stirring rod or wooden stir stick
Metric ruler
Hot plate
Crucible tongs
Bunsen burner
Balance

SAFETY CAUTIONS!!! Wear goggles at all times during the lab. NaOH is corrosive and can burn skin. Be careful not to inhale zinc dust. Use the hood for steps 1-4. Do NOT boil NaOH mixture. Do not light the Bunsen burner until after you have seen the demonstration on its proper use.

Procedure

Prepare a Data Table in your Prelab. Write observations and measurements into your notebook!

* * *Put on goggles and apron!***

1. Clean the penny and weigh it to two decimal places (write observations and mass into your notebook). Measure the diameter and the height of the penny in cm (remember to estimate the last digit).
2. Fill the 200-mL beaker with water and turn on the hood.
3. Add 20 mL of the 6 M NaOH to an evaporating dish.
4. Weigh -0.2 g Zn dust (note observations and mass in notebook); add to the evaporating dish. Stir with a glass stirring rod or with a wooden stir stick.
5. Place the evaporating dish on a hot plate in a hood and heat for at least 5 minutes (Do Not Boil!)
6. Using tongs, place the clean penny into the hot mixture in the hood and heat for 2-3 more minutes. Note any changes into your notebook.
7. Using tongs, remove the penny from the evaporating dish and drop into beaker of water until it is cool. Use a paper towel to remove excess Zn and dry the coin. Examine the coin and describe its appearance in your notebook. Weigh the coin to 2 decimal places and record its mass.

8. Light the Bunsen burner and use the base vent to produce a gentle, blue flame.

9. Using tongs, hold the coin in the outer part of the flame and heat the coin, moving it gently in and out of the flame until you observe a color change. Continue heating gently for - 2 more minutes. Do not heat in the central part of the flame or overheat the coin or it may melt. Put the coin into the beaker of water until it is cool. Assume the tongs are hot so neither you nor your partner accidentally get burned. Examine the coin and describe its appearance in your notebook. Dry and weigh it to 2 decimal places; record its mass in your notebook.

10. Decant the NaOH-Zn mixture into the waste container provided. Wash your dishes; clean your work area, and wash your hands. Lock your drawer.

11. Prepare a Results Table for the results of your calculations.

Analysis

To determine if you have indeed created silver or gold from your penny, you will examine the properties of your magic coin before, during and after its transformation-and will arrange your analysis in an appropriate Results table for easy reading. You will likely begin by checking your text or a handbook of chemistry for the physical properties of copper, silver, and gold. What do these metals look like?

Research the density of each metal. Calculate the density of your coin at each step of its transmutation (assume the volume of the coin is the same throughout the transmutation; density is sometimes expressed as g/ mL where I cm3 = I mL). Record the published and the observed or calculated properties in your Result Table.

Comparing the physical properties you observed and calculated, can you infer that you have indeed transmuted the penny to silver and to gold? Why? Was the penny you used solid copper? What IS the coin material before, during, and after the "transmutation?"

Questions

1. If your coin were solid copper, silver, or gold, at today's market value, what would it have been worth at each stage of the transmutation. Look up the current market value of the metals in a newspaper or on the web; report your source, the date and the market value in your answer. Show your calculations. [453.6 g = 1.000 lb; 1.000 troy ounce = 3 1. 10 g]

2. Post- 1982 pennies are 97.6% zinc, coated with a copper layer. At today's current zinc and copper prices, how much is a penny worth in dollars. Show your calculations.

3. Today, it is possible to convert copper or lead to another element, even gold. Explain how this could be accomplished? Would the resulting gold be worth the cost?

Data Table:

		Observations
Year on penny		
Mass of zinc, g		
Mass of penny, g		
Mass of penny after NaOH-Zn, g		
Mass of penny after heating in flame, g		
Height of penny, cm		
Diameter of penny, cm		
Sample Calculations:		

Results Table:

	Penny before Treatment	Penny after Zn/NaOH	Penny after heating
Calculated Density, g/cm3			
Published Physical Properties	**Cu**	**Ag**	**Au**
Density, g/cm3			
Color			
Luster			
Source(s):			

Teacher hints:

This lab is a fun way to introduce or review measurements, density, conversions, and physical properties. It should also have students looking for resource information in their texts, handbooks, in the newspaper, and on the web. It was written as an introductory experiment early in the chemistry year and assumes students know how to calculate the volume of a cylinder (V = r2h) and density (D = g/cm3). Allow 20-30 minutes for the lab, depending on the hood space available.

The Zn/NaOH step of this lab should be done in a hood; students should not be breathing the fumes. If you do not have zinc dust, you should be able to get decent results with larger-particle zinc; the results may not be as consistent. Do not let the Zn/NaOH mixture come in contact with paper; it can self-ignite. Neutralize the solution before disposing of it.

Students forget that the tongs will get hot, as well as the pennies. When the pennies are cooled in the water, students should cool the tongs as well and should let other students know that the tongs may be hot.

Several "short cuts" will save time during shorter lab periods:

- Turn on the hot plates in the hood before the period.
- Have students add NaOH solution to the evaporating dishes at the very beginning of the class.
- The amount of zinc dust is not crucial. You can weigh out small vials of zinc dust with approximately 0.2 g zinc dust for students to weigh (if you are teaching balance use) or you can label the vials "0.2 g" if time is really rushed.
- Several pennies can be placed in one evaporating dish. You get better results if the pennies are not stacked on each other.
- Students can measure the penny dimensions at home.

Pre-1982 pennies usually weigh approximately 3.0 g; post-1982 pennies weigh approximately 2.5 g. If high school students are doing birth year pennies, the pennies will likely be post- 1982. Some students may bring pennies for an older sibling or for a parent anniversary, which will be heavier. One of my students found a penny with the year of his parents anniversary, 25 years ago, and produced the "silver" penny as a unique gift for them.

The chemistry involves the formation in the Zn/NaOH mixture of sodium zincate, [Zn(OH)3(H20)1Na+, which reacts to plate. zinc on the copper surface of the penny. The flame then alloys the zinc and copper to give a brass gold color (Source: Summerlin, L. R. and J. L. Ealy, Jr. 1988. *Chemical Demonstrations: A Sourcebook for Teachers. Volume 1.* Washington, D. C.: American Chemical Society.)

You may choose to have students do two pennies simultaneously and have them average their density values. The metal densities, in g/cm3, are

Copper 8.93
Silver10.50
Gold19.28
Zinc7.14
(Source: Jones, L. and P. Atkins. 2000. *Chemistry: Molecules, Matter, and Change.* NY. W H. Freeman, pp. A18-A29).

The first two lab questions are included for real-world connection and for conversion practice. Students can find current market prices in most business sections of newspapers. Typical recent prices were:

Gold	$263.40 (New York Handy and Harmon) per troy ounce
Silver	$5.315 (Handy & Harmon (only daily quote)) per troy ounce
Copper	$0.81.25 /lb, New York merc. Spot
Zinc	$0.59.55-60.05 /lb delivered

Students may also find prices online, for example, at http://wwwmeta1prices.com

Answers will vary with the quotes the students find. A typical student calculation for the value of a 2.5 g penny made of solid copper would be $0.0045; made of solid silver, $0.41; made of solid gold, $20.53. The value of a post-1982 penny at September 1999 prices for zinc and copper would be close to $0.003.

Responses anticipated for question 3 would include nuclear processes. Students may come up with more creative ideas!

SPECIAL INTERESTS

Some Tips on Science Software

There are a variety of scientific software programs available. Most of these applications are commercial software requiring purchase. Many vendors offer trial downloads to allow you to evaluate the product. A few shareware or freeware programs are offered at little or no costs. Searches for "software for science," "scientific software," and "SciTech" will provide an endless source of links to explore.

http://jchemed.chem.wisc.edu/
http://www.graphpad.com/www/welcome.html
http://www.spss.com/software/science/
http://www.splus.mathsoft.com/splus/splsprod/default.htm
http://www.softshell.com/

The major focus of software for science lies in the following areas: data collection, performing statistical or data analysis, creating graphs, and publication for either print or world wide web presentation. After identifying your needs beyond a simple spreadsheet, shop around to find what fits your circumstance. While any number of software applications may streamline completion of your project, take heart, good old spreadsheet and word processing programs can yield excellent results even for Internet publications.

The College of Sciences, along with the departments of Biological Sciences, Chemistry, Geology/Geography and Physics at Eastern Illinois University invites you to join them in a program specifically designed to offer teachers the opportunity to advance their professional and personal competencies and scholarship in the natural sciences. The unifying principle of the Master of Science in Natural Sciences is to offer teachers significant advanced study opportunity in their specialized field. Students will elect an area of concentration in one of the following areas: Biological Sciences, Chemistry, Earth Sciences, General Science, Physics or Physical Sciences. All courses are offered during the summer terms. Options of Thesis (30 semester hours) and non-thesis (32 semester hours) are offered. Graduate assistantships are available for qualified students.

College of Sciences

For more information mail to:
Coordinator, M.S. in Natural Sciences
Department of Biological Sciences
Eastern Illinois University
600 Lincoln Avenue
Charleston, IL 61920-3099
E-mail: cfjam@eiu.edu
http://oldsci.eiu.edu/Physics/msns/index.html

Food Insight
Current Topics in Food Safety and Nutrition
http://ificinfo.health.org

TEA TIME

Tea time may have a new meaning. New studies provide further evidence that tea may have a protective role in the fight against several types of cancer and may possess many disease-fighting qualities. At the Second International Scientific Symposium on Tea and Human Health, held on September 15, 1998 at the U.S. Department of Agriculture, leading international researchers presented the latest data on the role of tea in disease prevention. The symposium was sponsored by the American Health Foundation, the American Cancer Society, the Nutrition Committee of the American Heart Association, and the Tea Council of the U.S.A.

Tea, the second most consumed beverage in the world, has an abundance of flavonoids. Researchers believe flavonoids are responsible for tea's health benefits. Some of these benefits include its protective role in reducing risk for some cancers (oral, digestive, lung and colorectal), heart disease and stroke. The flavonoids act as antioxidants, neutralizing free radicals that can harm cells and potentially contributed to these diseases.

At the September symposium, Ron Prior, Ph.D., USDA Human Nutrition Research Center on Aging at Tufts University, presented research on the antioxidant capacity of tea. His research showed that the antioxidant activity in dry tea exceeds that of more than 22 fruits and vegetables. When a black tea bag was placed in a cup of boiling water, Prior's team discovered that the antioxidants moved rapidly into the water indicating that drinking just one cup of tea could make a significant contribution to one's total daily antioxidant intake. It is important to note that brewing methods, such as steeping longer, may impact the final antioxidant level in the tea.

OPPORTUNITIES

AMERICAN ASSOCIATION OF PHYSICS TEACHERS BARBARA LOTZE SCHOLARSHIP $2,000

This scholarship is intended for students pursuing a career as a high school physics teacher. The applicant must be enrolled as either a high school senior or in an accredited two, four-year, or university. The scholarship may be awarded to the same individual more than once, but no more than 4 years.

DEADLINE: December 1, 2000. Award will be made at the 2001 AAPTAAS Joint Winter Meeting in San Diego.

For further information and application, visit the AAPT web page http://www.aapt.org/aaptgeneral/lotze.html or contact the AAPT Programs Department at aapt-prog@aapt.org or by phone at 301-209-3344.

HIGH SCHOOL GRANTS FOR INNOVATIVE TEACHING

We are looking for high school teachers with innovative ideas to apply for a grant. AAPT has set aside $1,000 for these grants. A committee of physics educators will award the grants, which can range from $100 to $500.

DEADLINE: November 1, 2000 Awards will be announced at the 2001 AAPT/AAS Joint Winter Meeting in San Diego.

For further information and application, visit the AAPT web page http://www.aapt.org/events/00hsg.html or contact the AAPT Programs Department at aapt-prog@aapt.org or by phone at 301-209-3344.

These AAPT Updates are archived on the AAPT web site at http://www.aapt.org/updates

American Association of Physics Teachers
One Physics Ellipse
College Park, MD 20740-3845
Voice: 301-209-3300
Fax: 301-209-0845
E-mail: aapt-exec@aapt.org
http://www.aapt.org/
http://www.psrc-online.org/

THE JASON PROJECT, a multimedia science education program, goes to the deepest depths of the ocean, to the top of erupting volcanoes, and to the heart of the tropical rainforest.

For more than 11 years, the JASON Project has put adventure and the thrill of discovery back into the classroom.

The Field Museum is a site for the 2000-2001 JASON Project — JASON XII: Hawai'i, A Living Laboratory. The JASON Project was founded by Dr. Robert Ballard, the discoverer of the Titanic. The 2000 - 2001 JASON Project, "Hawai'i, A Living Laboratory" looks at the islands' awe-inspiring volcanoes, its unique terrestrial and aquatic ecosystems, and its rich cultural history. Students become part of Dr. Ballard's JASON XII research team and will explore these isolated islands, shaped by 30 million years of volcanism and offering one of the best representations of Earth's geologic and biologic forces.

Designed for students and teachers in grades 5 to 8, the Project encourages interdisciplinary, hands-on, and inquiry-based teaching. The experience integrates: - A National Science Teachers Association-endorsed print curriculum - Video programs - On-line activities and chat rooms - Teacher Professional Development Workshops that include:

Part I: Aloha! Hawai'i –
JASON XII Educators Workshop Saturday, October 14 at The Field Museum (9 a.m. - 4 p.m.)

Part II: Diving In — Hands on Computer Lab Saturday, October 28 at the Medill Professional Training Center (9 a.m. - 12 noon OR 1 p.m. - 4 p.m.) - Field Museum Educator Materials and Post-Workshop Support -
JASON XII Live Expedition: Students and their teachers visit The Field Museum between Monday, January 29, 2001 to Friday, February 9, 2001, to experience an exciting event of exploration and discovery. The expedition will feature: live broadcasts from Hawai'i, connections with Field Museum scientists, a student science exhibit and cultural fair. Students will then tour the Museum's Traveling the Pacific and Pacific Spirits exhibition, one of the world's largest and richest collections of Pacific Island artifacts.

The cost to participate is $250 per teacher. This cost includes two professional development workshops, post-workshop support, the curriculum, video supplements, access to online activities and resources, and admission for up to 30 students to the JASON XII Live Expedition Broadcasts at The Field Museum.The cost for additional students to participate is $8.33 per student. The Chicago Public Schools Board of Education has decided to fund the program for their teachers, so for CPS teachers, there is no cost to participate.

Visit www.jasonproject.org or call 312/665-7307 for more information. To receive registration form, call 312/665-7307 or e-mail rjose@fmnh.org.

Raissa A. Jose
Project Coordinator, Educational Media
The Field Museum Dept. Education and Outreach
Roosevelt Road at Lake Shore Drive
Chicago, IL 60605
Telephone/Fax: 312/665-7307
E-mail: rjose@fmnh.org

AWARDS AND RECOGNITION

NABT
(National Association of Biology Teachers)
OBTA
(Outstanding Biology Teacher Award)
1999/2000

Mr. Terrence R. Mondy
Wheeling High School
900 S. Elmhurst Road
Wheeling, IL 60090

In addition to being recognized as the 1999/2000 OBTA from Illinois, Mr. Mondy's credentials include the following:

British Broadcasting Company – Reviewer, Author
Halinan & Associates – Consultant
Bureau of Education & Research – National Speaker, Author
NSTA's Manuscript Review Committee for *The Science Teacher*, 19921995
Role of Technology in Education Convention, 1996 - Presenter
Eisenhower Grant Awardee (3)
Trinity International University - Adjunct Professor of Education
NSTA, Presenter
ISTA, Presenter
Wheeling Scientific Society - Sponsor
Science Olympiad Team Coach
WYSE (formerly JETS) - Sponsor
Guest Lecturer Triple C High School, Cayman Islands
Cooperating Teacher for 20+ Student Teachers
ISTA - Top 10 Science Teachers in Illinois, 1993
School District 214 Publications
Discovered Dinosaur as a member of Glenrose Texas Dinosaur Research Team, 1985
Member of Polar Bear Study Research Group, Churchill, Manatoba, Canada 1998
Edmond James Scholar
Burgess - Norton Merit Scholar
B.S. - University of Illinois
M.S. - Purdue University

If you would like applications for the 2000/2001 OBTA Award from Illinois, after January 1, 20001 contact:

Mr. Kenneth Johnson
Hoffman Estates High School
1100 W. Higgins Road
Hoffman Estates, IL 60195

The deadline for receiving applications is **March 1, 2001.**

Eric Crossley
National Science Teachers Association
1840 Wilson Boulevard
Arlington, VA 22201-3000
Phone: 703-312-9258
FAX: 703-522-6193

TRIAD HIGH SCHOOL STUDENTS ARE NATIONAL FINALISTS IN DURACELL COMPETITION

Duracell Inc. and the National Science Teachers Association (NSTA) today announced that Jared Eaton of Troy and Dustin Alldredge of Edwardsville are national finalists and the winners of $500 savings bonds in the 18th Annual Duracell/NSTA Invention Challenge. Both Triad High School juniors, Eaton invented the battery-powered **Hands-Off Dispense**, and Alldredge invented the **Smoke Strobe Hat**.

Theirs are two of 100 inventions selected from 1,436 entries during preliminary judging. They will now compete for first through fourth place prizes to be awarded during final judging at Duracell's Bethel, Conn., headquarters. The forty top winners will be announced in early March.

A record-breaking 1,953 students entered the 2000 Duracell competing for $160,000 in savings bonds. Entries are judged in two categories, grades 6-9 and 10-12. In both categories, the Duracell/NSTA Invention Challenge will award two first place $20,000 savings bonds, four second place $10,000 bonds, 10 third place $3,000 bonds, and 24 fourth place $1,000 bonds. Students enter individually or in pairs and students on winning teams will divide their awards equally.

The first and second place winners, their parents and sponsoring teachers, will be guests of Duracell at an awards banquet on April 5 in Orlando during the 48th Annual Convention of the National Science Teachers Association. The six teachers sponsoring first and second place winners will Receive $2,000 gift certificates for computers and related equipment and every teacher sponsoring one of the 100 finalist inventions will receive a gift.

Sponsored by Duracell Inc. and administered by the NSTA, The Duracell/NSTA Invention Challenge is the nation's oldest and largest middle school and high school student invention competition. It challenges students to think creatively and expand their technological skills by completing a working device, powered by one or more DURACELL® batteries, which educates, entertains, makes life easier, or performs a practical function. Entries are judged on creativity, practicality, energy efficiency, and clarity of their written descriptions.

Duracell Inc. is a wholly-owned subsidiary of The Gillette Company and is headquartered in Bethel, Connecticut. Duracell is the world's leading manufacturer and marketer of high-performance alkaline batteries.

Founded in 1944, the National Science Teachers Association 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.

Congratulations Cathy!

ISTA Member **Cathy Wentworth** has been named an Illinois' 2000 Christa McAuliffe Fellow for an innovative project to help students see the heavens.

Cathy, who teaches fifth grade at Heyworth Elementary School in Heyworth will receive $15,000 from a U.S. Dept. of Education grant to support her Fellowship project. She will use her fellowship funds to create a large, "backyard" astronomy project for her students and the Heyworth community.

The program is administered nationally by the Council of Chief State School Officers and locally by the Illinois State Board of Education. The Christa McAuliffe Fellowship is awarded annually to innovative educators with at least eight years' teaching experience. McAuliffe Fellows must create and complete projects that will improve education. The projects must also support state education priorities.

The fellowship was created in 1987 in honor of Christa McAuliffe, the New Hampshire teacher who served as an astronaut on the ill-fated space shuttle Challenger .

Believing that students often learn best through hands-on work, Wentworth, a teacher since 1982 plans to use a professional-model telescope, mobile star lab, on-line connections with astronomers and trips to assorted planetariums and astronomy museums to create a new curriculum for her district. That curriculum will then be made available to other districts statewide. Pictures of stars taken as part of this project will be posted on the school's website. The instructional unit will wrap up with a community star party complete with stargazing and an astronomical "fashion show" of student designs showing what they learned through the curriculum.

ISTA MEMBER MARIANNE BARKER HONORED AS BEST IN STATE

Carmel High School is pleased to announce that Mrs. Marianne Barker is this year's recipient of the *Davidson Award*, which is given annually to one Illinois High School Chemistry teacher who has exhibited excellence in teaching. This prestigious award, now in its thirty-fifth year, is sponsored by The Chemical Industry Council of Illinois (CICI), through the Illinois Chemical Education Foundation (ICEF), which is a non-profit association of the leading chemical and pharmaceutical companies. CICI activities include programs in the areas of education, environment, government, and public affairs. The council hopes to promote a better understanding of the chemical industry and its contributions to Illinois.

Mrs. Barker was selected based on the following categories: her overall expertise as an educator in Chemistry, her innovative approaches to teaching, her teaching methods, her rapport with students, and personal educational development. Also, recommendations from Mrs. Barker's professional colleagues, and outside sources were evaluated. Lastly, the CICI committee visited her classroom to see this science teacher "in action." Mike Moss, Deputy Director of CICS says of Mrs. Barker "We think Marianne Barker symbolizes what the award is all about. She's a well rounded teacher who knows how to apply her knowledge to the classroom."

Fr. Bob Carroll, Carmel Principal says of Mrs. Barker "I feel strongly that Marianne's greatest strength is in having a clear focus on what is necessary for education at its best: a love for the subject, an incredible commitment to prepare through extensive research, a tireless energy level for conducting exciting classes, and a deep respect for the individual student involved."

Mrs. Barker, who has a Bachelor of Science degree from Loyola University in Chicago and a Master of Arts in Teaching from National Lewis University, celebrates twenty-two years of teaching experience at Carmel this year. She has taught a variety of science classes, including Earth Science, and Principles of Chemistry. Her teaching assignments have included college-prep, honors level, and advanced placement classes. Mrs. Barker's students rave about her ability to leave them with a sense of success and an understanding of the importance of science.

Congratulations, Marianne!

EDUCATIONAL MATERIALS

FLINN ANNOUNCES FREE CHEMISTRY DEMONSTRATIONS

Flinn Scientific offers a series of fun and exciting demonstrations and experiments called *ChemFax!*

ChemFax demonstrations/experiments are guaranteed to excite your chemistry students, and teach valuable and sometimes difficult-to-learn chemistry concepts. Two *ChemFax!* are now available.

Fun with Fluorescent Dyes – Discover the chemistry of color! The color that a solution appears to the human eye can change depending on the nature of the light source used to illuminate it. Make four solutions that appear one color under visible light but "change" colors when exposed to an ultraviolet (black) light.

Zinc Pyrotechnics – An Exothermic Redox Eruption!
A spectacular "fireworks" display is initiated by adding just two drops of water to a mixture of dry chemicals.

ChemFax! are free to teachers only. To receive copies please contact:

Free *ChemFax!*
Flinn Scientific, Inc.
P.O. Box 219
Batavia, IL 60510
1-800-452-1261
E-mail: flinn@flinnsci.com

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Books, Pictorial Histories, Biographies, Chemical Industry, and More...

Age of the Molecule
Edited by Nina Hall
This work—written and illustrated for anyone who wants to understand the world at the molecular level—describes the huge variety of chemistry's technological applications: liquid crystals, batteries, catalysts, plastics and novel electronic materials.
Published by the Royal Society of Chemistry. CHF is the North American distributor.
1999. 272 p, illus, index. Paper, 10.25 x 10.25, ISBN 0-85404-945-2, $35.00

Everybody Wins! A Life in Free Enterprise
Gordon Cain
From CHF's Series in Innovation and Entrepreneurship

A case study in American business enterprise: How one man effected a turnaround in the commodity chemicals industry. The result was a win for management, workers, investors, and the general economy.
Available soon in paperback! 1997. xiv + 348 pp, illus, index, apps. Cloth, 6 x 9, ISBN 0-941901-14-9, $24.95

History of Chemistry Wallcharts

This attractive series of timeline posters summarizes key achievements in specific areas of chemistry. A wonderful addition to the walls of any classroom, laboratory, or office.

- The Origins of Organic Chemistry 1800-1900
- Chemical Atomic and Molecular Theory 1800-1900
- Modern Atomic and Molecular Theory 1900-1960
- Industrial Chemistry 1800-1900
- Industrial Chemistry 1900-1960
- Analytical Chemistry 1800-1900

Published by the Royal Society of Chemistry. CHF is the North American distributor. All posters are 33 x 23.25 folded to 8.25 x 11.5. Single-sided.
$12.00 each or $54.00 for set of six (25% off the full price!)

For more information:
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315 Chestnut Street
Philadelphia, PA 19106-2702
www.chemheritage.org
888-224-6006

PLT Branch
Spring 2000
American Forest Foundation
Project Learning Tree
1111 Nineteenth Street, NW, Suite 780
Washington, DC 20036

GREENWORKS! WORKS: A GUIDE FOR ENVIRONMENTAL ACTION

GreenWorks! Is partnering with the National and Urban Community Forestry Advisory Council's (NUCFAC) Challenge Cost-Share program to produce a GreenWorks! Community Action & Service Learning guide. NUCFAC awarded PLT a two-year grant to develop the guide to promote urban and community forestry through environmental service learning to young people. Educators and their students will use this guide to assist them with the implementation of community-based projects that will partner local organizations/businesses, schools, civic groups, and young people to bring about positive change within the communities in which they live, work, and attend school. The guide will contain valuable resources and technical support to ensure the optimum hands-on experience that can be directly related back to the classroom curriculum. GreenWorks! Allows young people to move through the full cycle of environmental education from awareness, to knowledge, to action. The guide is in its final production stage and will be released this summer.

WILDLIFE EDUCATIONAL RESOURCES

Waterfowl of Illinois: Status and Management and a Companion Field Guide by Stephen P. Havera are available on the web at www.theramp.net/inhswaterfowl/page7.html. The book is a comprehensive source on the status, management and biology of Illinois waterfowl. It captures the strong traditions of waterfowling in the heart of the Mississippi Flyway and will be a welcome addition to libraries of those with a special interest in waterfowl. The guide is a resource for waterfowl hot spots and is a must for hunters, bird watchers and wildlife enthusiasts. Havera is director of IDNR's Forbes Biological Station and the Frank C. Bellrose Waterfowl Research Center. The book is $59.95, while the companion guide is $14.95, or $69.95 for the pair including shipping. Volume discounts are available.

The 2000 National Wildlife Foundation posters have arrived. This year's theme is "Water for Life: Keep the Wild Alive™." The water-based habitat unit contains ten lessons centered around watersheds, streams, lakes, wetlands and oceans and some of the endangered species that inhabit them. The lessons are available in both English and Spanish, are aligned to national education standards and are available online at www.nwf.org. Call 217/524-4126 to obtain copies of the poster for your next workshop!

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 cómmunication 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:

- 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.

20TH CENTURY BIOSCIENCE:
Professor O. J. Eigsti
And the Seedless Watermelon
By John H. Woodburn, Ph.D.

"The life story of O.J. Eigsti and the seedless watermelon is interwoven with the evolution of genetics, horticulture, and education throughout the twentieth century."

The uniquely intriguing biography brings front and center the highs and lows of being a farmer, scientist, and teacher throughout much of the century. With his first entry level position at the Carnegie institution of Washington at Cold Spring Harbor, Dr. Eigsti grew up with what was to become the most advanced branch of the life sciences. At the same time, he practiced the teaching profession during periods of unprecedented stress. This memorable version of the American dream invites the reader to revisit a life style and ways of doing things that certainly provoke priceless guidelines for the future.

At first denied a teaching position by the Great Depression, Dr. Eigsti eventually held full professor rank at the University of Oklahoma, Northwestern, and Chicago State. Research projects sponsored by a hybrid corn seed company led to an intervening stint as a geneticist and ultimately to team up with other scientists and growers to make the seedless watermelon a commercial success. In addition, and with the help of Agnes Weaver Eigsti, he produced microscope slides, albino soybeans, Indian con and other teaching aids that continue to be used worldwide.

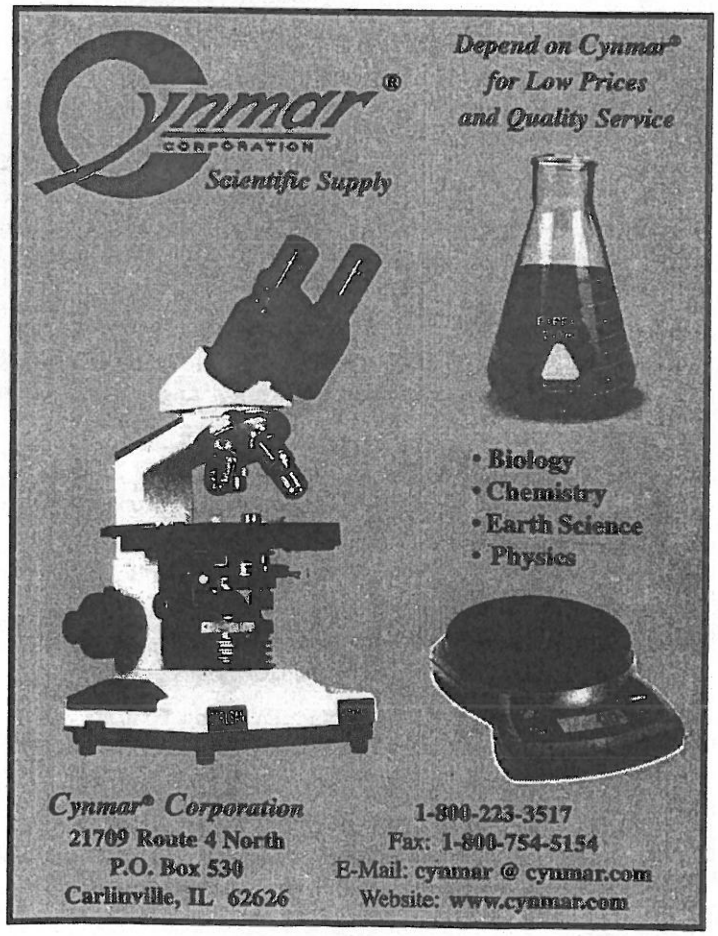
About the Author

John H. Woodburn survived the Great Depression and its effect on farm families. At mid-century, both he and Dr. Eigsti became closely involved in the discontent with how science was being taught, Dr. Eigsti at the Chicago Teachers College and Dr. Woodburn, first at the National Science Teachers Association and later at the Walter Johnson High School in Montgomery County, Maryland. This position enabled him to publish books that responded to the interests of young people and their science teachers. He received numerous regional and national awards before retiring in 1979.

ISBN# 1-57197-132-7. $21.95, 169 pages, 6 x 9"

To order this book :

Pentland Press, Inc.
5122 Bur Oak Circle
Raleigh, NC 27612
800-948-2786



CALENDAR YEAR 2001 MEMBERSHIP CATEGORIES

Any person interested in science education is eligible for membership. All memberships include a subscription fo the SPECTRUM and a subscription to the Newsletter, the ACTION. Write the number of the option for the membership category on the Membership Form on the back cover. Join now and your 2001 dues will be in force until January 2002. Membership year runs for the calendar year January 1 through December 31.

Option 1: Full Membership Dues- $35.00

Full Membership entitles individuals interested in Illinois science education to the following benefits: a one year subscription to the SPECTRUM, and ISTA ACTION. publications of the Illinois Science Teachers Association; 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

Associate Student Membership applies to full-time students who are not currently employed as professional educators (Requires the signature and institutional affiliation of the student's professor). Entitles member to Full Membership benefits, with the exception of voting privileges and the opportunity to hold an ISTA Officer position. Associate Retired Membership applies to individuals who are on retirement status. Entitles member to Full Membership benefits, with the exception of voting privileges and the opportunity to hold an ISTA Officer position

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.

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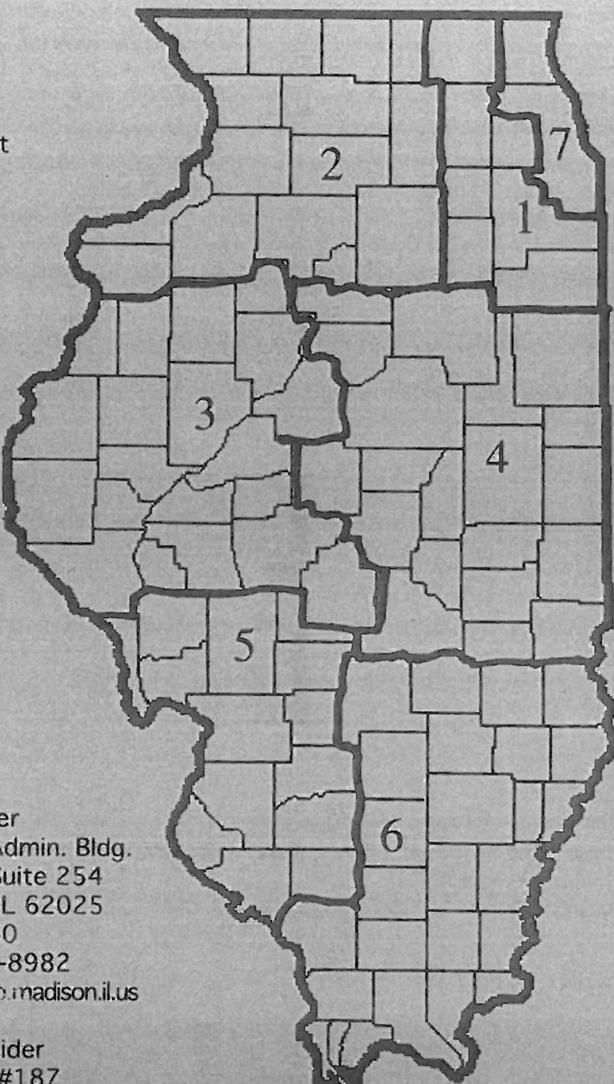

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ILLINOIS SCIENCE TEACHERS ASSOCIATION
MEMBERSHIP APPLICATION

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City, State, Zip Code	City, State, Zip Code
e-mail and/or FAX	

CHECK APPLICABLE CATEGORIES IN EACH COLUMN

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o Middle Level	o Life Science/Biology	o Administrator
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o College/University	o Earth Science/Geology	o Student
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