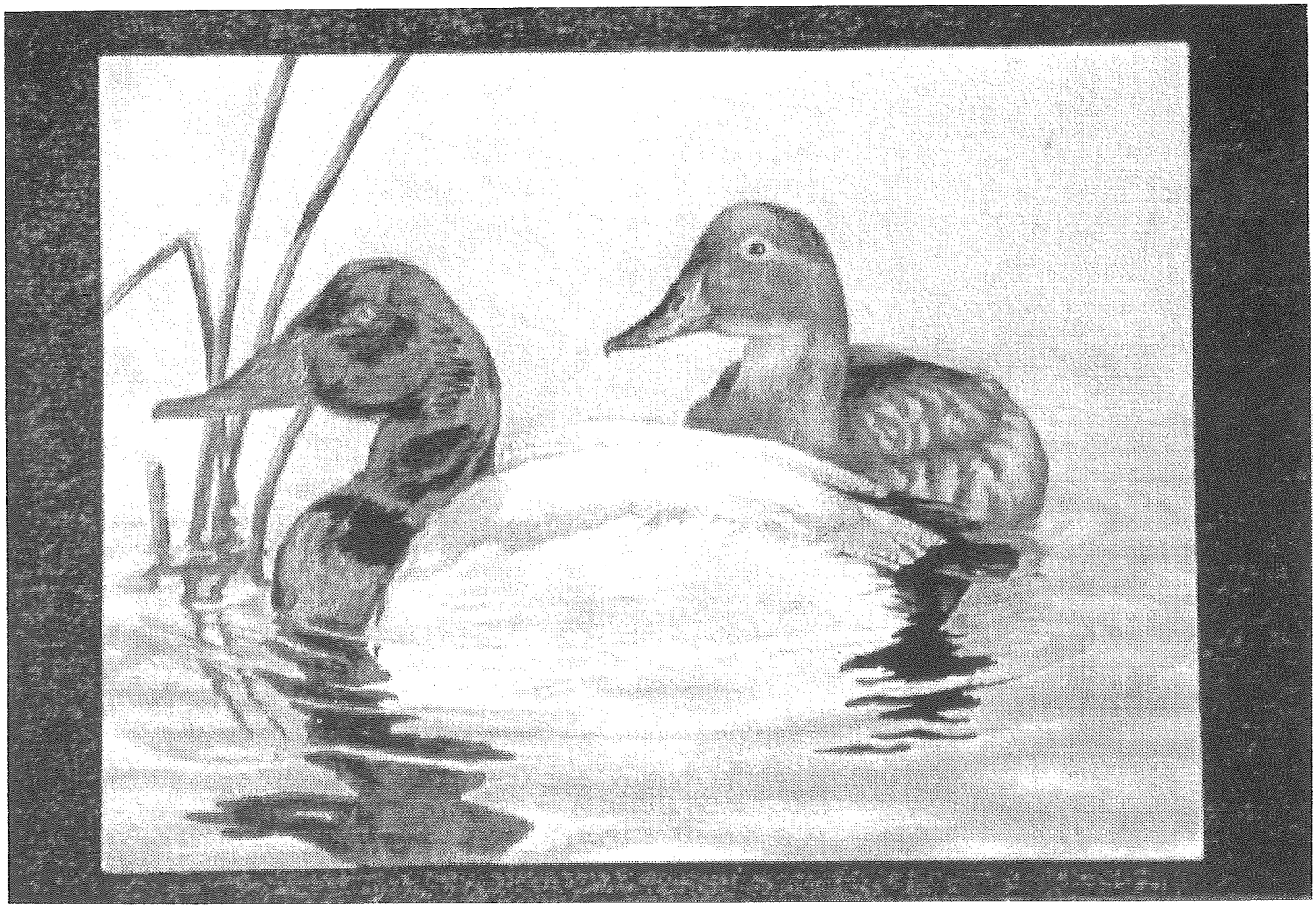
SPECTRUM

THE JOURNAL OF THE ILLINOIS SCIENCE TEACHERS ASSOCIATION



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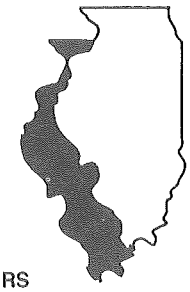

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ISTA NEWS

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LETTER FROM THE EDITOR

This is the time of year when things seem to accumulate and come crashing in from all around us. The end of the school year, although months away, begins to pressure us into pushing just a little bit harder to cover the material we hoped to get through for the year. A seemingly endless series of reports and evaluations seem to pop up, and meetings and conferences (both professional and school/parent) appear to increase in number and frequency. Indeed, the pressures and stress levels can certainly climb to new heights during the spring semester, causing us to just want to go home and close the door.

Being a "type A" personality, I am well aware of the intensity inherent with the spring semester. Each year, I try to make a conscious effort to say "No" to some things, to prioritize others, and to make my life a little smoother for the semester. I'm sometimes successful, sometimes not. Regardless, I've learned to look to the spring as a time for some renewal and extended planning. Take for example the professional conferences that open their doors each spring. NSTA's annual conference is in the spring (April 3-6 in New Orleans this year). I've only missed a couple over the past fifteen years, and usually find new and exciting ideas that I can try in my teaching. Some of our ISTA regions offer some meetings and conferences as well. January 24th saw the "Conference in the South" hosted by Region V and VI Directors at SIU-Carbondale. On April 18th, Region III has the Science Update Conference K-8 at WIU. Other regions may have meetings planned as well. I've found that teachers have a wonderful opportunity to share at these regional meetings, to gain new insights, to learn something new, and to refresh themselves. One such example is described in the article in this issue on the BioCom curriculum, which is something new and exciting that you may be interested in learning more about. What we take away from professional science education meetings can stir our thinking and cause us to redirect our teaching, to include new activities or topics, to view old standby lessons from new perspectives. In short, although its one more thing to cram into our heavy spring schedules, attending these conferences helps us renew ourselves and helps remind us that we have common goals for our students.

Along with finding new perspectives and ideas, we each should look back at what we've done and accomplished over the past several years. There are some good ideas that we've put on the back burner and essentially "forgotten." A case in point deals with assessment. Only two years ago "assessment" was quite the buzz word around Illinois. Most schools and districts were learning about and hammering together a wide variety of assessments. When the ISBE shifted its focus last year, work on science assessment at the school and district levels almost disappeared. Assessment is a very important component of education, and our efforts to improve it should not cease simply because the spotlight is not longer focused on it. Rich Walker gave a wonderful speech about assessment at the ISTA convention in Chicago this past October. We've obtained a copy and have included it in this issue for you. Its a good piece to think on.

What other good ideas and good activities have become dusty? Could reviving any of them improve your science teaching? What new ideas have you found that can invigorate your science teaching? What colleagues have you located who can support you, and whom you can support in turn, in science teaching endeavors? What will you want to do the same or differently next school year? Now is the time to begin planning, even if only in our minds.

Much has been thrust upon us over the past few years: assessment: national guidelines in the form of benchmarks from the AAAS, standards from the National Research Council, and NSTA's Scope, Sequence, and Coordination; proposed changes from ISBE in the way and time of assessing science in our schools; increasing access to internet and other technologies; an explosion of new science information; and more. Working together, we might just find some direction and a way to deal with this myriad of change. What will YOU do with all of it?

What can WE do with all of it? The answers are in our hands, if we choose to grab onto them. All of us are smarter than any one of us. Lets work together to improve science education for everyone!

PLEASE TURN TO THE CENTER OF THIS ISSUE OF THE SPECTRUM FOR AN IMPORTANT MEMBER QUESTIONAIRE!

Gwen Pollock
Illinois State Board of Education
Springfield, Illinois

DID YOU KNOW?

The **Presidential Awards for Excellence in Mathematics and Science Teaching** selection process is set for March. Many teachers called with questions about making their packets spectacular. I am expecting great things this year, as always. The day that the selection committee meets is one of the most fun days to know about science teaching in Illinois. Sometimes we are extra slow at reading, because we are taking notes on all the great ideas we read about!

Another unique opportunity has been presented to Illinois teachers in the realm of science safety. **CHEMIS**, Chemical Health and Environmental Management in Schools, from the U. S. Fire Administration, has been developed as a district policy-making process and software product for the acquisition, inventory, storage, and disposal of chemicals in the science, art, and industrial technology classrooms, as well as those used in custodial, maintenance, and transportation applications. The (DOS only) software product was developed to comply with the safest and most appropriate requirements for record-keeping and sharing. The Illinois State Fire Marshall's office has transferred copyrights to ISBE to duplicate the software, video and accompanying instructional materials for our schools. Training was offered in December for ROE/ISC Scientific Literacy contacts and their teams of teachers for follow-up opportunities at the local levels. More information and updates will follow.

Also to be released shortly will be the final additional sections to the **Guidelines for Science Safety in Illinois Schools** which was released in November, 1995. The additional sections include guidelines for **Life Science Classroom Safety**, as submitted by the IABT, **Outdoor Classroom Safety** which was written by the EEAI and **K-8 Science Safety** from ISTA. The first chapters, written under the direction of the local chapters and members of the American Chemical Society and IACT, focused on **Chemical Science Safety**, include the Illinois Department of Labor **mandated** requirements for local Chemical Hygiene Plans.

More opportunities for science teachers include upcoming **NASA** presentations at 15 sites around the state. ROE/ISC Scientific Literacy contacts have made local arrangements for potentially 900 elementary, middle and high school teachers to participate in Earth/Space Science workshops which will introduce four enterprises from NASA (including Mission to Planet Earth, Manned Space Flight, Aeronautics and Earth Science) to assist teachers in implementing the proposed Academic Standards. There is a 32-teacher limit for each day of the two-day workshop; the first day will focus on early and late elementary classroom applications, while the second day will focus of middle and high school applications. Openings may still be available for upcoming dates. It is hoped that these participants can become part of a teacher/leader cadre for each of the ROE/ISC in this specific learning area, with additional training/sharing opportunities. Contact your ROE/ISC Scientific Literacy staff person for further details.

The Academic Standards Project is entering is refinement stage. The Science team is under the direction of Doug Dirks and Ray Dagenais. The goal of our team, composed of several of our past Presidential Award winners and nominees, is to consider comments received through the review process and incorporate these refining changes. Our work is scheduled for submission in early April for State Board of Education consideration through May and June and then submission to the legislature by early August. We sincerely appreciate the thoughtful suggestions that so many of you submitted through this process.

Plans are continuing for some excellent sciencing opportunities for Illinois' teachers and students. Further information about the following opportunities is available through the Center on Educational Innovation and Reform's Secondary Support Division. Please contact me at 217/782-2826 or email: gpollock@spr6.isbe.state.il.us

Evaluation of Instructional Materials

At the fall pre-conference for the ISTA convention, I promised to offer some strategies for the evaluation of instructional materials. Since that time, this information has been the basis for a training for the ROE/ISC Scientific Literacy contacts. We had materials from the state of Virginia, the North American Association for Environmental Education and National Science Resources Center.

I would like to share with you a specific effort that was a part of the Virginia State Systemic Initiative, as funded by the National Science Foundation. V-QUEST was designed to incorporate seven necessary components for the systemic reform of science and math education in their state. One of these components involved the creation of an 11-state mini-consortium, composed of adoption and non-adoption states. We worked on the development of a position paper describing the research and needs of schools for effective instructional materials, making special efforts to remove references to text-only resources. For further information or to receive the entire set of criteria, contact me or your own ROE/ISC.

REGION 5 REPORT

As the new Region V representative, please allow me to express my gratitude to all of you who voted for me in the past election. As a faculty member in the Department of Chemistry and as a member of the Office of Science and Math Education (OSME) at Southern Illinois University at Edwardsville (SIUE), I look forward to serving the needs of the teachers in this area. My scholarly activities include the enhancement of science education for grades K-12 in the surrounding areas.

With this in mind, I have had the pleasure and honor of visiting local schools to perform science demonstrations (on a variety of topics) and/or give a talk entitled "Biotechnology" based on my experience in plant biotechnology at Monsanto. The schools I have visited recently include: Dupo High School, Belleville East High School, Ellisville Elementary in Ellisville, MO, Governor French Academy in Belleville and Alton High School. If you are interested in having me visit your school or would like SIUE to host a visit for a laboratory hands-on experience for your students, please call or write (information given below). We have also implemented a newsletter (entitled MEST, Metro-East Science Teachers) for area teachers to enhance the communication between science instructors in the area. I will be spending a good deal of time writing grants to enhance science education in the area based on what I perceive are the needs so if you have any ideas, PLEASE share them with me. I am open towards any way I can be of assistance towards the enhancement of science education at your school, so please share your dreams and wish lists with me. If you have any dates or special activities that you would like to share in the Spectrum from the Region V area, please send them to me and I will include it in this section of the next Spectrum. Thank you!

Pam Keck
SIUE, Chemistry Dept., Box 1652
Edwardsville, IL 62026;
e-mail: pjkeck@siue.edu, phone: 618-692-3558.

Regional Dates of Importance: April 11 and 12, Region 12 IJAS Science Fair, SIUE (contact Dawn Olive, 618-692-3065).

Regional Awards: SIUE Excellence in Teaching Awards, Science Division: Patricia Oser from Carlinville High School, Joanna Enoch from Collinsville High School and Jo Thatcher from Carrollton High School. Please join me in congratulating them!

PLAN NOW TO ATTEND THE 1997 ISTA CONFERENCE IN PEORIA!

The 1997 ISTA Conference will be held in the Peoria Convention Center and Pere Marquette Hotel on October 3rd and 4th. There will be a leadership conference on October 2nd dealing with professional development efforts. Space is limited for the leadership conference, so it is important for persons interested in attending to register early.The program should prove to be exciting and contain something for everyone! The program committee for the ISTA conference has tentatively scheduled the following activities:

- **Thursday evening:** Stargazing with the Peoria Astronomical Society
- Friday morning general session speaker: Susan Quinlan, author of Mysteries of Nature
- **Friday afternoon general session speaker:** Vince Miller, expert on tornados and consultant to the movie Twister
- **Friday workshops** planned include "High Arctic Ecology" by Susan Quinlan and Bud Lehnhausen
- **Friday tours** are being planned, and will be announced in the Summer Spectrum
- **Friday evening:** a tour of Lakeview Museum and a show at the Lakeview Planetarium, PLUS a night hike at Wildlife Prairie Park
- **Saturday morning speaker:** Don Palleck, NASA astronaut
- **Saturday workshops** include "The Rain Forest" by Susan Quinlan and Bud Lehnhausen

THANK YOU TO OUR VENDORS WHO PARTICIPATED IN THE "SCIENCE IN THE SOUTH" CONFERENCE AT SOUTHERN ILLINOIS UNIVERSITY CARBONDALE

Beckley Cardy Group
Carbondale Conservation Cats
Coal Research Center
Dale Seymour Publications and Cuisinaire Co.
Harcourt Brace School Publishers
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Illinois Clinical Laboratory Science Assoc.
Illinois Department of Commerce and Community Affairs
Illinois Middle School Groundwater Project-SIU-Edwardsville
Institute of Food Technologists
Macmillan/McGraw-Hill
National Association of Biology Teachers
Prentice Hall Publishing
Optical Data School Media
Scholastic, Inc.
Scott Foresman-Addison Wesley
Southern Illinois Ag. Awareness Committee
St. Louis Science Center
The Scope Shoppe, Inc.
Touch of Nature
Worldwide Youth in Science and Engineering

"SCIENCE IN THE SOUTH"

The first regional conference on science education was held at the SIUC Student Center on January 24, 1997. This program, sponsored by the Illinois Science Teachers Association and the Colleges of Agriculture, Education, Engineering and Science, hosted over 300 science educators from the southern Illinois area. Goals of this conference included:

1. Increase membership in Regions 5 and 6 of the Illinois Science Teachers Association.
2. Enhance the curriculum of K-12 teachers in science.
3. Increase teachers' skills to teach academic science concepts by hands-on, applied activities.
4. Increase teachers' knowledge of introducing careers to their curriculum, specifically majors offered by SIUC.
5. Allow SIUC to show off the campus to teachers who are great recruiters of students for the university.

Sessions ranged from recycling, agriscience, hydroponics, computer technology to conservation, genetics, weather, and using the internet. The program included a variety of 45 workshops and sessions for K-12 teachers. Between these presentations, participants enjoyed 24 vendor exhibits of the latest in science related educational supplies, materials, and technology.

The program was concluded with luncheon keynote address by two ISTA Presidential Award winners, John Baird and Mary Sue Kerr. Ms. Kerr was the National Elementary Award winner in 1996.

The first effort was an overwhelming success stated the committee composed of K-12 science teachers and SIUC staff. This success reinforced the belief that there is a real need for this type of program for teachers. The support of the county Regional Superintendent of Schools also contributed to the success of this program.

An evaluation sheet distributed at the conclusion of the conference showed an overwhelming majority of attendees rated the conference excellent in terms of format, handling of registration, room arrangement, variety of sessions, luncheon speakers, and location of conference. All but two attendees thought it would be worthwhile to offer it again.

Richard Walker, Ph.D.
Science Assessment Consultant
Illinois State Board of Education

PURPOSES OF ASSESSMENT

1996 ISTA Leadership Conference
Chicago

Three essential, interlocking dimensions of assessment are purpose, unit of analysis, and the rights of subjects. These remarks will address only the first two.

1. PURPOSES

Three main purposes of assessment are to 1) monitor, 2) evaluate, and/or 3) stimulate change. Each has its champions. The choice of purpose drives the type, time, research design, measurement quality, audience, frequency, and testing stakes for those being assessed. Since assessments are almost always commissioned, conducted, and controlled by superordinates to generate information about subordinates, these three purposes form a hierarchy of risk to the subjects. In education, for example, superordinates may be teacher over students, principal over teachers, local superintendent over principals, state agents over local superintendents, and federal or state legislatures over state agents.

Hierarchy of Risk

First, the simplest purpose of assessment is to monitor and record, much like a thermometer monitors the temperature in a room. There is no risk to those being assessed because there is no judgment or retribution by result.

The early history of IGAP illustrates this. Originally IGAP merely monitored school scores throughout the state, reported results to each school, and recorded them for trend analysis. The state attached no risk or reward to the results. The only risk to schools was the selfimposed shame of low performance relative to the state mean or one's neighbors, especially if aggravated by comparisons in the press.

A second purpose of assessment is to evaluate (judge). Superordinates set cutscores, classify performance, and raise the stakes by heightening the penalties of failure and/or the rewards of success. In this way superordinates attempt to hold subordinates accountable. Using cutscores, superordinates rank and label subordinates as successes or failures, excellent to poor, superior to inferior, etc. This is analogous to the thermostat settings of "too cold" or "too hot," requiring appropriate action. The thermometer and thermostat operate in tandem to provide continuous feedback to maintain room temperature within acceptable ranges.

IGAP, for example, described performance standards and set cutscores in 1992, and in 1993 began labeling each school as "fails to meet," "meets," or "exceeds." This changed the basis of school comparisons away from solely one's neighbors (norm-referenced testing) to fixed levels of performance (criterion-referenced testing).

A third purpose of assessment is to serve as a catalyst for educational change, independent of results. Some educators use assessment per se to "send a message" to foster change in their profession. They have concluded that what is taught and how it is taught should urgently and dramatically change. To foster change, state and federal government should regulate educational standards for curricular content, academic performance, and instructional and assessment practices. Interest is not focused on the assessment instrument as a reliable measure, but for its utility for advancing cultural change.

For example, the lack of high statistical reliability of portfolio assessment and of many forms of performance assessment is a secondary concern. Rather, most important is the power of portfolio assessment itself to stimulate teachers to change their teaching, assessment practices, and the philosophy of education behind them. Thus, the mode of assessment—not objective results—is *the* central message. This is to say, by analogy, replacing the old thermostat with a new brand is more important than the reliability of either its measurements or settings. Thus, the mode of assessment should be changed, not because new modes necessarily provide better information, but because they set the proper example and lead in the direction they want to go.

These educators emphasize the direct benefits to learning that flow from alternative modes of teaching and testing and their alignment at all levels. They also emphasize indirect benefits such as the positive, invigorating sociological impacts that labor-intensive assessments (writing scoring rubrics, training, grading exams, teacher-to-teacher dialogues, etc.) can have on teachers and local school administrators.

Other states have tried this approach using a variety of different assessment instruments and testing models. Evaluation of the results is beyond the scope of this address. Some educators in Illinois, including leaders at ISBE, want testing changed to serve as a catalyst for change. Others do not.

Three Ideal Types

Advocates of these three purposes are quite different philosophically and merit brief stereotypes:

Advocates of the first purpose—monitoring—tend to emphasize objective (i.e., scientific and statistical) criteria such as validity and reliability. They are objectivists. Politically, they tend to support local school autonomy, decentralized decision-making, diversity, and the importance of intrinsic professional and cultural norms as motivators. With respect to large-scale assessment, that government which assesses least governs best; the purpose of assessment is to describe, not prescribe. They do not consider local schools, in general, to be nearly as dysfunctional as government bureaucracy. Of the forces that drive the quality of life, assessment is a pale moon. It reflects, but does not generate, light.

Slogans: "The purpose of assessment is to not to fatten the calf, but weigh it." "The state should do what the state can do best—standardized multiple choice tests—and the schools should do what the schools can do best— performance testing in the context of classroom instruction." "Good teachers do not fear good tests, regardless the mode."

Banner words: "Validity," "reliability," "bias free," "division of labor," "local autonomy."

Suspicions: They suspect that a component of the often strident call for a paradigm shift in instruction and assessment— especially given the fact that performance assessments have often proven to be disappointingly unreliable, biased, nongeneralizable, and costly—is a desire to escape accountability based on objective measures and uniform standards.

Champions of the second purpose evaluation—tend to advocate hierarchical mechanisms of command-obey control, centralization, and topdown punishment and rewards as extrinsic motivators. They are statists. They believe that professional organizations are not sufficiently rigorous to uphold acceptable standards; moreover, American culture at-large (local school boards, parents, media, voters, unions, market forces, etc.) is even less redeeming. They hold that America is a nation at risk, in jeopardy of disintegrating, and that public education is key to halting a decline in standards and quality of life, both materially and culturally. Large-scale assessment, coupled with statewide curricula and standards, with the force of law, can reverse these trends. Because government bureaucracy is not nearly as dysfunctional as local schools, the state must dictate common goals and set standards for all. Of the forces that drive the quality of life, government-mandated assessment is an essential lever for lifting standards and the quality of life.

Slogans: "The purpose of assessment is school improvement." "The purpose of assessment is to raise the standard of performance."

Banner words: "Statewide curriculum," "state and national standards," "state leadership," "accountability," "watchlist," "partnership," "vertical alignment."

Suspicions: They suspect that teacher unions protect too many incompetent teachers, and that local teachers and administrators hide from accountability behind a banner of "local control."

Champions of the third purpose of assessment—cultural change—tend to advocate performance assessments and, at the same time, eschew traditional forms of objective tests as reactionary. Multiple-choice tests are invalid and largely counterproductive because they cannot assess performance. Philosophically, they are constructivists. They hold that knowledge is constructed, not discovered; therefore scientific and statistical criteria for assessment designs, measurement instruments, and data quality do not overly impress them. They favor "practical applications," "hands-on" experiences, and "meaningful examples from everyday life" over memorization of theory or fact and over verbal instruction. Politically, they are good opportunists. Modes of assessment are not neutral; but are powerful weapons and messages as to what and how one should teach and learn. Although they tend to view both government bureaucracy and local schools as equally dysfunctional, government control is the most practical, expedient means to cultural and educational revolution. Whoever controls the government controls assessment; whoever controls assessment, controls education; whoever controls education, controls the future i.e., what is taught and how it is taught.

Slogans: "What you test is what you get." "Assessment drives the curriculum." "Good assessment mirrors good instruction." "The teacher should be the guide on the side, not the sage on the stage."

Banner words: "Hands-on," "group learning," "process," "inquirybased," "constructivist classroom," "paradigm shift."

Suspicions: They suspect that anyone who disagrees with them is intellectually obsolete, an obstacle to progress, and resistant to enlightened change.

Few individuals—and fewer assessment programs—maintain a consistent philosophy of education or purpose of assessment. Programs and views usually represent a compromise or mixture of these ideal types, are often internally contradictory, and change course whenever political winds shift. Nevertheless, these philosophical differences are significant, clashes between their advocates are often fierce, and the consequences for the future of education are substantial IGAP is presently in deep crises, caught in the middle of philosophical warfare, and in danger of vanishing altogether.

2. UNIT OF ANALYSIS

Who is to be monitored? Who is to be judged? Who is to be changed?

The unit being analyzed—whether an atom or a galaxy, whether a worker or a corporation—is the unit of analysis. The choice of the unit of analysis determines which variables are included, excluded, and held causal or accountable. This is to say, it determines where and on what level of abstraction the hunt for facts and causes will be conducted. Causation and/or accountability may be environmental, social, legal, economic, political, moral, and so on.

It is important to recognize that the unit of analysis is not the dependent variable, not the independent variables, and not even the unit being measured. Rather, the unit of analysis is the level (or locus) of the *independent* variables believed to be responsible for significant change in the dependent variable. For example, in education the dependent variable is often academic achievement. The unit of measurement is often the individual student. However, the unit of analysis may be the student, family structure, teaching methodologies, school curricula, district policies, state funding formulae, or national priorities. Factors at any of these levels may be significant.

Of course, with respect to assessment, superordinates usually select a unit of analysis that affects the subordinates immediately under their command and for which they can be held responsible. For example, if the unit of analysis is the individual—i.e., reflecting the view that the student is responsible for his or her academic achievement—then his or her choice of friends, aptitudes, personal habits, attendance, learning style, and attitude may be among the independent variables measured. These are the factors his or her teacher, who is immediately responsible for his or her learning, is likely to notice, consider important, and report to parents. On the other hand, the student's mother's education; the teacher's personality, preparation, and style; the school's curriculum and budget; the principal's philosophy of education; the district's policies on discipline, class size, and technological change; and inequities in state or local funding are largely invisible *at that level* of analysis.

In this regard two major errors often lead to false conclusions. First, in the example above the *unit of analysis* and the *unit of measurement* are the same the student. Students' achievement was measured and variables related to a student were hypothesized to be the causes for it. But this coincidence, in which the unit of measurement and the unit of analysis are the same, is often not the case, especially in large-scale, top-down assessment. The distinction between the *unit of measurement* and the *unit of analysis* is therefore essential to clarity of purpose and analysis. For example, if achievement is the dependent variable and class size is the independent variable, then the *student* is the unit of measurement, but the *class* is the unit of analysis; again, if achievement is the dependent variable and school size is the independent variable, then the *student* is still the unit of measurement, but the *school* is the unit of analysis. This is to say, schools have population sizes, teacher/student ratios, divisions of labor, and so on, not individuals.

Unfortunately, some variables are applicable at multiple levels of analysis, such as individual and team achievements in academics and sports (e.g., IGAP scores, batting averages). Although the units of analysis are on different levels—student score vs. school score vs. district score vs. state score, or individual, team, or league batting average, the fact that they are measured the same way and on the same scale often causes conceptual confusion.

Second, the greater the difference in power between levels—between those being measured (students) and those being assessed (e.g., schools, principals)—the greater the tendency to blur the distinction between the unit of measurement and the unit of analysis and blame those being measured for the results. The teacher blames the students for whom he or she is responsible, the principal blames the teachers, the superintendent blames the principals, and so on. As one critic of organizations noted, credit flows up, blame flows down. The beneficiaries of privilege, power, and wealth have a long history of blaming the underprivileged, politically weak, and poor—i.e., blaming the victim.

Once the unit of analysis and unit of measurement are blurred or mistaken, i.e. once the locus of causation or responsibility is wrongly shifted, bad policies, laws, and programs intended to "fix the problem" are enacted, overlaid on an already stressed system, then politically orphaned. In government-sponsored large-scale assessment programs, this cycle takes about ten years, giving rise to the oft heard reaction, "This, too, shall pass."

Select IGAP History

The ten-year history of IGAP illustrated a confusion of both purpose and unit of analysis. Why we assessed—the purpose and what we were assessing— the unit of analysis—were, respectively, inconsistent and muddled. In fact, over the years each confusion compounded the other.[2]

Originally, when assessment began in 1988, the purpose of IGAP was to *monitor* academic achievement with respect to legally mandated goals in six fundamental subjects. The *unit of analysis* was the school. The *unit of measurement* was the student.

Misnamed a "goal assessment" program, IGAP was, in fact, a norm-referenced school achievement monitoring program.[3] A correct title would have been School Assessment Program. IGAP's inability to clearly maintain the distinction between the unit of analysis (the school) and the unit of measurement (the student) was severely compounded by midstream changes in political purposes. Consider the following examples:

1. Whereas IGAP stated that the school was the unit of analysis—and in fact reported scores for schools, not students—the section of the agency responsible for testing was officially and publicly called the "Student Assessment Section." Furthermore, at the same time it reported scores for schools, IGAP reported scores for districts and the state as a whole. It was not clear whether IGAP was assessing goals, students, schools, districts, or the state. Inclusion of racial and ethnic categories (some but not others) on student answer sheets further blurred the picture.

2. Whereas IGAP sent each school its scale score, the statewide score against which the school score was compared was the mean score of students, not schools. On a practical level, the statistical difference between the two was usually minor; on a conceptual level, however, it represented a fundamental lack of program clarity. This was another of several missteps that invited educators to confuse the unit of measurement (students) for the unit of analysis (schools).

3. Whereas IGAP stated that the school was the unit of analysis, it collected data on every student in every school every year in every subject at every grade tested. This testing design appears to have been a product of the confusion mentioned above. Census testing—instead of sampling—was not only statistical overkill, it again invited policy-makers to shift the unit of analysis away from the school to the individual. Once data on every student were generated, the temptation to use them was too hard to resist.

4. In 1991 the stakes to schools were dramatically raised. IGAP became one component of a state-mandated school improvement system the Illinois Public School Accreditation Process. The purpose of IGAP shifted from monitoring schools to evaluating schools. To do so, IGAP wrote narrative descriptions of three levels of performance and set cutscores on the 0500 IGAP scale. These cutscores defined the categories "fails to meet," "meets," or "exceeds." But a major conceptual error was made. Whereas the *school* was said to be the unit of analysis, teachers were assembled to describe what *students* should know and be able to do by subject and grade. Thus, the narrative standards did not describe the characteristics of high, middle, and low performing *schools,* rather they described high, middle, and low performing *students.*

5. As a consequence, IGAP set cutscores for students, not schools. It was an expensive operation: Hundreds of teachers across the state were assembled to look at individual IGAP test questions. They were instructed to estimate, for example, what percentage of marginal students would know, say, 3-4-5 right triangles. Their estimates were summed across all teachers and test questions. These percentages, once converted, established cutscores for "fails," "meets," and "exceeds" on the 0-500 IGAP scale in each subject. Thus, cut scores for students were established in each subject at each grade tested.

Finally, to determine a school's status required several additional steps. Using the cutscores, IGAP then classified each student's scores in each subject into "fails," "meets," and "exceeds," summed the number of scores in each pile, then calculated the percentage in each pile per all the IGAP scores in the school. In this way, each school was characterized by the profile of its three percentages. Having ginned up a school profile from student scores in this fashion, IGAP devised two new cutscores to sort schools into the three categories: What percentage of student scores in a school have to "fail to meet" for the whole school to fail? What percentage of student scores in a school have to "exceed" for a whole school to excel? The new cutscores for judging percentages were not publicly derived, but chosen inhouse to ensure that the politically correct number of schools in the state were recommended for the first watchlist—not too many as to offend a critical mass of educators, not too few as to offend a critical mass of legislators. Thus, the misconception of the standard-setting process made it unduly and unnecessarily vulnerable to political influence.

Note that in using this method to set standards, a school's IGAP score played no role in the calculation or determination of a school's status. In fact, IGAP publicly admitted that a local school could not determine its status by analyzing its IGAP scores. In effect, IGAP became schizophrenic. It *monitored* schools with school scores, but *evaluated* those same schools at the same time with student scores.

6. At the same time (1993) that IGAP began labeling schools and recommending which schools be put on an academic watchlist, it began sending individual student scores to students and their parents. This invited a shift in analysis and accountability away from the school at the very time it was most needed.

7. At the same time that IGAP told each student's parents that "the information from IGAP [is] to be used to evaluate schools, not individual students," it also told them "IGAP is one indication of how well your child is doing in each of the areas tested" and told them that the first purpose of IGAP was "to help the state evaluate the extent to which students in each school are meeting the state goals."

8. At the same time that IGAP told parents and educators that the information from IGAP is to be used to evaluate schools, not individual students, and told administrators that "neither individual nor aggregate scores are to be part of a student's permanent record or to be used for grading, promotion,

retention, graduation, or personnel evaluation...", IGAP sent each school administrator a student roster of individual IGAP scores on computer disk, further inviting a shift in focus away from schoollevel variables and onto the student.

9. In its early days IGAP resisted requests by others to use IGAP for purposes other than that for which it was intended and suited. But by 1996 IGAP found itself joined at the hip with the controversial Illinois Public School Accreditation Process. With the revision or demise of that system imminent, IGAP tried to save itself politically by making itself useful to virtually any purpose. In 1996, IGAP added codes to individual student answer sheets for Title I students. It also added an optionalschool-use-grid to each answer sheet for any subset of student categories a local school might wish to evaluate (gifted, vocational education, race, ethnicity, Goals 2000, Jump Start, and so on). The unit of analysis became, so to speak, a local "roll your own."

Not one of these conceptual errors was, by itself, fatal. In fact, some of them were minor. In combination, however, they reflected a fundamental lack of clarity, purpose, and analytical power. This conceptual error—mistaking the *unit of measurement* (student) for the *unit of analysis* (school)—deepened the blind spot with respect to causes and accountability and amplified the invitation for others to make the same mistake.

At this critical point—the point when standards were set for students and not schools— IGAP lost sight of its dependent variable and of any hope of seriously diagnosing and improving school performance. IGAP could neither descriptively define a good or bad school, nor analytically diagnose what caused its performance to be high or low, much less specify what the state could do about it. Standards made it possible, for example, for IGAP to measure how many math students failed to understand the Pythagorean Theorem, but impossible to determine whether and how much school size, teacher/student ratio, per capita school expenditure, educational philosophy, or other school-level variables contribute to a school's success or failure. Such factors remained largely invisible, leaving the status quo largely unchanged. This is to say, statewide standards, benchmarks, curriculum, and cutscores for *student* performance do not, per se, make a *school* a better place in which to learn. Said again, better definitions of health and better diagnoses of illness do not, per se, make a patient well.

A servant to too many masters and too diffuse in its effects, in 1996 IGAP lost political support and legally died. In spring, 1996, the legislature changed the unit of analysis of state assessment from the school to the student. Under HB 2596, new tests will be used to determine whether each student is performing two or more years behind his or her grade; should be given more concentrated or longer instructional time; given tutorial sessions or different instructional materials; compelled to attend summer school; be held back a year; and so on. As well, each student and his or her state scores will be tracked and made part of his or her permanent record.

The new law also specifies that IGAP cease in 1998, that state testing be cut from 18 to 11 tests per year, and that no testing occur between grades 5 and 12. Under the new law there will be no statewide science or social science assessment except at grade 12, and no fine arts or physical development and health testing at all.

Beyond the new law, the future of state assessment in Illinois is unknown. In going back to the drawing board, some want to revive IGAP in basically its present form; others want to keep the word "IGAP" on the shingle, but gut the building; yet others want something altogether different, especially performance-based. But whoever designs it—objectivists, statists, or constructivists—and whatever it may be, history makes it clear: State assessment must be conceptually incisive, analytically penetrating, and as brief and unobtrusive as possible a laser beam, not a Swiss Army knife.

Specifically, the purpose of assessment must be clear, the unit of analysis must be consistent, and the rights of subjects must be respected. These must be inviolable. Otherwise, in the long run, large-scale assessment programs even those like IGAP that are technically sound, highly reliable, and widely accepted—that promise to drive large-scale advances in achievement set themselves up for large-scale failure.

Notes

1. For example, the preambles to the old and new state goals in science reflect the fall of the objectivists and the rise of the constructivists in the last ten years. The goals set forth in 1985 were written by objectivists. The preamble to the goals stated, "Science is the quest for objective truth." The state goals in science set forth in 1996 were rewritten by constructivists. The preamble makes no mention of objectivity or truth as a pursuit of science. Rather, the preamble suggests that the purpose of studying science is because children are naturally curious and because science is useful in everyday life. The words "truth" and "objectivity" do not appear.
2. This essay assumes the reader is familiar with the history and structure of IGAP. They will not be described in detail here.
3. Goals are objectives, constants. One does not assess goals, one pursues them.
4. The name was changed to "School and Student Assessment Section," then to "Standards and Assessment Section," then to "IGAP Section."
5. But not always. In science in 1996 the grade 7 statewide average, based on students scores, was 252, but the average for schools was 244—an 8 point difference. In mathematics, the grade 8 statewide average, based on student scores, was 282, but the average for schools was 271—an 11 point difference. Thus a school with an average score in mathematics was led to believe it is 11 points below average.
6. In later brochures the wording of this purpose was changed: "to help the state evaluate the extent to which each school is meeting the state goals."

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Millstadt, IL 62260

IMPROVISATIONAL SCIENCE IN THE INCLUSION CLASSROOM

You've heard of improvisational comedy? At our house, we do improvisational science. The trick is for me to take the toy my daughter Colleen is engaged with at the moment, and turn it into a science experiment that the two of us can enjoy together. Take the underinflated playground ball she was kicking around the room last week. We dropped it three times and made marks on the wall to show the height of the bounce. Then she gave it ten pumps with the bicycle pump, and we dropped it three more times. Thirty pumps later, she was beginning to understand the relationship between air pressure and the elasticity of solids.

A comedian would say that Colleen is a "tough room." Colleen is a high functioning autistic. She has a short attention span, comprehension that is two years below grade level, and the impatience with parental lecturing that is typical in ten-year-olds. But she loves science.

It occurred to me that the special needs learners in the middle level classroom where I teach could benefit from the same type of approach. I can't give every student a toy. I can't abandon the curriculum. But I can use what I know about student interests to guide them into areas of learning where they will be most successful.

LOOKING FOR THE "TEACHABLE MOMENT"

Finding that interest can take some sleuthing. I start off the school year with a personal profile sheet that asks students to list, among other things, their hobbies and favorite after school activities. The sheets are kept on file for those moments when one of the students starts to lose interest in science class.

Science fair projects are one of those times that can be a teachable moment or a struggle. We've all tried to guide the students who seem to have little motivation. They can't find anything that they want to turn into a project for science fair. Luckily, I can look at those personal profile sheets they completed the first day of school and check out their favorite after school activities. Then, since science lurks somewhere in any hobby a kid can dream up, I have a place to start to spark their interest. If they're interested in model trains, why not build railroad trestles with different types of beams and test their strengths? If cheerleading is their activity of choice, why not measure skin temperatures of fingers and toes before and after certain types of cheers?

Science Olympics is another set of activities that can bring stand up science to inclusion students. Events like egg dropping and tower building bring out the best in challenged students. The contests give them a chance to show their creativity without having to struggle with the written word that is often a problem for them. Because their disabilities force them to see the world differently than other students, they often have unusual and unique solutions in problem solving situations.

It's important to make lessons for these students relevant and concrete. When a student cannot grasp the abstract lessons that are common in science, it may take several hands-on examples to get the point across. In the upper grades, it is necessary to take the time to point out why the lesson is learned at all. Middle level students want to know why they have to learn this. Their questions should be answered thoughtfully and honestly.

There are other techniques for reaching the inclusion students that may take just a small adaptation of the methods we use already. For example, I write notes at the board and allow the students to copy them quietly before I start my lecture. Many learning disabled students are capable of attending to only one source of input at a time. Listening to a lecture and writing clear notes is not possible for these students.

All of these methods require more time in preparation; but they provide more benefits for the whole classroom. They are often helpful to all of the students, not just the special needs learners, and make the science classroom an exciting place to be.

YOU DON'T HAVE TO DO IT ALONE

Speaking now as a parent, there are some opportunities that I feel every school should have available to assist classroom teachers with their inclusion students.

*** Classroom Support**

It's virtually impossible for a single teacher to teach a special student included in a regular classroom. While most school systems in our state have special education programs, there are still schools in small communities and rural areas that do not have support services in place. If there are special needs learners in your classroom, you should insist that you have the support of special education professionals. If there are none in place, ask that your administration find some. Volunteers or teaching aides already on staff can be trained to work with the children who need special help. The kids deserve that help, and so do you.

My first encounter with teaching a learning disabled student was at a small private school in a rural area. The child was taken to the public school nearby for some special classes, but he struggled in science class. I tried to help, but I know I didn't do everything possible for him or the other kids that followed. There wasn't enough time for me to provide the individual help they needed.

Since then, I have moved to a school where aides are in my classroom with the students who need extra help. They take my worksheets and tests and make the adaptations necessary for their students to succeed. I get a wealth of information and teaching hints during weekly meetings with the special education staff.

The difference in the approaches at the two schools has taught me that I can't teach special students alone. And I don't have to. As a parent, I insist that my daughter's school provide the aides that give the extra help she needs.

***Training**

Each disability has different requirements. There are so many workshops available that cover the topics dealing with different types of developmental disorders, it should be possible for every teacher to attend the ones that would help them the most. But you don't have to leave the building to get the training. Ask your administrator to invite a specialist to an inservice day, or to an after-school session with the teachers involved in carrying out a particular student's IEP. The Judevine Center in St. Louis, for example, provided training for Colleen's staff both at their center and at the school building. The individualized information and suggestions they gave were invaluable to all of us.

***Parents as a resource**

Many of us with disabled children have became experts in our child's disorder. We read up on the latest treatments, the hopes for a cure, and the best instructional methods. We often have a shelf full of books and articles that we're willing to share with those who educate our children. Add the years of experience we've already gained by living with the child, and you can see what a resource we can be for a teacher. As a teacher, don't hesitate to make that phone call about the latest problem you've had in class. We may be able to give you a few tips and tricks to help you get through the week.

While teachers need to think of their special students for only a few years, we parents have before us the concerns of a lifetime of special services. We worry about this year, and the next, and high school, and the possibility of college, and group home situations, and providing for the disabled adult. We have a vested interest in helping teachers provide the best education possible for our children.

***Help with finding resources**

Local chapters of national organizations that assist those working with disabilities are the first step in finding help for the classroom. They have books, pamphlets, research articles, volunteers, and professionals who can give ideas that are specific to a particular students.

The October/November issue of *NSTA Reports* included an article that listed programs and resources for teachers who work with children with disabilities. The list is included at the end of this article.

MAKE THE DIFFERENCE

This may all sound familiar. Of course it is. We've heard that students learn better when they can pursue their own interests, ever since our first teacher ed course. We know that the "teachable moment," when we're improvising the lesson to fit the situation, can give students rich experiences in the science happening around them. But with inclusion students, the use of these techniques becomes imperative.

Yes, it does take extra planning and flexibility. It does take teamwork between staff members. It does take effort. As a parent and teacher, I'm saddened to see those who are not willing to put that effort into giving inclusion students a chance in the classroom. There are hundreds of stories of giant leaps in the development of a child when just the right teacher made just the right effort at just the right time.

Please make the effort to be that teacher. Science can be the spark that holds the interest of these challenged young minds. It can give students in the inclusion classroom the motivation to learn to read, to do math, and to write by allowing them to explore the things that already fascinate them. Improvisational science can have a place in a classroom where special needs learners are grasping for understanding of science. Watch carefully for the spark of interest, nurture it, and help it grow into a useful skill.

PROGRAMS FOR PERSONS WITH DISABILITIES

Directorate for Education and Human Resources, NSF
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Arlington, VA 122230
703-306-1636
http://red.www. nsf.gov/EHR/HRD/disabil.htm

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c/o American Association for Higher Education
One Dupont Circle
Washington, DC 20036
202-293-6440, ext. 48
email easi@educom.edu
http://www.isc.rit.edu/~easi/

DO-IT
(Disabilities, Opportunities, Internetworking, and Technology)
University of Washington
Box 354842
Seattle, WA 98195
206-685-DOIT; fax 206-685-4045
email doit@u.washington.edu
http://weber.u.washington.edu/~doit/

For a copy of *Inclusionary Education for Students with Disabilities: Keeping the Promise:*
National Council on Disability
1331 F St. NW; Suite 1050
Washington, DC 20004
202-272-2004 fax 202-272-2022

Science Association for Persons with Disabilities
Benjamin Van Wagner, President
Fresno Pacific College
1717 S. Chestnut Ave.
Fresno, CA 93702
209-453-2278
email bvanwagn@fresno.edu

Foundation for Science and the Handicapped
E.C. Keller, Jr., President
West Virginia University
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Marilyn Sinclair, Kevin Leander, Matt Stuve and Margery Osborne
College of Education
University of Illlinois

DEVELOPING ACTIVITY-BASED SCIENCE CURRICULUM FOR THE ELEMENTARY GRADES: BUILD ON SCIENCE, PART 1

INTRODUCTION

During the past two years we have been working together with teams of elementary teachers from Thomasboro and Mahomet, two rural school districts in Champaign County, to develop activity centered, inter-disciplined K-8 science-based curriculum tailored to meet the unique needs of those respective schools. This paper presents an overview of the goals and rationale behind this curriculum development project. In a later issue of Spectrum, we will outline the project's implemetation and describe the curriculum the teachers developed and the results in their classrooms.

Many tales of in-service projects have been told in the past. Most reports of this nature write to describe and advocate a particular approach to working with practicing teachers to attain a set of goals. Rather than take a similar approach, in this set of papers we wish to describe our work more problematically: first describing what we did and why and then talking of structural, philosophical and personal problems which we needed to confront. We wish to write about how working with teachers to implement curricular change in their classrooms, even in settings ideologically supportive, confront multiple problems with which all must actively struggle.

HISTORY

Several years ago, Champaign Unit #4 School District was in the process of changing its K-5 science curriculum from text-based to a teacher developed program that was activity-based and inter-disciplined. Such a change was deemed necessary in light of the multitude of recent research which asserts that children need to *do* not simply read or be told about science in order to learn (for example: Aldridge, 1992; Bredderman, 1983; Rutherford and Ahlgren, 1990; Shymansky, 1989; AAAS, 1989, 1996). That such a curriculum be teacher developed reflects our beliefs that teachers need to be viewed as professionals responsible for the learning environment in their classrooms and as such need to be primary creators of that environment (Schon, 1983, 1987; Stenhouse, 1984; Hopkins, 1985).

In 1989, a Science Literacy Grant obtained through the state of Illinois was used to initiate this large project. Recognition of the need to provide teachers support in the development and teaching of this new curriculum motivated the district to garner the expertise of professionals from other local agencies. Through the combined efforts of teachers, the school administration and the local universities, Champaign elementary teachers were trained in curriculum development, then supported as they produced activity centered science units. Before the science units were implemented in the classrooms of the district, they were piloted on students in a two week summer science camp. As a result of this effort Champaign Unit #4 teachers produced 15(?) separate self-contained science units which now constitute the science curriculum in the district. These units include such subjects as: weather, simple machines, water, and structures and can be viewed at http://www.ed.uiuc.edu/BOS/.

Out of these early attempts at curriculum reform rose a conviction that the teachers in this school district needed to experience science learning themselves which was hands-on and activity oriented and to reflect, in a low pressure environment, on how to teach in such a manner. From this realization grew a larger program known as *"Grow in Science,"* also funded by the Science Literacy Grant program, which has provided in-service training in teaching activity-based science to more than 70 elementary classroom teachers from surrounding school districts (Brown and Sinclair, 1993). The program proved to be a leavening agent, raising the awareness of

teachers in surrounding districts to the inadequacies of their textbook driven science curricula. These teachers returned to their classrooms with a renewed understanding of student learning and of the central importance of active exploration in the classroom.

This consciousness raising coincided with implementation, by these school districts, of the Illinois School Improvement Plan guidelines. The same teachers who participated in *"Grow in Science"* participated in developing, with their districts, learning outcomes in science which meet state goals, and in developing assessment instruments to measure student progress. This intersection of experiences has led many teachers and administrators to identify the need for the improvement of the science curriculum within districts and to recognize the power of a program such as *"Grow in Science"* with its inherent support system to help realize such change. It is out of this need and in this environment that *"Build on Science"* was articulated and begun.

The idea for *"Build on Science"* was initiated by teachers who had participated in *"Grow in Science ."* The new program was designed by us with the teachers to directly serve these teachers and administrators in their school districts in order to address their interest in developing new science curricula for the K-8 students. Specifically, the project serves teachers from grades K-5 of the Mahomet-Seymour School District Unit #3, Mahomet Illinois, and K-8 teachers of the Thomasboro Elementary District, Thomasboro, Illinois. These school districts are in rural areas of Champaign County. Seventeen teachers and administrators from Mahomet are involved in the program, representing three buildings: an early childhood center, a primary grades building, and an intermediate grades building. Thomasboro has one K-8 elementary building and six teachers were involved in the program.

"Build on Science" has roughly followed the procedure outlined in the description of the Champaign Unit #4 effort and *"Grow on Science."* Teachers worked in teams to discuss curriculum goals and topics, compiled materials and tested them, wrote drafts of curriculum, piloted these and revised. We supported this effort by hosting and mediating debate, serving as sounding boards for ideas and providing materials and information. We also worked with the teachers to carve out space and time for their work to proceed. A final step in the program is the in-servicing of the remaining classroom teachers in each district and building by the participating teachers of the program. The total number of teachers reached through this program is 64; 54 at Mahomet and 10 at Thomasboro.

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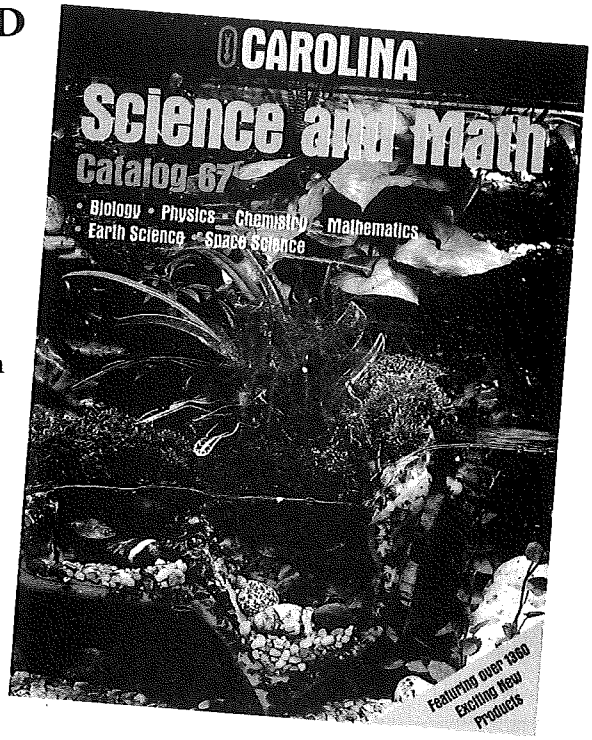

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GOALS AND RATIONALE

The primary goal of the *"Build on Science"* program was to provide support and guidance to the staff of the participating school districts for the development and implementation of an activity-centered and inter-disciplined science curriculum and teaching practices within elementary classrooms. To sustain such change, support to the "Development Teams" has been provided for (1) the development of a cohesive elementary science curriculum which emphasizes experiential learning and (2) by providing appropriate support for teachers in their effort to provide those learning opportunities to the students in their classrooms.

EFFECTS

The goals and methods of implementation of *"Build on Science"* are carefully thought out to try to enable and support teams of teachers to design curriculum in science which address current beliefs about effective science learning for children while simultaneously respecting teachers as thinking, creative and caring professionals. These goals and methods include debate over the meaning of effective science learning and curriculum content, allowing teachers space and time to construct their own meanings of these phrases, enlarging the domains in which teachers work to construct curriculum, introducing innovative resources such as Internet technology to teachers, treating teachers as creators of curriculum rather than simple implementors. Each of these is in turn problematic, or introduces qualities that become problematic. In fact we assert that the uncertainties inherent in many of these goals and beliefs both empower teachers and create disquiet and unrest. As others have pointed out before us, institutional change, even at the level of curriculum is systemic: small changes are pervasive and are not easily absorbed (Sarason, 1982; Cuban, 1984; Lortie, 1975; Cohen, 1993). Treating teachers in a manner to which they are unused causes ripples of change which effect more than just the individual. In an upcoming paper, which relates the process of implemantation of this project, these uncertainties will be explored in depth.

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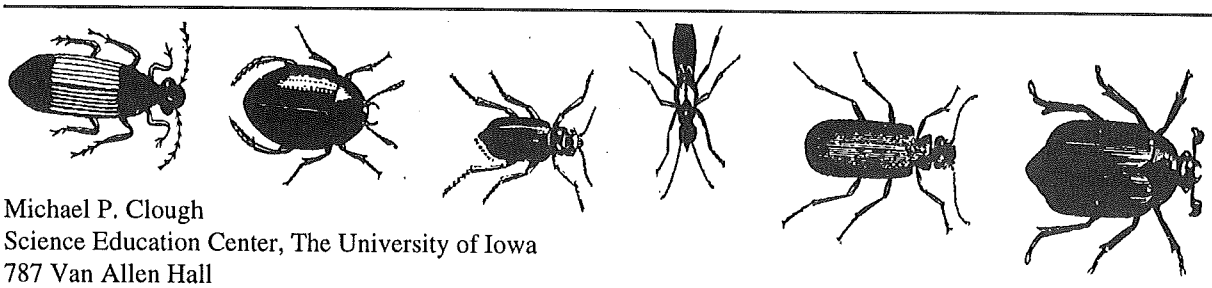

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BIOLOGY: A COMMUNITY CONTEXT— A NEW APPROACH TO BIOLOGY EDUCATION

Introduction

For the second consecutive decade, science education in the United States has been identified by science educators to be in crisis. Students see science classes as dull, no fun, and a place they do not wish to be. The 1986 NAEP report indicated that "roughly 33% of seventh and eleventh-graders described their science classes as often or always boring" (Weiss, 1993, p. 39). And the more years students enroll in science courses, the less they like it (Yager and Penick, 1986). More condemning are the data indicating that approximately half the surveyed students felt their science knowledge was useless outside of school. Hands-on activities and investigations are infrequently used, and the United States has the disconcerting distinction of ranking first in frequency of textbook reading as a means of instruction (Lapointe, Mead, and Phillips, 1989). Project 2061: Science For All Americans (AAAS, 1989, p. 14) maintains that:

The present science textbooks and methods of instruction, far from helping, often actually impede progress toward scientific literacy. They emphasize the learning of answers more than the exploration of questions, memory at the expense of critical thought, bits and pieces of information instead of understandings in context, recitation over argument, reading in lieu of doing. They fail to encourage students to work together, to share ideas and information freely with each other, or to use modern instruments to extend their intellectual capabilities.

Problems identified and proposed solutions center on several areas: too much content coverage and specialized vocabulary resulting in overstuffed-undernourished curricula, an emphasis on following directions rather than thinking, insufficient application of scientific knowledge, and the depicting of science as a rhetoric of conclusions. Recent systematic reform projects have targeted these problems. Reform suggestions usually revolve around teaching less content, but with more depth, allowing students to make more decisions about how to learn, emphasizing design of experiments rather than following recipes, and applying knowledge rather than merely learning as an academic exercise.

For example, *Chemistry in the Community (ChemCom)* was developed by the American Chemical Society (1988) for the college-bound, non-science major, and it focuses on chemical concepts that have community and personal relevance. *ChemCom* has gained widespread acceptance, but it unfortunately reaches only a fraction of high school students because most do not complete a chemistry course. The success of *ChemCom*, and the fact that 90% of high school students are required to take an introductory biology course, make *ChemCom* a model worth considering when addressing biology education. A biology course with a community context could potentially reach nearly all high school students, improving their attitude toward science, and enhancing their understanding of biology and the relationships between science, technology, and society.

For these and other reasons, *Biology: A Community Context* (Formerly known as *BioCom*), a curriculum designed to be relevant to students' lives and user friendly for teachers, has been developed with funding from the National Science Foundation. Teams consisting of science teachers, scientists, and science teacher educators began the writing process in the spring of 1993 at Clemson University in Clemson, South Carolina. The curriculum has been extensively field-tested, and feedback from this field-testing (Clough, 1994) was utilized during the revision process to ensure that the final product would meet the needs of students and teachers. *Biology: A Community Context* was made available for adoption in January 1997.

Biology: A Community Context is significantly different from currently available biology curricula (Leonard, Penick, and Speziale, 1996). Unlike most introductory high school biology courses, *Biology* promises to be more appropriate for the vast majority of students. *Biology* was developed with the following assumptions: (1) depth of understanding must replace coverage of isolated facts; (2) inquiry skills applicable to both societal and career success are essential; (3) ecology, evolution, and genetics are the fundamental ideas in biology; (4) active learning (hands-on/minds-on) must together make up approximately 75% of the curriculum; (5) the most pressing problems students will face throughout their lives are rooted in overpopulation and the deterioration of the environment; and (6) the developed curriculum must be seen by teachers and students as doable. *Biology* is divided into eight units for the entire school year (See table 1). However, only the first three units must be done in sequence, thus significant freedom is built into the curriculum.

Instructional Strategy

Each *Biology* unit incorporates a unique instructional strategy that carefully considers current research on teaching, learning, and cognitive development. Overtly inquiry oriented, the instructional strategy was, in part, developed to facilitate improvement in student attitudes, as well as understanding of biology concepts and science as inquiry. This strategy was also designed so that students would notice and come to anticipate each phase, thus facilitating the implementation of each portion of the instructional strategy. Since many biology teachers feel they do not have the expertise or time to sustain an inquiry-oriented biology program (Costenson and Lawson, 1986), the instructional strategy is an overt attempt to help biology teachers implement active student inquiry, and facilitate several goals associated with the emerging consensus regarding the desired state of science education (NRC, 1996; Texley and Wild, 1996).

The instructional strategy in *Biology: A Community Context* was developed to promote science teaching and learning that models the processes of inquiry (e.g., formulating questions, observing, speculating, controlling and manipulating variables, collecting and organizing data, drawing conclusions); the tentative nature of science knowledge; and the interactions between science, technology, and society. In addition, the instructional strategy calls on students to apply their knowledge in various ways. The instructional strategy should enhance student learning of biological concepts and skills, develop positive attitudes and values toward science, enhance creativity, and facilitate the transfer of scientific knowledge to everyday life. This, in turn, is expected to enhance students' understanding of the nature of science and

Table 1. *Biology* Unit Titles, Sequence, and Estimated Allocated Class Time.

Unit Title	Sequence	Approximate Days	Quarter
1. Matter & Energy for Life	First	25	1
2. Ecosystems	Second	20	1
3. Populations	Third	20	2
4. Homeostasis: The Body in Balance	Non sequential	20	2-4
5. Inheritance	Non sequential	20	2-4
6. Behavior and the Nervous System	Non sequential	20	2-4
7. BioDiversity	Non sequential	20	2-4
8. The Biosphere	Last	25	4

technology as students are performing research concerning the natural world and then later applying portions of this knowledge to societal problems. The *Biology* instructional strategy has seven parts.

Initial Inquiry

Typically lasting one to two days, each Initial Inquiry is developed for use with an entire class, and uses visuals to introduce a science-based societal problem that students can relate to. Ideally, to help generate student interest, this setting depicts an event that really happened. For example, in Unit I students are introduced to our societal waste problem with a video of the *Mobro*, a trash barge carrying New York City's garbage from New York to Central America and back seeking a place to dump its load. The purpose of the video is to have students generate as many questions as they can concerning the particular societal problem. Depending on how the teacher uses the video, these questions may be brainstormed at points where the video is stopped, or at the end of the video. The teacher accepts all student questions, and students write all questions in their *BioLog*—a daily journal of questions, personal thoughts and experiences, data, conclusions, or anything else that pertains to the course. The *BioLog* is critical as many future activities call on students to consider previous material, activities, notes, and thoughts. In this way, the *BioLog* mirrors the exacting records that scientists must keep of their work.

Brainstorming after the initial scenario serves several functions. First, contrary to most students' past science experiences, the unit begins with students doing most of the thinking and talking, not the teacher. Students are not only active, but they learn up front that what they think matters! Moreover, as students verbally participate and write down their ideas in their *BioLog*, they are already working on communication skills important in doing science. The questions generated by the class create a need to know and this leads into the next portion of the instructional strategy.

Guided Inquiries

Here several hands-on/minds on investigations are introduced over a period of six to seven days. In most cases, nearly all students will complete each activity, but this is not essential as will be explained in the next part of the instructional strategy. Some of these activities are designed to teach specific skills while others provide basic conceptual information necessary for a satisfactory resolution of the issues raised in the Opening Scenario. Optional activities will be made available as students complete the required core. In most Guided Inquiries, students make significant decisions about variables, techniques, and interpretations. However, in Unit I, the teacher and the curriculum will make many of the decisions about what activity to do and how to do it. As the year progresses, students will make more and more of these decisions. The Guided Inquiries purposefully make connections between biological concepts and the issues raised in the Initial Inquiry. Consequently, upon completion of these activities, students are better acquainted with the biological ideas, issues, and other ideas related to the Initial Inquiry.

Self-Checks

To facilitate self-reflection and ensure that students are prepared to move forward, student Self-Checks appear twice in each unit. Each Self-Check lasts one day, the first coming after the Guided Inquiries and the second after the Extended Inquiries. Self-Check 1 is primarily a review of the significant concepts and experiences introduced in the Guided Inquiries. Students, working in small groups, divide the work equally and research their respective items before reporting back to the team and teaching the other team members. Forcing students to take responsibility for explaining concepts to their team is a powerful way to facilitate learning and other important science goals, and it allows teachers an opportunity to peer into their students thinking and determine student misconceptions.

The second Self-Check is more holistic and interdisciplinary, emphasizing extended answer questions that force students to discuss the nature of science, conceptual links, and issues in and out of science. Consequently, Self-Check 2 should often result in prolonged discussions and debates. This again provides the teacher with significant diagnostic information in which to structure future lessons, and it provides a nice segue to the final portion of the instructional strategy.

Science Conference

In the Initial Inquiry, Guided Inquiries, and Self-Check 1 students have had a number of experiences designed to illuminate useful information, skills, and science processes. The Science Conference, lasting one to two days, is where students share what they have learned. Continuing the theme of active science, students make formal and informal presentations, arrange and perform demonstrations, role-play, or find other ways to communicate and share their information and ideas. Acknowledging constructivist learning theory, the instructional strategy recognizes that not all students have experienced and learned the same things. Hence, the conference is a place where the sharing of information is critical to understanding the questions generated in the Initial Inquiry. Four questions drive the Science Conference: (1) What do we now know after having completed the Guided Inquiries and first Self-Check? (2) What evidence do we have for that? (3) What more do we need to know? and (4) How will we gather that information? Through presentations and addressing the four focus questions, students show their thinking, providing teachers with valuable diagnostic information.

Extended Inquiries

Over the course of six to seven days, students, working alone or in small groups, design and carry out investigations which will provide data, answers, and more questions regarding the societal issue at hand. Students also continue monitoring and collecting data from long-term projects begun during the Guided Inquiries. Some of the extended inquires will themselves be long-term. While some students will be well-prepared to design their own investigation, other students may be hesitant or unable to perform such an abstract task early in their *Biology* experience. A few students may simply

not exhibit the motivation to create their own investigation. Here again, the value of the instructional strategy is illustrated. Several Extended Inquiries are more structured in nature so as to nurture particular students along. In addition, because not all students completed each of the Guided Inquiries, students experiencing difficulties developing their extended investigation may be directed back to more Guided Inquiries. By the end of the school year, a significant number of students should achieve the confidence and motivation to follow through on their own ideas.

Science Congress

The Science Congress, lasting one to two days, begins with each individual or group communicating to the class what they found out in their Extended Inquiries. The object is to let others know what they learned about nature and other topics relevant to the issue at hand. After everyone is done communicating the results of their investigations, the emphasis now changes to deciding what are the major problems associated with the central issue, what other issues are involved, and students' personal stands. Now that students are more aware of the societal issue, scientific knowledge relevant to the issue, and other pertinent information, they will engage in discussions concerning the implications of the available knowledge.

Unlike the Science Conference, a Science Congress is a meeting which goes beyond sharing ideas to discussion, identification of points of conflict, and, ultimately, consensus as to necessary policy-decision action. Students may decide to consider resolutions for policy-decision action and vote on such resolutions. At this time students are NOT deciding what nature is like, rather the implications of scientific knowledge for policy-making decisions are being considered. During the discussion students may begin by supporting one policy position, but then end up supporting another. Being swayed by evidence and sound reasoning, or convincing others of your view, is part of science and rational decision-making dialogue and part of what this innovative curriculum is determined to facilitate. The Science Congress provides an opportunity for students to make their voice heard and prepare for the unit-ending Forum.

Forum

This culminating activity in each unit lasts one to two days, and may be local in nature, or extend up to the global perspective. In most instances students role-play the principal players in a particular scenario, and debate the issues. In unit 1, for example, students role-play a River City Council Meeting where the town's overflowing landfill is an issue. In unit 2, a court case between the People and several copper-mining companies is played out. In unit 6, students act out a grand jury scenario in which an individual admits to antisocial behavior but attributes it to a poison she ingested. These activities facilitate a better understanding of complex issues and the importance of biological knowledge in making appropriate personal and societal decisions. Closure may be reached in some cases, but not others, and this again models authentic societal issues. The unit ending Forum is designed to result in extensive discussions of real societal issues involving science and technology. Ideally, teachers will ensure that students take a form of action that goes well beyond the classroom.

Conclusion

Biology: A Community Context is one way in which biology teachers may include all students, abandon "ability grouping" or tracking, improve performance of challenged students, create a challenging environment for motivated students, and eliminate entrenched practices that lead to dull classes. For more information and preview units, please contact the *Biology: A Community Context* national headquarters at:

Biology: A Community Context
400 Tillman Hall
Clemson University
Clemson, SC 29634-0709
Phone: (803) 656-1398
E-mail: bjspz@clemson.clemson.edu

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Stewart E. Brekke
Chicago Public Schools

MURDER, GUNS AND VIOLENCE; AN INTEGRAL PART OF THE CHICAGO SCIENCE EDUCATION SCENE

It is now one week since I attended the funeral and burial of a young African-American physics student who was gunned down by mistake in a crossfire on the South side of Chicago. Like so many others, she was a bright pretty girl with a child, hers being three years old. Cassandra attended school fairly regularly taking time off only when she needed to care for her child. She was a B student in regular physics. Cassandra was the fourth young Black science student I have lost in 6 years to crossfire and outright murder. Not only did Cassandra become a victim, but also the unborn child she was carrying. About two weeks later her boyfriend, another student in our school committed suicide in despair.

Last year, about the same time, Phillip was killed by crossfire in front of his home, again on Chicago's South side. Phillip was in General Science, bright and capable, but a gangbanger who did not always follow school rules. Terrance, also in General Science, was shot supposedly by accident in an acquaintance's home and died a few hours later. Another young African-American, a bright high school senior, my first student killed by gunfire, was the best in his physics section. He did well enough in class that I was able to get him accepted in an upward bound program at a local university. Unfortunately, he was involved in gang activities. Over the summer he went out at night for a sandwich, and was shot in the head as he stood in the doorway of the coffee shop.

I could name others, young Black students, who were in my other courses who were shot and wounded. There was the girl, the best in Algebra I, who was shot in the eye during crossfire near our high school or the gang leader at yet another school who was shot in the ankle. I could name the brother of the school librarian this last year who was murdered, shot in the cross fire, between two rival gangs, again on Chicago's South side. At my other school the Earth Science teacher unwittingly moved into a new apartment only to have her new car shot up in crossfire between two rival gangs shooting it out in the neighborhood over drug territory.

For every murder I can name, I am certain that each one of my students can name two or three that they know of and probably, at least one or two murders they have actually seen in the neighborhood. Before I was at another school two months, we heard of another execution that had taken place overnight on the railroad track. At that school, two executions had taken place, each on different days, overnight on the track. At my previous school, I overhead a conversation between some of the young African American physics students before the class about "where they throw the bodies." Apparently, when gangs murdered someone, they would dispose of the bodies behind a store. A student described how he saw the body of a naked young girl with her nose cut off laying dead behind a store, among others who were murdered and dumped there every so often. One teacher at my present school, who has been in the system longer than I, says he knows of sixteen young Black students who have been killed over the years. I can think of over twenty young black and Hispanic students murdered by gunfire. When I first came to my the school there were two executions that took place overnight within two years of each other and we came to school the next day to a murder scene.

Anyone who deals with these young inner city students, both Black and Hispanic, knows that substantial potential exists among these children. Many more of them could be science professionals such as physicists, chemists, engineers and medical personnel. However, the destruction of the environment they live in is enormous. Many of them have low aspirations, and some never make it at all because of death by gunfire, psychological or physical injury due to violence in their lives. All of these children are afraid, not only on their way to and from school, but also in the school itself where violence can erupt at any moment such as in the halls, the washrooms, the lunchrooms and in the classroom themselves.

The toll the violence takes not only affects the students, who cannot escape it, but the teacher as well. There was an average of one fight a week in my General Science class at another school I worked in. I found that when there were two or more violent outbreaks in a week, I would come home depressed. I could handle one, but not two fights a week. Think of how this affects these students, who see substantially more violence in their lives everyday, at school, at home, at play, and just about everywhere in the inner city. Certainly, their performance is impaired. I am certain, just from personal experience, that great psychological damage is done to these inner city children from very early on due to the violence that pervades every aspect of their lives. This damage is not only psychological, but also physical due to fights where brain damage has been inflicted, scarring due to fistfights and broken limbs as well as blinding due to crossfire injuries.

At my school a bright gang leader in General Science was hit in the head during gang warfare in the neighborhood, and was out for about three weeks due to a concussion. Another of my General Science students was walking to the store and was gang-banged. The boy was put in a coma for a week just because he belonged to another gang. I was told that the gangbangers try to inflict injury to the head. This may explain why at one school I was at a boy was gang banged in the school lunchroom. His head was pounded on the concrete floor of the cafeteria so many times that he was carried out in convulsions to the waiting ambulance. Therefore, this gangbanging results in a number of head injuries to these young bright children.

At my school in the General Science room, last year, just as the students were arriving for class, four strange students appeared and each took a position approximating the four comers of the room with fists clenched. At first, I thought they were after me because the year previously I unwittingly stopped a dice game taking place in a hall corner and the gang running the dice game had me in "violation." My worst fears were unfounded, however, since the minute the four spotted the young student they were after, they converged upon him and began punching him. I tried to shield my student as they punched him in the head over my shoulders. After they were satisfied that they got their punches in, they left. Some of them were caught, suspended, but not prosecuted by the police. However, last year, I was hit, an uppercut to the jaw, by a student in General Science who put his arms around me pretending to hug me and as he pulled away he threw his punch. Apparently, I was putting too much pressure on the students to do their work in this one class in General Science. This student was suspended, but not prosecuted by police as well. The general policy of the schools, even in most school districts across the United States, is to avoid police involvement when it comes to violence in the schools.

At the school where I teach now the administration is committed to making the school a safer place. But as in most other inner city schools, administrators are overwhelmed by the violence that takes place on a daily basis. This violence is a spillover from the neighborhoods and is gang related, and no one, from the parents in the neighborhoods to the best minds in the world, knows how to stop the killings and the violence. To teach Physics, Biology or General Science in these situations is not easy, but at least I can escape the violence when I go home to my safe neighborhood on the North Side of Chicago. The students and their families are under the violence gun twenty-four hours a day and the effects upon learning not only science but any other subject at these schools in the inner cities is great.

I detail incident after incident from inner city schools of Chicago, but I think I have made my point. Certainly, guns, gangs, violence and science do not mix. How can any person talk to these students about universal laws of nature when in the back of the students' minds, safety is a prime concern permeating every action they take in school and out of school? It is a credit to the students and the families themselves that they do as well as they do. One thing is definite—we must eliminate the access to guns by adolescents. It is "kids killing kids," as we all know. The sciences have given us gunpowder, guns and bullets. Perhaps, that same combination of human ingenuity can provide a solution to the murdering and violence, intentional and unintentional, that is destroying the potential of inner city youth.

1997 ISTA Member Survey

On behalf of the Executive Officers and the Board of Directors of the Illinois Science Teachers Association, I would like to invite past and present members of the ISTA to complete the 1997 Member Survey which follows. In an attempt to better serve the needs of ISTA members and *plan for the future direction of our statewide organization,* it is critical that we hear from you!

Please take a moment to thoughtfully complete the survey, stamp and return your comments!

Remember,
don't put off until tomorrow,
that which you can complete today!

Sincerely,

Debbie Clinebell,
ISTA Region 5 Director

8) Would you be willing to pay higher ISTA membership fees to:

Yes No a) provide additional member services?
Yes No b) pay for a full-time Executive Secretary?
Yes No c) support ISTA awards programs?

9) Would you be willing to serve as a Regional Director or Officer for the ISTA? If yes, please include your name on this survey, or contact :

Diana Dummitt, % SPECTRUM,
390 Education Building, 1310 S. 6th Street,
Champaign, IL 61820

1997 ISTA Member Survey Response Profile

Please Complete

1) Are you a current member of ISTA? Yes No

2) In what ISTA region do you live? 1 2 3 4 5 6
(see the back inside cover of the Spectrum)

3) Are you receiving the Spectrum? Yes No

4) Did you attend the 1996 ISTA convention? Yes No

5) Have you ever received an ISTA award? Yes No

6) What is your current position in science education? (circle one)

student pre-service teacher teacher administrator retired other_____

Optional

Name_____Home Phone_____

Address_____Work Phone_____

City, State, Zip_____ Email_____

Fax _____

1997 ISTA Member Survey

How well is ISTA serving the needs of science educators?

1) What do you feel are the greatest benefits to being a member of ISTA?

2) Does the Spectrum provide you with useful information? Please elaborate.

3) Does the annual ISTA state convention provide you with useful information? Please elaborate.

4) Have you visited the ISTA home page on the Internet? _____
If yes, does the ISTA home page provide you with useful information? Please elaborate.

5) Are you aware of the duties performed by the ISTA Executive Secretary?
(Circle One) Yes No If Yes, please explain.

6) Are you aware of the ISTA awards program available to science educators?
(circle one) Yes No If Yes, please explain.

7) What information, needs, or services could ISTA provide to better serve ISTA members?

Join the Chicago Botanic Garden and Children's Rainforest Workshop in an immersion learning experience for teachers:

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*Enjoy star-gazing, boat floats, a hammock nap, local music and dancing, fishing, swimming, photography, bird watching, and night time trail walks
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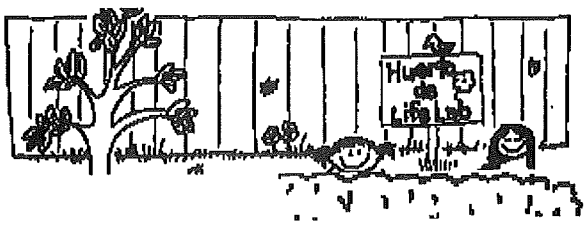
Cost includes domestic air allowance of $350 (home/Miami/home), international air fare, all meals, lodging, transfers, airport departure tax, tips for guides and other servers, three rainforest '97 t-shirts, journal, textbook and curriculum materials. Ideas for subsidizing the costs for this workshop will be provided. Graduate credit (4 cr., $400) includes 3 additional 1/2 day workshops scheduled before and after travel workshop, keeping a journal and producing a ready to use lesson plan and unit outline. Contact: Lynne Hubert, Chicago Botanic Garden, 847/835-8280.



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To receive registration information and/or speaker proposal forms, please contact Lynne Hubert, Chicago Botanic Garden, 847/8~35-8280.

COMPUTER SPECTRUM

Mark Hayward
International Museum of
Surgical Science
1524 N. Lake Shore Drive
Chicago, IL 60610-1607
312.642.6502 Fax 312. 787.1624

WEB SITE IS YAHOO PICK OF THE DAY

The International Museum of Surgical Science Web site was selected as a "Pick of the Day" on December 12, by a search engine called Yahoo. Yahoo is one of the most popular search engines on the World Wide Web. Our Web site can be accessed by entering the url:
http://www.imss.org.

Visitors to the site are greeted by a count of fatalities and survivors. These numbers refer to participants in the museum's electronic exhibition called "Virtual Antique Illness". The "Illness" is an interactive story in which the participant comes down with a sharp pain in his or her abdomen that will not go away, and must choose from a variety of treatment possibilities. Unfortunately, it is the 1870s, and many of the possible treatments do not do any good or eventually lead to death. Only one possible treatment ends successfully.

The Museum is located at 1524 N. Lake Shore Drive, one half block south of North Avenue. The museum is open Tuesday through Saturday 10 am to 4 pm, and Sundays from 11 am to 5 pm. Suggested admission - $2.00.

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Compiled by Rick Kang
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SCIENCE WEB SITES: ASTRONOMY

INDICES

http://pmo-sun.nero.net/astrosites.htm takes you directly to Pine Mountain Observatory, to a listing of a wide variety of astronomy topics. We (Friends of Pine Mountain) contemplate adding a virtual tour of the telescopes, domes, and grounds, a virtual observing run on our CCD-equipped telescope, projects for students, and archived images. Soon we will offer remote control data acquisition for students/teachers.
http://zebu.uoregon.edu/galaxy.html takes you to Professor Greg Bothun's Astronomy page at the University of Oregon's Physics Department site. Greg (Dr. Darkmatter), Director of Pine Mountain Observatory, regularly updates his page with sites that contain current research/discoveries (like the newly found planets).
http://www.skypub.com/ takes you to the home page of Sky Publishing Corporation in Cambridge, MA. They publish Sky ~ Telescope and CCD magazines. Their pages, aside from containing quick access to what's up in tonight's sky and research headlines, contain one of the largest indices to astronomy sites and topics. If you can't find it here, it probably doesn't exist!

HOT NEWS from HUBBLE

http://www.stsci.edu/pubinfo/PR.html takes you to the listing of releases of Hubble Space Telescope images and findings, starting with the most recent and going back through the year. This site contains most of the hot astronomy news items.

BASICS

http://www.actden.com/sky_den/contentshtm takes you to ACT Laboratory's Digital Education Network where you will find an excellent overview of astronomy topics, including some nice graphics.

SOLAR SYSTEM

http://bang.lanl.gov/solarsys/ takes you to C. J. Hamilton's excellent tour of the Solar System, including many current images.
http://www.seds.org/nineplanets/nineplanets/ nineplanets.html takes you to the Students for the Exploration ~ Development of Space (SEDS), University of Arizona based, tour of the Solar System, put together by Bill Arnett, and similar to Calvin Hamilton's but with a different format and several different images. (yes, nineplanets three times :)).
http://encke.jpl.nasa.gov gives you the latest info on currently visible comets, including Hale-Bopp, with coordinates and other data listed. See also:
http://galileo.ivv.nasa.gov/comet/
http://www.comet-track.com/hb/hb.html

http://www.fourmilab.ch/solar/solar.html gives access to a nifty "Orrery" of the Solar System (like the mechanical crank and chain driven ones of pre-computer vintage). John Walker's clever program lets you visualize what planets are visible when and why. If you want to go directly to the graphical orrery, you must type **http://www.fourmilab.ch/cgi-bin/uncgi/Solar/action?sys=-Sf,** seems easier to type the first one, then select the hypertext link.

DEEP SPACE: NEBULAS AND GALAXIES, MESSIER OBJECTS

http://www.seds.org/messier/ takes you to Hartmut Frommert's excellent indexed collection of images and explanations, again at the SEDS Arizona site. Alternative URL is
http://seds.lpl.arizona.edu/messier/index.html

CONSTELLATIONS, SKY MAPS

http://www.iwe.com/has/deepsky/ produces an index of Constellations put together by the Hawaiian Astronomical Society. The links take you to excellent overview and detail maps, plus info about deep sky objects and sky lore. Another very good similar site is Chris Dolan's Constellations pages, at University of Wisconsin's server, at
http://www.astro.wisc.edu/~dolan/constellations/

NUCLEAR SCIENCES SITES

www.ans.org
American Nuclear Society

www.lhs.berkeley.edu
Lawrence Hall of Science

www.education.lanl.gove/
Los Alamos Nat'l Lab Education Projects

www.acuri.com/snta.html
American Nuclear Science Teachers Assoc.

www.snm.org/
Society of Nuclear Medicine

iderl6.psu.edu/rmenuc/users/chernobyl/
Chernobyl, Penn State University

www.nea.fr/html/rp/chernobyl/chernobyl/chernobyl.html
Chernobyl, Nuclear Energy Agency

school.discovery.com/
Discovery TV Channel

www.iaea.or.at/
International Atomic Energy Agency

www.who.ch/
World Health Organization (food irradiation)

neutrino.nuc.berkeley.edu/ifr.html
Integral Fast Reactor

www.ocf.berkeley.edu/~iisme/
Industry Initiative for Science & Math Education

www.sciam.com/WEB/index.html
Scientific American

www.uic.com.au/
Uranium Info Center of Australia

www.uilondon.org/
Uranium Institute of London

www.usii.net/hps/
Health Physics Society

www.dne.bnl.gov/CoN/index.html
Table of the Nuclides

nuke.handheld.com/
Nuke Handheld Database

www.nei.org
Nuclear Energy Institute

www.fnal.gov/
Fermi National Accelerator Lab

RESOURCES FROM ILLINOIS GEOGRAPHICAL SOCIETY

Mapquest has added worldwide coverage. Interactive maps detailed to highway and boulevard levels.
Http://www.mapquest.com/

Census Bureau/WWW USA Counties Clickable Map has demographic, economic, and governmental data.
Http://govinfo.kerr.orst.edu/usacostateis.html

Map Blast displays detailed maps by address and zip code.
Http://www.mapblast.com

The Coral Forest contains high-resolution images, information about actions to preserve coral reefs; lesson plans
Http://www.blacktop.com/coralforest/

TVWeather.com contains graphics and animation on weather topics; maps; climate and agricultural data; educational links.
Http://www.tvweather.com

Census Bureau web site includes "Population Clock," "Economic Clock," other resources.
Http://www.census.gov/

USGS. National Mapping Program provides accurate and up-to-date cartographic and other data. Geographic Names Information System is official geographic names source. http://www.usgs.gov/

EARTHWATCH WEB SITE

The EARTHWATCH web site at **www.earthwatch.org** has just received five planets from Luckman's WWW directory for best in all categories of graphic design, overall design, content, and ease of navigation. The EARTHWATCH web site contains over 1,400 pages of graphically exciting information on sponsored research projects in 52 countries and 24 U.S. states, including hundreds of pictures, field reports by scientists on results of their work, as well as articles by returned EarthCorps volunteers and original scientific data which is being used in classrooms across the country to get students excited about science and learning through the organization's Global Classroom project. The site also won "coolest site" award from Netscape, "top 5% of all web sites" from the Magellan Group, and the Philanthropic Diamond award.

EARTHWATCH is a nonprofit volunteer organization founded in 1972 which funds scientific field research worldwide through its EarthCorps of some 4,000 volunteers each year helping university scientists with their fieldwork on expeditions in 24 states and 52 countries. The organization also publishes the biannual color magazine EARTHWATCH, a lively newsletter called Field & Team, and an annual large format catalogue of sponsored expeditions seeking volunteer help. Since 1972, over 48,400 volunteers have donated over 5.6 million hours of labor and $40 million to the search for answers to important questions about global change and our planet's biological and cultural resources.

SPECIAL INTERESTS

1601 NASA Road 1
Houston, TX 77058
281-244-2105
FAX 281-283-7724

UPCOMING EVENTS/ACTIVITIES

"Speed:" January 3 - July 3. An eye-popping, heart-pounding, stomach-rolling IMAX experience. Speed is an exploration of the social, historical, comical and scientific aspects of speed—a truly modern phenomenon. Combining unusual computer graphic effects with live action, the film is an entertaining look at people's fascination with speed from the caveman chasing his prey on foot to the astronaut soaring above the Earth at 25,000 miles per hour. Guaranteed to make the viewer queasy.

"The Robot Zoo:" Memorial Day - Labor Day. This interactive, 3-dimensional exhibit seeks to explain the magic of nature through the genius of engineering. "The Robot Zoo" mechanizes ordinary animals into huge robotic creatures.

"Mission to Mir:" July 4. An exclusive Space Center Houston premiere. The newest space-related IMAX feature compiled by the astronauts and cosmonauts involved in the Space Shuttle/Space Station Mir docking missions. "Mission to Mir" takes a look back at the grand sweep of history that has led to the development of an international space program and the events which herald the next age of space exploration.

"To Be An Astronaut:" Space Center Houston's awesome signature large-format film. To Be An Astronauts produced by BRC Imagination Arts, focuses on the euphoric personal experiences of astronauts in training from classroom lectures to onorbit operations.

"SpaceWeek '97: Robotics and Animation:" July 20 - 26. A week-long series of events paying tribute to the men and women - and technologies - who have made space exploration possible. SpaceWeek 1997 begins on Space Day (July 20) which marks the anniversary of the Apollo 11 lunar landing.
Admission prices, operating hours and exhibit times and dates are subject to change without notice.

Norm Bettis
Illinois State University
Illinois Geographical Society
Department of Curriculum & Instruction
Campus Box 5330
Normal, IL 61790-5330

GEORESOURCES

"Where in Time is Carmen Sandiego?" essay contest information is available at Delta Airline's Web page at http://www.delta.com or call Amy Burg at WGBH: 617-492-2777.

A CD-ROM that supplements the print materials of ARGUS (Activities and Readings in the Geography of the United States) includes images, maps, and data. $9. CD-ROM and print materials (over 700 pages of student activities for $52) from AAG at 202-234-1450.

Free research articles and status reports on U.S. wetlands from U.S. Fish and Wildlife Service. Contact: Wetlands Status and Trends Unit, 9729 Executive Center Drive, Suite 101, Monroe Building, St. Petersburg, FL 33732. Phone: 813-570-5412.

Travel the Trail of Tears-Online" is a project designed to connect via the Internet fifth-grade classes in the states through which the trail passed. Illinois is one of seven targeted states. Photography, journal-writing, and research are involved. Funded by a grant from the Oklahoma Geography Education Fund. Contact Sue Cullum/Jayne Marley, Rt. 1, Box 1, Roland, OK 74954; e-mail: trail.ipa.net

Follow the adventures of Pam Flowers' 1600-mile solo expedition from Resolute Bay in the high Arctic of Canada to the magnetic North Pole and on to the geographic North Pole. For a bi-weekly newsletter of the expedition's progress, send name and school mailing address to Pam Flowers Expeditions, Box 874924, Wasilla, Alaska 99687.

Illinois Map T-Shirts and Bumper Stickers

The fertile mapping mind of Fred Willman, Kennedy Junior High in Lisle, has come up with an encore to his first generation of Illinois Map T-Shirts. The current model is a dark green Russell 50/50 short sleeve T in XL and XXL. On the front Fred has a map of Illinois featuring authors from the state. On the back a second Illinois map shows Native American tribes once living here. The left sleeve carries the IGS logo. We sold 27 of these shirts at the Alliance Fall Conference. To get one for yourself send $14 to the IGS Central Office. Specify size.

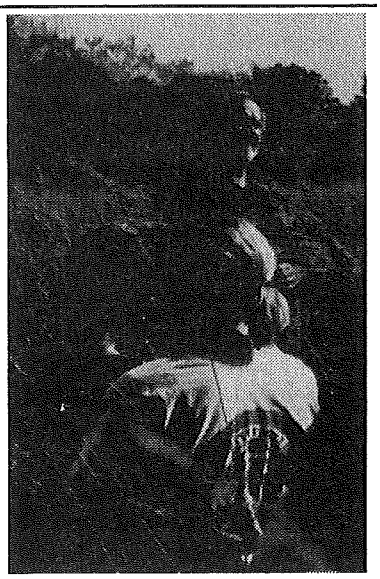
You may also want to show off the new Illinois Geographical Society logo on the bumper of your vehicle (or other suitable spot). Stickers are available for $1 at the annual IGS conference or for $1.50 each by mail from the IGS Central Office.

IGS Annual Meeting

College of Lake County will be the site of the 1997 annual meeting of the Illinois Geographical Society on April 25-27. An all-day field trip and evening banquet are planned for Friday. Paper presentations, workshops, and the awards luncheon are scheduled for Saturday.

Bill Beckman, Coordinator, Central Region
Science Education Partnerships in the Illinois Middle School Groundwater Project
East Peoria Comm. H.S.
East Peoria, IL

GROUNDWATER PROJECT IS MANY THINGS TO MANY COMMUNITY SCHOOLS



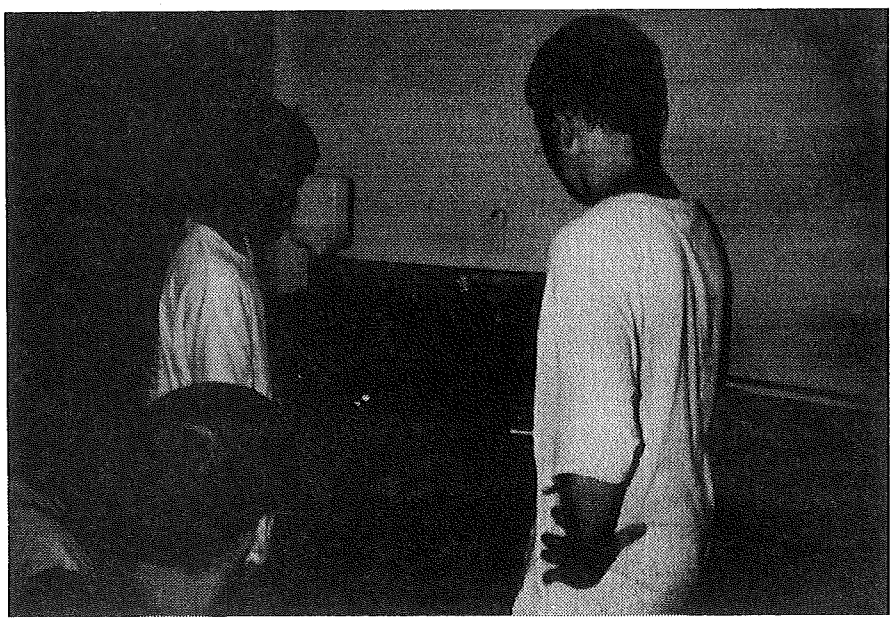
The Illinois Middle School Groundwater Project is the result of a unique partnership dedicated to protecting Groundwater resources via community based education. The organizers of the project are actively working toward achieving this goal via the following objectives: a) making students and adults aware of the connection between good health and safe drinking water and b) learning how hazardous materials in polluted water directly affect all living things.

The project started in 1993 under the direction of Dr. Robert Williams from SIU-Edwardsville. Three regions in the state were identified using data from the Illinois Environmental Protection Agency. These regions are named "northern," "central" and "southern" regions. The project is underwritten by the W.K. Kellogg Foundation.

The leading partners in this unique project are agencies, businesses, organizations, and schools (e.g., Illinois Department of Natural Resources, Illinois-America Water Company, the Illinois Farm Bureau and two hundred twenty-one middle schools.). The Illinois Middle School Groundwater Project is school based and uses the curriculum, H_20 BELOW.

Exceptional school programs and special award winners are abundant and readily identifiable in the project. The total project recently received the Illinois Groundwater Association's highest award - The Groundwater Science Award. I have selected five schools to highlight: Broadmoar School at Pekin, Brimfield Elementary School at Brimfield, Hollis Grade School at Peoria, Metcalf Lab School at Illinois State University at Normal, and Metamora Grade School at Metamora. These schools are generally representative of the project (i.e., city, suburban and rural schools.).

Brimfield Elementary has three classrooms teamed together for a school based project named "Ecobuddies" the by students. Classrooms are linked via the internet to each district building, and to students around the world. The students team up to study ecology themes and set up thematic "room bubbles" (i.e., fourteen by ten foot plastic modules.) to work in. Topics studied include air pollution, groundwater pollution, and soil conditions. Establishing this sort of classroom environment has engaged the students to direct their learning, while the teachers serve as facilitators from outside the room bubbles. These students become mentors to the primary students. Educators so often hear about new programs that are short lived. Not so at Brimfield...The middle school students advance to the high school where they in turn serve as mentors to the middle grade students. The contact person is science teacher Pam Fabish.



Above: Students of Jo Crow, Metamora, investigate surface contaminants. Buddy Rubison, Luke Maurer, Drew Packman, and Justin Mishler. At right: Naturalist Hal Gardner leading the prairie walk "Ecobuddies" at Brimfield Elementary School, Pam Fabish, teacher.

Pekin's Broadmoar students and teachers have made several Groundwater presentations to adult audiences including the Governor's Conference on the Management of the Illinois River System and the '96 Clean Water Celebration (CWC). This team is led by science teacher Dr. Ken Grodjest. Many people at Pekin believe the community became actively involved in Groundwater protection because of the school-based Groundwater education programs. The city of Pekin is the first in Illinois to become a nationally recognized "Groundwater Guardian" award recipient.

Hollis Grade School, led by teacher Karen Zuckerman, has achieved the high distinction of forming a partnership with the SUN Foundation at Washburn and provided training for forty additional "groundwater project" primary schools. Karen works as both the lead teacher at Hollis Grade School and the coordinator of the primary school Groundwater Project. Metamora Consolidated Grade School is led by science teacher Jo Crow. She says the students have not only been active in the classroom, but outside as well. Her students worked with members in the community to complete a tree planting project using trees that the students obtained at the '96 CWC. Metcalf Lab School at Illinois State University has been a community leader in the twin cities (i.e., Bloomington - Normal.). Science teacher, Fred Basolo, has taken his students from the classroom to the world, via the internet. Students traveled to Peoria to make presentations at the Governor's Conference on the Management of the Illinois River System and the '95 **and '96 Clean Water Celebrations.** The Metcalf student's effort's are supported in part by grants from the McLean County Office of Solid Waste Management.

Sponsors and organizers of the **Illinois Middle School** Groundwater Project could not have predicted all the unexpected positive outcomes born from this grassroots classroom-based community education project. To sum up the collective spirit that this project is steeped in, I quote Pam Fabish, project teacher, "What started as a novel idea at a workshop, ended up being sound educational practices that were exciting for students and teachers alike!".

The 1996 **Clean Water Celebration was highlighted in USA TODAY in April 1996 as one of fifty outstanding Educational** Community Solutions programs in the U.S. In August 1996, the Pioneering Partners Foundation recognized students and teachers at Hannah Beardsley Middle School at Crystal Lake (i.e., located in the northern region.) for their classroom activities including their participation in the Illinois Middle School Groundwater Project. This award includes many supports including $5,000 to the school. The teachers from Crystal Lake stated their collective efforts by saying, "...Your decisions - your environment - from water quality to total quality!". I couldn't agree more with them. This project gives me hope for youth, systemic educational improvement and a global viewpoint of our planet's capacity. This should be leading us collectively toward improving our management of the earth's finite resources.

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Home page: Http://www.siue.edu/OSME/river/river.html

SIX DAY SUMMER TRAINING PROGRAM IN RIVER STUDY

The Rivers Project located at Southern Illinois University at Edwardsville is accepting applications for two summer training programs on July 20-25, 1997 in Chicago or August 3-8, 1997 in Edwardsville. Participants will be interdisciplinarily trained in six curriculum areas that relate to river study - chemistry, biology, earth science, geography, mathematics, and language arts. This NSF developed training will be conducted by experienced staff and Rivers Project curriculum writers, who are also past participants. Lodging, meals, and materials are available. Cost for the training is $200 for the week. Graduate credits may also be earned. For an informational package please contact the River Project at tha above address.

RIVERS PROJECT CURRICULUM GUIDES

A set of six curriculum guides have been developed by the River Project, through an NSF grant to introduce water quality and river study into the nation's high schools. The six units are specifically designed to enable students to work together in learning about the environment and gain valuable hands-on experience while exploring on-going projects in their local communities. The six curriculum unit guides are for Rivers chemistry, geography, earth science, mathematics, language arts, and biology. The first three are back from the publisher (Dale Seymour Publications) and are available for $23.95. The remaining units are available in draft format and may be purchased for $12.00. Please direct inquiries to the River Project at the address above.

Lori F. Breslauer
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Phone: 312/922-9410 x627
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e-mail: breslau@fmppr.fmnh.org

A. WATSON ARMOUR III SPRING SYMPOSIUM AT THE FIELD MUSEUM "Biological Invasions: Consequences and Ecological Restoration"

On Saturday, April 12, 1997, The Field Museum will present the A. Watson Armour III Spring Symposium, "Biological Invasions: Consequences and Ecological Restoration." This one-day symposium will gather international and local scholars, environmental biologists and conservationists to discuss the impact and consequences of invasive species — plants and animals that invade (or colonize) a new ecosystem. Freed from predators, diseases and other factors that keep them in check in their original habitats, some of these biological invaders wreak massive ecological and financial havoc and are extremely difficult to control.

Some exotic invaders have made their way to the U.S. by accident — like the Zebra Mussel, which is believed to have arrived in the ballast water of a transatlantic ship. The U.S. Fish and Wildlife Service expects Zebra Mussels to cause $5 billion in damages by the year 2002. Other "invaders" are simply colonizing habitats made more favorable because of human-induced or other changes to the environment (e.g., Brown-headed Cowbirds invading farmland and agricultural fields). Still other exotics have been introduced deliberately by humans — for example, Purple Loosestrife and European Buckthorn have escaped our gardens and now choke local wetlands and forests, driving away native plants and wildlife.

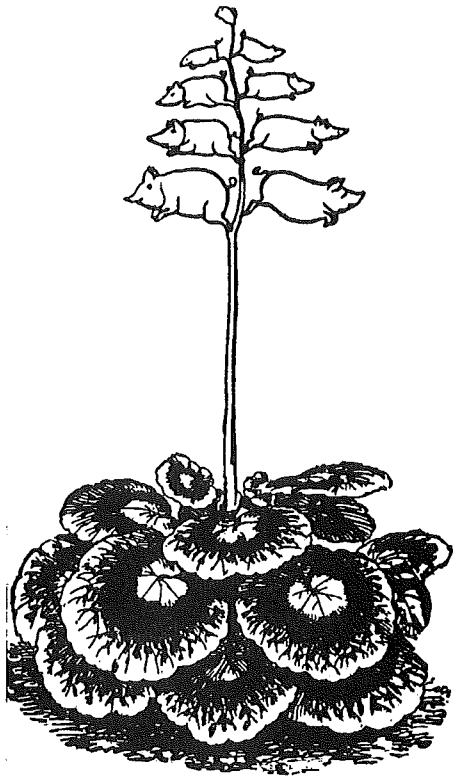
The migration of species into new habitats has always been part of nature. But the ever increasing ease of human mobility in the past 500 years, and the accelerating pace of human-induced habitat changes, have radically increased the numbers of species moving from one ecosystem to another. Introduced species are changing the very fabric of many natural communities, pushing already endangered species further toward the brink of extinction. Exotic species are estimated to have contributed to the decline of 42% of U.S. threatened and endangered species. Human interference has so amplified the magnitude and rate of biological invasions that this important evolutionary and ecological topic is now of great practical relevance, especially in conservation and ecological restoration.

The symposium will explore the biological and ecological characteristics that lead some species to become good invaders, the mechanisms through which exotic species are introduced, and the efforts that have been developed to control and manage "problem" species (see detailed schedule below). The talks are open to the public and are aimed at professionals and students in biology, ecology, anthropology, resource management and conservation biology. The symposium is also designed for teachers, particularly at the high school level, who are concerned with ecological, evolutionary or conservation issues.

The morning sessions will examine global biological invasions and human colonizations. Afternoon speakers will focus entirely on local invasions and ecological restoration. A noontime workshop for Chicago area land managers and volunteer stewards will focus on the biological riches of the Chicago region, and the critical dependence of these communities on conservation and restoration efforts. The symposium coincides with the first-year anniversary of Chicago Wilderness, a massive regional effort to protect and celebrate our rich biological heritage. Displays and activities in Stanley Field Hall will focus on the juxtaposition of a large metropolis and globally significant natural areas, and the concepts, practices and controversies centered around ecological restoration.

The registration fee is $40 ($20 students, $10 Volunteer Stewards). To register by mail, please send a check (please do not send cash) made payable to The Field Museum. All payments should be directed to Spring Symposium, The Field Museum, Roosevelt Road at Lake Shore Drive, Chicago, Illinois 60605-2496. For more information please contact Academic Affairs at (312) 922-9410 x559 or via e-mail at <symposia@fmppr.fmnh.org>.

The Field Museum's annual spring symposium is named in recognition of a major bequest through the will of A. Watson Armour III. The Board of Trustees of The Field Museum is deeply grateful to Sarah Wood Armour and her late husband for their many years of generous support. Their civic leadership and dedication to the advancement of culture and learning in the City of Chicago serves as an inspiration to us all.



MINI IDEAS

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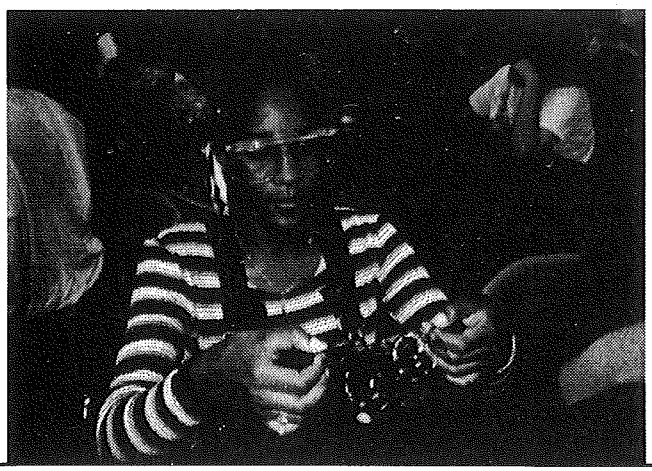
ATOMS FOR PEACE (BILL KURTIS' NEW EXPLORERS)

First a brief walk through nuclear history

460-316B.C.	Democritus had an idea that the universe is made up of tiny indivisible particles called atoms.
1808	John Dalton suggested that each chemical element is composed of identical atoms. Each element is different because it is made of different atoms. Now known as Dalton's Atomic Theory.
1896	Antoine Becquerel discovered radioactivity. Uranium salts un expectedly clouded a photographic plate.
1898	Marie and Pierre Currie found that uranium's ore pitchblend, is so radioactive that another radioactive element must be present.
1905	Einstein theorized that mass can be converted into energy.
1919	Ernest Rutherford discovered that atoms have tiny dense nuclei.
1938	Lise Meitner proposed that nuclear fission is possible.
1939	Otto Hahn and Fritz Strassman produce the first nuclear fission experiment.
1942	Enrico Fermi built first nuclear reactor at University of Chicago.
1945	First nuclear bombs dropped on Japan.
1951	First nuclear electricity made by an experimental breeder reactor built in Idaho.
1956	First commercial nuclear power station starts in England.
1979	Three Mile Island had no fatalities in this accident but turned public opinion against nuclear power plants.
1986	Chernolbyl, the largest disaster, had nuclear melt down and re leased radioactive materials into the atmosphere.
1991	First controlled nuclear fusion, JET (Joint European Torus) in England.
1996	Nuclear energy provides the United States with 20% of its electricity, second only to coal.



Let's get down to business and discuss the "F" word, fusion or fission. In simplest terms, fusion is the process by which two nuclei fuse to form a heavier nucleus. Fission is the splitting of the nucleus of an atom, also known as the splitting of the atom. The following activities are not only fun, but can convey these two processes, as well as the basic concepts of nuclear energy, clearly to all.

TINY BUBBLES

Purpose:
To demonstrate two separate processes which both produce nuclear energy. Fusion, which normally occurs in the interior of stars, or fusing of two nuclei to form a heavier element; and fission, splitting the nucleus of an atom. Both processes release tremendous amounts of energy.

Materials:
Baby food jar with lid
Solution of super bubbles*
2 Wands of the same shape

Procedure:
1. Place the two wands simultaneously into the super bubble solution.
2. Take the two wands out and pull them in opposite directions, forming 2 bubbles from one, or procuring nuclear fission.
3. Using the same procedure above, in step 2. after separating the 2 bubbles, combine them to form one larger one (fusion).

Discussion/ Notes/ Extension:
This activity is easy to follow, not to mention fun. An extension can be made dealing with water tension. Another off shoot can be encasing a student or students within a bubble, using a hula- hoop (for those of us who remember it the first time around), in a small tub or wading pool.
* The following ingredients will make the best and biggest bubbles.
1. 1 oz Dawn or Joy
2. 8 oz distilled water- not the designer favored just generic will do
3. 1 oz white or light Karo syrup

That's it—stir it together, but put in an air tight container, don't shake it because the froth from the shaking contains high concentration of carbon dioxide which is also known as Public Enemy #1 for bubbles.

THESE TRACKS WERE MADE FOR WATCHING

Purpose:

To produce a visual record of tracks made by nuclear particles.

Materials: *

Cover Blotting Paper
Container with Black Bottom
1# Dry Ice
Radioactive Source (Alpha Particle)
Flashlight
Alcohol

Procedure:

1) Remove cover.
2) Saturate blotting paper with alcohol.
3) Place cover on chamber.
4) Remove radioactive source from plastic tube and insert in hole on side of cloud chamber.
5) Place cloud chamber on dry ice. Ice should be large enough to cover the bottom of the chamber.
6) Allow a few minutes for cooling, so alcohol vapors become supersaturated.
7) Shine flashlight beam parallel to bottom of chamber and observe "vapor trail" as radioactive particles are emitted from source.

Discussion/ Notes/ Extension:

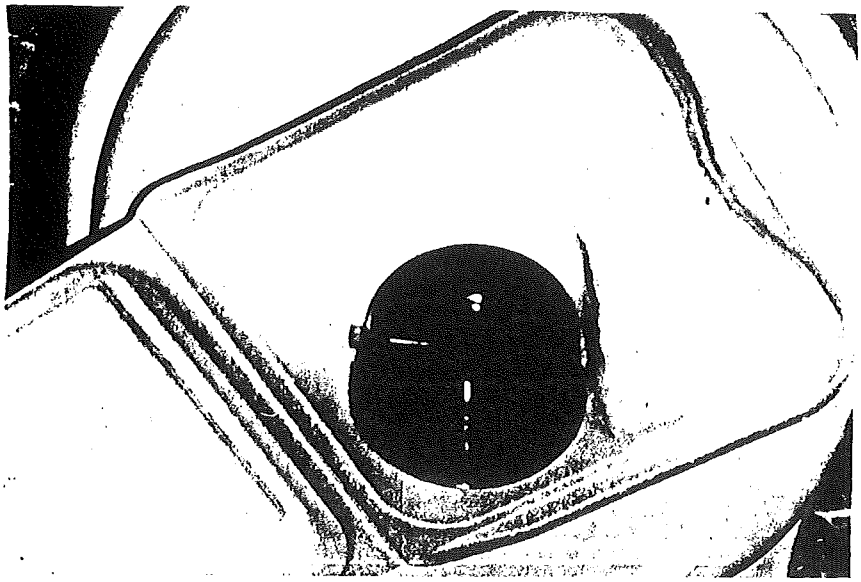
Using an alpha particle is one of the least radioactive sources available. (Remember that paper can stop alpha particles.) In researching these activities, the author found a source that stated a carbon dioxide fire extinguisher can be used in place of the dry ice.

The observer is viewing radiation indirectly, because our senses do not allow us to detect the presence of radiation. The cloud chamber produces a gas, dry ice and alcohol, which is the medium allowing the observer to view tracks produced by the alpha particles. This is similar to the vapor trail produced by jet planes in the sky.

Figures 2 and 3 are pictures of the purchased cloud chamber, and a picture of the vapor within the chamber, but the actual tracks are not visible.

*This kit can be purchased from Science Kit & Boreal Supply Co., 1-800-828-7777 for $29.50, item # 64712

FIGURE 2



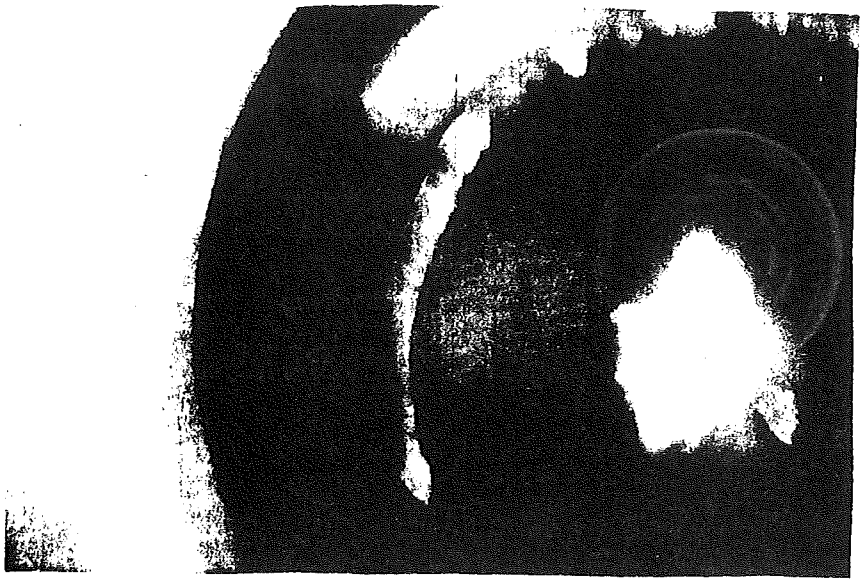
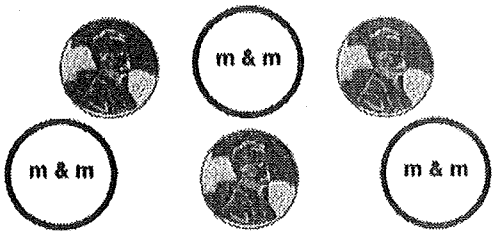


FIGURE 3

ONE (HALF) LIFE TO LIVE



Background:
Half-life is the time required for one-half of the sample of radioactive material to decay. One element's half-life may be a few seconds, while another's may be millions of years. There is no way to know when a particular element will decay, but by observing a large number of atoms of a particular element, the decay rate over a certain period can be statistically predicted. The radioactive substances that pose the greatest harm to humankind have neither very short nor very long half-lives. The short lose all activity so quickly that they are not dangerous. The very long half-life substances take so long to lose their radioactivity that their radiation is virtually harmless.

Purpose:
To learn more about "half-live" in radioactivity and predict how fast decay will take place in a radioactive substance.

Materials:
-50 pennies*
-container
-Half-Life lab sheet
**can substitute 30 m & m's (enjoy when completed)*

Procedure:
-Place 50 pennies* in container and shake.
-Pour pennies* on table.
-Take "heads-up" pennies* and place them in the first column.
-Repeat process with each successive column until all pennies* are used. (Skip a column if no "heads-up pennies" are tossed.)
**30 m & m's*

Conclusion:
1) What can you say about the shape of the graph?
2) How many throws does it take before you remove half the pennies (m & m's)?
3) How many throws does it take to remove the next half?
4) What is the "half-life" for this decay, measured in number of throws?

Element	Half-Life
Uranium-238	4.5 billion years
Potassium	1.3 billion years
Carbon-14	5,570 years
Cobalt-60	5.2 years
Thorium-234	24 days
Tellurium-206	4.2 minutes

GLOW LITTLE GLOW WORM

Purpose:
To replicate Antoine Henri Becquerel's discovery of radioactivity, using radioactive rocks and film, to see if it will leave an impression.

Materials:
4 Radioactive Rocks
1 Box Kodak Professional Film
10 Sticky Labels (Ektachrome 64)
Aluminum Foil

Procedure:
1) Label rocks with name on sticky labels.
2) Enter dark room, open film box, gently remove film, and place each rock on film.
3) Pull label off rock and place on film.
4) Repeat these steps for the remaining rocks.
5) After two full days, in total darkness, wrap the exposed film in aluminum foil.
6) Repeat the steps above, using new labels, expose the same set of seven days.
7) Wrap the seven day exposures also in aluminum foil, label each package either 2 or 7 days.
8) Take exposed film to professional film processor to be developed.

Discussion/ Notes/ Extensions:

Of all the activities presented, this was the most interesting, difficult, frustrating, and amusing. The author has gained new respect for the blind.

The first hurdle to overcome was addressing the replication of this discovery. Sources differ on the fact, whether Becquerel intentionally, or accidentally placed the radioactive rock on the photographic plate. One source uses a 2 day exposure frame and other sources give none. The 2 sets of data i.e. 2 and 7 days were arbitrarily selected.

The second hurdle was finding someone whose rocks were radioactive. Luckily, science teachers in general are a generous lot, and a colleague volunteered his rocks.

The third hurdle was trying to explain this activity to the experts at Wolf Camera in Skokie. They were most helpful after the laughter died down. The film listed in the material section was selected. This film is not a negative, but a positive. Basically, Figures 5 and 6 are the inverted vision of a normal photograph. The black is white and the white is black, otherwise everything remains the same. The author was assured that the integrity of the product would not come into question.

The most difficult obstacle to overcome was entering a totally dark room, opening the film, while trying to keep the sticky labels on the proper rocks, and using the sense of touch to "see" what one was doing. This may seem trite, but be assured, the urge to turn on the light to see what one was doing was great! It was this part that the author gained respect for the blind.

The four radioactive rocks used in this activity were Torbernite, Uraninite, Metatorbernite, and Corvusite. They came from a kit from Earth Science Materials, Inc., 1900 E. Lincoln, P.O. Box 2121, Fort Collins, Co. 80522. All are considered radioactive, but one needs to consider the level of radioactivity if this company is selling this kit to the public. All these rocks are considered minerals associated with the mining of uranium.

The reader may be wondering why this activity was chosen. How many times have you gone somewhere, such as a hospital, where people are wearing badges? Where did this idea come from? Those badges were developed to record the amount of radioactive exposure given over time.

THE GOOD, THE BAD, AND THE UGLY OF NUCLEAR ENERGY

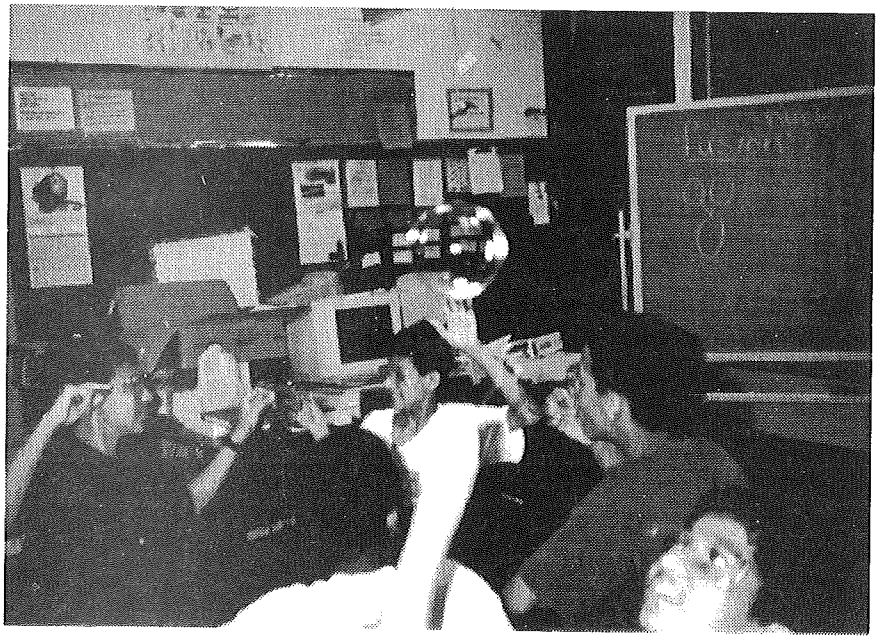
Homo sapiens are born with five senses. Some of us may be blessed with a so called sixth sense, but that's all there is. These senses enable us to fend for ourselves, alert us to danger and self preservation. How can we protect ourselves from radiation? We are exposed to varying forms of radiation daily. There is nothing within our internal structure to alert us to this type of exposure. Smoking, flying, specific locations of residence and elevation, all determine amounts of radiation that we are exposed to. Radiation or radioactive isotopes are in consumer products from cosmetics, sterilization of talcs, and in home smoke detectors.

The Atoms for Peace video depicts the negative aspects of nuclear energy. We have all heard and read about Three Mile Island, Chernobyl, core melt downs and every negative aspect regarding nuclear energy. Lets face the facts, we have had accidents, we have had problems resulting in grave consequences. Nuclear waste is a definite problem which needs our immediate attention. These are all facts. What are we going to do in the future, beat a dead horse? We can harp on the negatives till the cows come home. Where is this going to leave us? What are our options once all our fossil fuels run out? Solar energy is terrific! How many of us remember the 30 plus days a few years ago in November, most people went through light deprivation, during this period. This past Spring, how many rainy days did Chicago have? Let's face the fact, Chicago, and the Midwest aren't known for bright sunny days. Next question- what are our options after solar energy? Whether or not we are in favor of nuclear energy, **it is the future.**

There are positive outcomes to nuclear energy. Is there anyone here who does not know someone who has had cancer and that someone has gone for radiation treatments? How about radioactive tracers being placed within the human body? The tracers or "tags" allow scientists to study how and where the human body processes current or new drugs. These procedures use nuclear waste to make a negative into a positive. Technology has developed a gamma knife, which aims radiation at an exact spot and replaces the scalpel in surgery.

Industrial applications include the automotive industry which uses radiation in testing the steel in the manufacture of cars. Highway contractors use radiation to measure the density of pavement, paper, sheet metal, aluminum cans, and foils, and plastic wraps use high sensitive radioactive gauges to control the thickness of their products. The list of applications are extended daily. Nuclear energy and its by products are here to stay.

Our astronauts were one of the first guinea pigs to consume irradiated food in space. The process they used consisted of sterilization by ionizing radiation. The process preserves food without refrigeration or freezing, which can be problematic in extended space flights. There are two types of irradiation, the first being pasteurization which induces low level radiation, and the second is sterilization with high doses. Consuming irradiated food, contrary to popular belief, **does not** make you glow in the dark or make you radioactive.



Radiation doses in the processing of food are measured in "rad" which is **radiation absorbed dose.** The definition is the quantity of ionized radiation resulting in the absorption of a measured amount of energy. (The kilo rad has 1,000 Krador the megarad 1,000,000 Mrad are practical levels of radiation.) Depending on the specific process pasteurization or sterilization the regulation of doses are important. An example of pasteurization would be the keep onions and potatoes from sprouting, disinfects grains and cereals from insects, and deactivates the Mediterranean Fruit Fly in fruits. This process is becoming common in produce and dairy products to prolong shelf life of these commodities and prevent spoilage.

The World Health Organization (WHO) has approved this process for consumable food world wide. "One of the study's aim was to determine whether the chemical substances produced in foods through **irradiation,** called radiolytic products, could have toxic effects for consumers. The findings are entirely reassuring in this regard. Almost 40 years of research shows that radiolytic products resulting from **food irradiation** are very similar, if not identical, to those found in unprocessed **food, or in foods,** that have been processed using conventional methods."[1]

Salmonella contaminates 60% of our poultry industry. Irradiation of the poultry would eliminate this problem. The FDA and the USDA approved this process years ago, yet well known companies such as Tyson Chicken refuse this process because of "bad press", and the ever dreaded "N" word. Tyson Chicken is in contact with Texas A & M and keeping current on the latest research, but fear of consumer's wrath have kept them from this process.

In conclusion, good can come from the bad and the ugly if we allow it. Nuclear energy is here to stay. It is up to us to educate the public on the benefits, and support research in the resolution of the problematic areas.

1. WHO Studies Safety and Nutritional Adequacy of Irradiated Food. P. 107

Special Thanks to Dr. Sam Bowen from Argonne National Labs for his guidance in all the activities.

Al Fleming
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TOOTHPICKS, PENCILS, AND VECTORS

Introduction

Although the use of vectors is one of the fundamental tools used by physicists and physics students alike in mechanical physics, the conceptoften proves less than exciting to work with and difficult to comprehend. In response, I use two approaches to demonstrate how vectors can be used to explain motion, forces, gravity, etc.

Demonstration

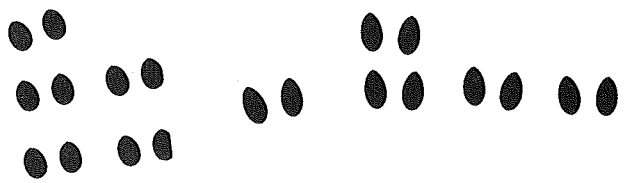
A simple demonstration of vector addition is to use toothpicks on the overhead projector to represent vectors. Buy the flat kind (so they won't roll around) that have a point on one end and a blunt end on the other. Force vectors are a good example to illustrate. The length of the toothpick represents the vector magnitude and the pointed end represents the direction of the force vector. Take five or six toothpicks and make them various lengths (magnitudes) by breaking off the blunt end of each toothpick. Now each vector has a different magnitude. Place the toothpicks, points radiating (tails touching) from one spot, on the overhead projector. It can then be demonstrated, for the entire class to see, how vectors are added. Students find this very helpful because they can all see that adding one vector to the next, by sliding it head-to-tail, does not change the direction of the vector that has been moved. It is also obvious that the resultant vector that forms, after all vectors have been added, is responsible for disequilibrium of the forces. The same problem can be repeated by replacing the force vectors in their original positions and then adding them again, this time in a different order. The resultant vector producing disequilibrium is always the same. This demonstrates that the order of vector addition is not important.

Small-Group Exercise

To reinforce the concept, have students in small groups of three to four (at a lab table) use pencils to repeat the demonstration for themselves. Have them place their pencils, eraser ends touching, at a point. Taking turns, each student can add a vector to another until all vectors have been added and the resultant vector identified. The pencils will normally come in various sizes (magnitudes) and the students can arrange (direction) and add them as they like.

Conclusion

This simple, inexpensive exercise provides students direct hands-on experience as soon as the concept is introduced. As they work at solving a problem they have designed, I have the opportunity to go from group to group to immediately assess their comprehension and provide feedback. It is also an opportunity for me to directly observe critical thinking skills and work with students in small groups.



MEETINGS AND WORKSHOPS

Dr. Bob Williams
.Box 2222
Southern Illinois University
Edwardsville, IL 62026

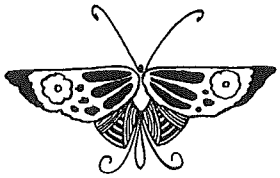
ICELAND, ENGLAND, & GREENLAND STUDY TOUR

SPONSORED BY: Southern Illinois University at Edwardsville for teachers who wish to develop their expertise in science and environmental education. Content will focus on exploring the natural and cultural history of Iceland and the museums of England. A Greenland trip will be possible as anextension. Limit: 20.Call as soon as possible for reservation. Plane reservations can be made by calling Cheryl at Travel Express 1.800.783.8101. For Information call 618.692.3788 or FAX 692.3359 or Email: rivers@siue.edu

Registration is on first-come-first-to-go basis.

27 June F Depart, Fly to Baltimore; Icelandic Air, 8:00 PM
28 June Sa Arrive Reykjavik, check in hostel, Explore city on foot
29 June Su Depart N. Thingvellir NP. Langjokul Glacier, Camp
30 June M Holtavorduheidi, Akureyri, Godafoss Water Fall,
1 July Tu Lake Myvatn, Skutustadir, Krafla volcano area, Camp
2 July W Kjolur Highlands, Geysir hot springs, Return Reykjavik
3 July Th Blue Lagoon with Icelandic teachers
4 July F Fly to London, Stay Kings College Campus,
5 July Sa British Museum
6 July Su Old Royal Observatory, Greenwich
7 July M British Museum of Natural History
8 July Tu Kew Garden
9 July W Victoria and Albert Museum, Science Museum
10 July Th Museum of Mankind
11 July Fr Field Trip to the Stonehenge and Chester, hotel
12 July Sa Field Trip to the Stonehenge and Chester, hotel
13 July Su Depart England, Stop Iceland and Baltimore, home
14 July M Optional 3-5 day trip to Greenland

Dr. Marylin Lisowski
Eastern Illinois University
600 Lincoln Avenue
Charleston, IL 61920
(217)581-5728
cfmfl@eiu.edu



AN INVITATION TO EXPLORE AND EXPERIENCE THE WILD AND WONDERFUL

Costa Rica is a land of unparalleled ecological diversity. Lowland jungles, high altitude cloud forests, black sand and coral beaches, mountainous paramos, over 40 volcanoes and some of the finest tropical white water rivers found anywhere are all carefully preserved by one of the most remarkable national park systems in the world.

Costa Rica stands like a bridge, spanning the gap between two of Earth's major continents. Its strategic geographic location gives it a unique biological make-up, combining the southern range of North American species of fauna and flora with the northern range of South American species. With over 10% of its total area protected in natural parks and reserves, it is easy to understand how Costa Rica has earned its reputation as the "Wildlife Sanctuary of the Americas." If you would like to explore and experience the lowland tropical jungles, high altitude cloud forests, the black sand and white coral beaches and dazzling reefs of Costa Rica then this ten day nature expedition may be for you.

This memorable excursion begins August 2, 1997. For more information and a brochure on this all inclusive educational adventure contact Marylin Lisowski at the above address.

Astronomical Society of the Pacific
390 Ashton Avenue
San Francisco CA 94112
lkeechler@aspsky.org
415.337.1100 or fax: 415.337.5205
http://www.aspsky.org

THE UNIVERSE IN THE CLASSROOM—A WORKSHOP ON TEACHING ASTRONOMY IN GRADES 3-12

June 27 & June 28, 1997

Presentations, discussions, hands-on demonstrations, free resources included. To be held at the Hyatt Regency in Chicago. sponsored by the Astronomical Society of the Pacific at its 109th Annual Meeting. CEU's are available.Write to the above address for more information.

1997 ILLINOIS NET WORKSHOPS NOURISHING MINDS AND BODIES

Most workshops are approximately 60 minutes in length, but could be adapted to fit your time requirements. The hands-on workshops require 90 minutes.

TEACHERS

The A...B...Cs and 1...2...3s of Good Nutrition for Tots

Encouraging preschool children to make wise food choices can be as easy as A...B...C or 1...2...3. This workshop will focus on the 1995 Dietary Guidelines for Americans and will include a variety of hands-on activities, snack ideas, and parent education information. (Child Care Staff, Grades PreK-1 Teachers)

Cooking Up the Pyramid

Cooking activities at home and in the classroom encourage young children to try new foods. Kids also learn new vocabulary, polish math skills, develop fine motor skills and much more while working with the food activities shared. (Child Care Staff, Grades PreK-3 Teachers)

Meet the Five Food Groups

Learning about good nutrition can be fun for young children when the information is presented through fun classroom activities, children's literature, games and flannel board stories. Participating sites will receive a curriculum based on the five major food groups found in the Food Guide Pyramid. The longer session includes an opportunity to make educational resources for the classroom. (Child Care Staff, Grades PreK-2 Teachers)

Healthy Start

Good eating habits not only affect a child's growth and development, but also their ability to learn. This workshop concentrates on how to meet the nutritional needs of young children. Participants will be given suggestions for easy to make healthy snacks for young children. (Child Care Staff, Parents)

Well Read, Well Fed

Explore ways to help children learn about food and encourage good eating habits through literature. Classroom activities and snack ideas that coordinate with storybooks will be shared. Participating sites will receive a copy of an early childhood nutrition education resource book. This workshop is updated annually to include new books. (Grades PreK-2 Teachers)

Multicultural Make and Taste

Discover how to use food activities as a springboard for cultural exploration in the classroom. Children learn best through their senses. By seeing, touching and tasting foods from around the world, they learn to appreciate diversity. Multicultural recipes will be provided in this hands-on workshop. (Grades PreK-3 Teachers)

Take a Bite of the State Science Goals

Integrate nutrition into the elementary science curriculum using proven, hands-on science activities that will help teachers meet the Illinois State Science Goals. (Grades 3-6 Teachers)

Pyramid Power

There is more to the Food Guide Pyramid than meets the eye. This workshop provides a variety of hands-on activities to convey the Food Guide Pyramid message to students and will help meet the Illinois State Goal For Physical Development and Health Education. (Grades K-6 Teachers)

Pyramid Plus

Nutrition + Fitness = Health. This workshop shares lessons and activities to encourage students to make healthy food choices and exercise regularly. Participating sites will receive "Pyramid Plus,": a program for teens based on the Food Guide Pyramid. (Grades 7-12 Health Education Teachers, Consumer and Family Science Teachers, Physical Education Teachers, Coaches, and Nurses)

Nutrition: It's a Family Affair

Healthy eating habits begin at home. Parenting is a complicated business, but good nutrition doesn't have to be a mystery. Learn how to encourage healthy eating habits at home with breakfast and snack ideas. (Parents)

A Game Plan for Sports Nutrition

Many athletes are physically fit, but not nutritionally sound. Learn how diet affects athletic performance and how you can help athletes win with food. (Consumer and Family Science Teachers, Health Education Teachers, Coaches, and School Nurses)

FOOD/CHILD NUTRITION STAFF

Healthy Cuisine for Kids

This hands-on workshop will take you step-by-step through planning and preparing lowfat meals. Modify recipes to cut the fat, learn how to select lower fat menu items and combine food items for more healthful meals.

You Make the Difference

Student acceptance of more healthful meals depends on you. Keep your student participation up by using proven techniques that help students adapt to change. Learn how to successfully market new menu items from selection to service.

Setting Sail for the Dietary Guidelines

Learn through the experiences of 15 Illinois schools that set out to serve meals consistent with the Dietary Guidelines. The successes and challenges they met in purchasing, food preparation and marketing more healthful meals are explored. The workshop ends with recommendations for making your voyage successful.

Cafeteria Connection

Food/nutrition staff are encouraged to take an active role in nutrition education and to use the cafeteria as a learning laboratory. Developing partnerships with other disciplines: Physical Education, Consumer and Family Science, Health Education and Computer Science will only increase nutrition awareness and improve the success of a food/nutrition program.

ABOUT OUR WORKSHOPS

Our programs are available free of charge to teachers, parents of school children, coaches, school nurses and food service employees. No classroom presentations are available. The suggested audience for each of our workshops is indicated after the workshop description. Most workshops are approximately 60 minutes in length, but could be adapted to fit your time requirements. The hands-on workshops require 90 minutes.

Two or more programs can be presented on the same day, if desired. The same workshop can be presented twice at conferences or institute days if you think it will be a popular choice.

An audience of at least 15 people is required. If your center's staff is small, please consider inviting other area centers who may be interested in attending a NET workshop at your center.

A maximum of 30 participants works best with Well Read. Well Fed; Meet the Five Food Groups; Multicultural Make and Taste; and Cooking Up the Pyramid.

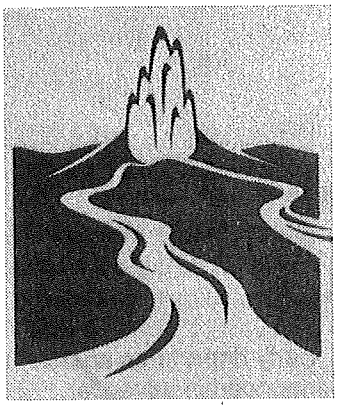
Workshops are scheduled on a first come, first served basis. The sooner we have your request, the more likely the desired date will be open. We hope we can assist you in encouraging good eating habits in children!

Please return form to either:

Deborah Rees, R.D., L.D.
Northern Illinois NET Center
245 W. Exchange Street, Suite 4
Sycamore, Illinois 60178
Phone: 815-895-9227
800-466-7998
Fax: 815-895-2971
or
Cathy Ludwig-Bell, M.S., R.D., L.D.
Southern Illinois NET Center
1006D N. Carbon Street
Marion, Illinois 62959
Phone: 618-997-3759
800-831-7836
Fax: 618-997-2557

PROJECT LAVA

Learning About Volcanic Activity



Would you like to spend six days exploring one of the world's most active volcanoes? If so, Project LAVA is for you!

Project LAVA, a course for K-12 science teachers, is conducted on Kilauea Volcano in Hawaii Volcanoes National Park on the island of Hawaii. Two six-day sessions are offered this summer.

June 19-24 and July 10-15, 1997

(Thursday through Tuesday schedule allows you to take advantage of less expensive weekday airfares to Hawaii)

In Project LAVA, you will learn about volcanic processes ... explore lava tubes and cinder cones ... feel the heat from steaming ground cracks ... witness Kilauea's current eruption ... collect volcanic rock samples for your classroom ... photograph lava trees, craters, and other features of Hawaii's volcanic landscape ... and take home educational materials to enrich your volcano teaching unit. Classroom sessions, which include demonstrations, hands-on activities, and lectures, are followed by field excursions that provide "real-life" experience on an active volcano. The course topics and field sites are shown on the tentative schedule on the back of this page.

Janet L. Babb, who holds degrees in education and geology, conducts the course in cooperation with Hawaii Volcanoes National Park and Eastern Washington University. She has been involved in education for more than 20 years as an elementary school teacher and as a geology instructor at universities in Hawaii and on the mainland. She now works part-time for the U.S.G.S. Hawaiian Volcano Observatory and shares her knowledge about volcanoes and enthusiasm for science education through courses and workshops for teachers.

Project LAVA participants are housed in rustic cabins at Kilauea Military Camp (KMC) near the summit of Kilauea Volcano in the National Park. Meals are available at the KMC cafeteria and snack bar. Food items and miscellaneous supplies are also sold at the KMC general store.

The cost of the six-day course is $595, which includes housing (seven nights), ground transportation from/to the Hilo airport and during all field excursions, and instructional materials. Optional university credit is available for an additional fee of approximately $100. Airfare is not included, and participants must make their own travel arrangements to Hawaii. Participants are also responsible for their meals during the course. Registration is limited to 20 teachers per session and is on a first-come, first-served basis. **Registration deadlines: April 30, 1997 for June course; May 15, 1997 for July course.**

For registration forms or more information, contact:
Janet Babb
Project LAVA
P.O. Box 794
Volcano, HI 96785
TEL/FAX: (808)985-8972
E-mail: jbabb@aloha.net

REVIEWS

Reviewed by Betty Collins, Sagle Elem. School, Sagle, ID.
Submitted by April Whitt
Fernbank Science Center
156 Heaton Park Dr. NE
Atlanta, GA 30307-1398

Breathing, Anna Sandeman, Copper Beech Books, Brookfield, CT, 1995, ISBN 1-56294-620-X.

Did you know that in 24 hours you breathe in nearly 2, 200 gallons of air? Or that a sneeze can explode at a speed of more than 100 miles an hour? These are some of the interesting facts that are scattered throughout this delightful book on breathing.

The author introduces and discusses in simple text and colorful illustrations such concepts as why breathing is necessary, how breathing works, what happens when a person breathes slowly or rapidly, and even breathing problems. The unique combination of photography and artwork helps to clearly illustrate how the inside of the body looks, making it easier for students of all ages to understand how breathing works more thoroughly.

A variety of easy projects are included to further involve students. One such activity is to measure the expansion of your rib cage. This is a simple means to see how large your ribs need to stretch to allow room for the air you breathe.

This book can serve as an excellent resource for students who want to know how breathing works. Students and teachers alike will find the table of contents and index very helpful. A factual "Did you know?" section is also included. To learn more about the body, look for three other books on eating, bones, and the senses in this Body Books series.

Clever Kids: Science Ages 5-7, World Book, Inc., Chicago, IL, 1995, ISBN 0-7166-9204-X.

This workbook-type formatted book on science activities for young children has a bright, colorful cover to catch one's eye but that is where the attraction ends. The science activities are a repeat of many other books. They are the usual topics of plant parts and growth from seeds, rocks, dirt, air, water, feeding animals (i.e. birds and small creatures), and seasons. These are all great ideas for the very young child to explore. However, this book is written as if the children who use it are able to read and write competently. Many children at this level are not able to read or write very well so adult assistance would be necessary to use this book.

Some of the concepts are not age appropriate. It would be very difficult for a youngster of this age to understand such ideas as the water cycle, earth's rotation, and dew. This "richly illustrated book" is merely mediocre black and white line drawings. It does contain a table of contents, a list of needed items for each main activity, and some helpful hints listed with each activity to help explain or extend each activity. The positive aspects of this book are not enough to make me want to purchase this book. I would look elsewhere for a better quality book in which to invest my money.

Clever Kids: Science Ages 8-10, World Book, Inc., Chicago, IL, 1995, ISBN 0-7166-9206-6.

This publication by World Book is an appropriate answer to providing an easy to follow, simple activity-oriented book for children on science. The topics focus on questions children are curious about. Each activity is complete with a list of necessary items needed. Most of the items are simple household products or are easily obtained. The steps for each activity are organized numerically. Some cautions are noted where hot water or chemicals (i.e. ammonia) are used. Parents should be aware of these when their child is busy testing out an activity. Some of the activities do not carry caution remarks. "You've Got Some Nerve(s)!" uses pins to test the sense of touch on skin and carries no warnings. Many new vocabulary words along with their meanings are introduced throughout the book such as geotropism and isosceles. Children of this age usually enjoy learning new words.

A bright, colorful cover and table of contents also make this book attractive to look at and use. Another feature is the answer key in the back of the book. This contains more complete explanations to some of the puzzling concepts a child may experience. This book would be a good start for children of this age who are interested in science and need some guidelines as well as fun activities to start them learning about science.

Bones, Anna Sandeman, Copper Beech Books, Brookfield, CT, 1995, ISBN 156294-621-8.

Students and teachers who are looking for an informative book about bones should get this volume. Among the many topics covered are what bones are made of, how your spine allows you to move, the importance of the skull bones, and how your bones grow.

The unique combination of artwork and photography illustrates very well how bones look on the inside of our bodies. The clearly written text explains about bones as well as including those special facts that children love to learn. The colorful format draws the reader in find out more.

This book could serve as an excellent resource on bones. A table of contents, an index, and a "Did you know?" fact section are also included. Projects such as counting your teeth or measuring the length of your thigh bone are not what I would consider "...lively projects" as the cover refers to. Teachers would need to use other resources for hands-on activities to supplement the information in this book. To learn more about the body, check out the other three volumes in this Body Books series on eating, breathing, and the senses.

MATERIALS SCIENCE AND TECHNOLOGY (MAST) CURRICULUM MODULES FOR HIGH SCHOOL SCIENCE STUDENTS

Teacher Professional Development Workshop University of Illinois Department of Engineering June 23-27, 1997

We would like to invite local teachers to participate in a pilot workshop related to an NSF-funded high school curriculum on materials science and engineering, developed by the University of Illinois Department of Engineering faculty working in conjunction with high school science teachers. The recently published curriculum includes seven modules on the following topics: semiconductors, metals, concrete, polymers, ceramics, composites, and energy. The modules can be used in whole or in part to supplement many traditional science courses or programs, such as chemistry, physics, earth science, tech-prep, and general science. Individual modules can also be used as integrated science units or the entire curriculum could be used as an integrated secondary science course.

We plan to continue to involve teachers in interactive workshops which will facilitate familiarization with the modules as well as support furthur curriculum development activities.

Specifically, teachers enrolled in the workshop will:

- Become acquainted with the materials engineering content of the current MAST curriculum modules through both formal presentations by engineering faculty and hands-on laboratory activities
- Explore teaching concepts and strategies which support a student-centered, active learning (i.e., constructivist) approach to science education
- Engage in the development of teaching plans and activities for implementation of the MAST curriculum, including consideration of computer network-mediated educational projects

Additional Information:

- Teachers enrolled in the workshop will also be enrolled in MatSE 390, and will receive 2 hours or 1/2 unit of college credit
- Lunches and refreshments for breaks will be provided
- The workshop will be held on the U of I campus at the College of Engineering; parking will be provided
- The workshop will be conducted by faculty and staff from the Colleges of Engineering and Education
- Follow-up support will be provided for teachers who implement the modules in their classrooms

Teachers interested in participating in the workshop should complete and submit the attached form. Additional information will be sent to potential participants, including a specific agenda, details on location and parking, etc.

Materials Science and Technology: Discovering the World Around Us

Please complete and return the information below to indicate an interest in participating in the MAST workshop. Thank you!

Name: _____

Mailing Address: _____

_____

Phone: _____

e-mail address: _____

Subjects and grade levels taught: _____

_____

Please indicate below if you have a specific interest in one or more of the MAST module topics:

Return by April 18th to:

MAST Workshop Registration
Department of Materials Science and Engineering
University of Illinois
1304 W. Green Street
Urbana, Il 61801

AWARDS AND RECOGNITION

David M. Stone, Teacher-Advisor
dstone@uni.uiuc.edu
University Laboratory High School
Urbana, Illinois

ADVICE TO OTHERS CONTEMPLATING EXPLORAVISION PARTICIPATION

APTA - Advanced Prosthetic Technology Arm — 1996 ExploraVision Competition, High School Division First Place Project

Competition Overview

ExploraVision, a competition jointly sponsored by the National Science Teachers Association and Toshiba, challenges students to work together in teams to select a technology, research the history behind that technology and develop a vision of the state of that technology and its societal impact twenty years from now. ExploraVision, the largest international science competition in the world, involved almost 20,000 students at four grade levels (K-3, 4-6, 7-9, and 10-12) last year.

Team Creation

This is the third year that University High School has been involved in the ExploraVision competition as well as the third year that I have served as teacher-advisor of a team. Each year, students are made aware of the ExploraVision competition through 1) announcements in their science classes, 2) posting of ExploraVision informational posters on bulletin boards and 3) informal conversation with science teachers. Each year, a group of three to four interested students have approached me to express interest in participation. In each case, I played no role in team selection. Once teams are established, I meet formally with the students during a lunch period or after school every other week to 1) determine the team's intial topic, 2) determine each team member's area(s) of interest and effort and 3) discuss individual/team progress since the last formal meeting. Students typically meet and work for several hours in a library, computer lab or at the home of one of the team members between our formal team meetings.

David Stone, parents, winning students Daniel Beedy, Richard Lin, Balázs Bognár, NSTA Rep. Carol Van De Walle, and Rep. Ewing's legislative assistant Jim Eichhorst.

Creating a Successful Team Environment (Regional Competition)

It is essential that students develop their own vision of the future. Ideally the project should begin early enough that students can take a week or two off from the project during "crunch" times during the school year or athletic season. Team meetings should be casual, enjoyable opportunities for individuals to share their thoughts as they develop their vision of the future. The first round goal of the team should be completion of a well written proposal and a set of well drawn, logically sequenced storyboards that meet the high expectations of all of the team members. During the first round of competition my main role as advisor has been 1) assistance in initial organizational efforts, 2) coordination of individual team member and group efforts, 3) anticipation of/assistance in resolution of team member conflicts, 4) assistance in proofreading of final drafts and 5) assistance in copying, collating and final mailing of the first round entries.

Creating a Successful Team Environment (Final Competition)

There are few things more exciting than being a member of a nationally acknowledged team. In fact, much of our team's motivation second round motivation came from the acknowledgement received through local and national media. The main roles of the teacher-advisor outlined in the paragraph above continue, though the production of the videotape for the second round of competition requires considerably more time and effort than do the first round advisory activities. Additional second round responsibilities included 1) assisting in procuring video equipment and props students determined to be essential for video production,

2) scheduling appointments with discipline-specific authorities for interviews to be incorporated in the videotape and 3) organization of large blocks of time after the normal school day, on weekends and during Spring Break for team video production and editing efforts. Teacher-advisors can considerably reduce the stress students experience during this round of competition by planning as far ahead as possible and anticipating potential problems the students may encounter in their efforts to complete the final video in a timely fashion. The 25% probability of being awarded a trip to Washington DC and a $5,000-$10,000 savings bond served as excellent motivators during this round, though they may also catalyze conflicts regarding team member's relative efforts and contributions. The teacher-advisor needs to be particularly vigilant and ready to head off minor conflicts as the video deadline approaches.

Video Production Background and Suggestions

Video production turned out to be the most time consuming and frustrating aspect of the competition for our team, though in retrospect it was probably one of the best learning opportunities team members encountered during their high school careers. We began by developing an outline for the video based on the storyboards submitted during the first round. We chose to produce and edit the entire video on a Macintosh Power PC 7200/70 using two VHS video cameras, Avid Videoshop™, Morph™ and MacRender™. We obtained some introductory video footage from a local news station and taped a number of scenes using student volunteers. In retrospect, we went much beyond our expertise (and the capabilities of our video editing software package) in the production, resulting in numerous time delays and hundreds of hours of computer hardware and software problems prior to completion of the final video. Our major problems centered around transfer of the components of the final product to videotape. I suggest that other teams advancing to the second level of competition do much of their filming and editing directly on/from VHS tape and avoid reliance on a single software package. We found Avid Videoshop™ to be well suited to production of many individual components of the video with its particular strengths being soundtrack production and modification. Its weaknesses as a video editing tool center around its limited capabilities in final transfer of the produced video to a smooth running VHS format. Better video-editing software can now be obtained for less than $100. MacRender™ is a wonderful tool for the production of rendered simulations, though the learning curve is somewhat steep and the team must allow significant numbers of entire evenings and weekends for the computers to fully render student assigned information. Morph™, an image conversion software package, is extraordinarily easy to use, fast and efficient. We were able to produce approximately 10 seconds of production quality footage in ten minutes using this software package.

Successful Project Proposal Suggestions

I've found that the best way to jump-start the creation of a successful entry is to encourage interested students to regularly read a number of science/technology magazines such as Discover and Scientific American to develop an appreciation of new, developing technologies while, at the same time, pursuing their own interests in scientific and technological fields. Preliminary reading should ideally be done several months prior to the initiation of the project. I believe much of our success in advancing to the final round can be attributed to the melding of a number of different technologies (prosthetic arms, memory metals, advances in cell culture and nanotechnology) that are presently considered to be distinctly separate areas of scientific/technological endeavor. I also recommend that any team considering ExploraVision participation look over the array and types of topics selected by winning teams from prior years in the early stages of project selection, though the final decision regarding topic should be based largely on student interest. On the other hand, we were unaware of the fact that a prosthetic arm was the winning technological product in the 1994 ExploraVision High School Division. Had my students known been aware of a mechanical arm's high placement in past a past year's competition, they may very likely have selected a different direction of development entirely. In closing, I think all potential teacher-advisors need to be aware that creativity and technological interest are equally important in the development of a winning project. Diversity in interests and talents among team members should be encouraged. Strong writing skills and artistic/graphics skills are as important as technological understanding of the area(s) of interest during the development of the paper and storyboards for the first round of competition. An interest in video production and a willingness to experiment with whatever equipment can be begged or borrowed is more important than having access to high quality video production equipment during the second round of competition. Above all, a good sense of humor, a desire to get together with friends to collectively pursue a vision and a willingness to learn as the project progresses go a long way toward making ExploraVision participation the exceptional learning and growing experience that it has been for all members of the University High School ExploraVision team during the past year.

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Nick Hockings is a member of the Lac du Flambeau, Wisconsin, Band of Lake Superior, Ojibwe Indians. He is a traditional pipe carrier, Drum Chief of the Chi' De' we-gan Society of the Ojibwe and a certified Ojibwe language and culture teacher.

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➳For information concerning course requirements*, tuition, fees, and other course details contact:

Dr. Clifford Knapp
P. O. Box 299
Oregon, IL 61061
(815) 732-2111 or (815) 753-0205 or FAX (815) 732-4242.

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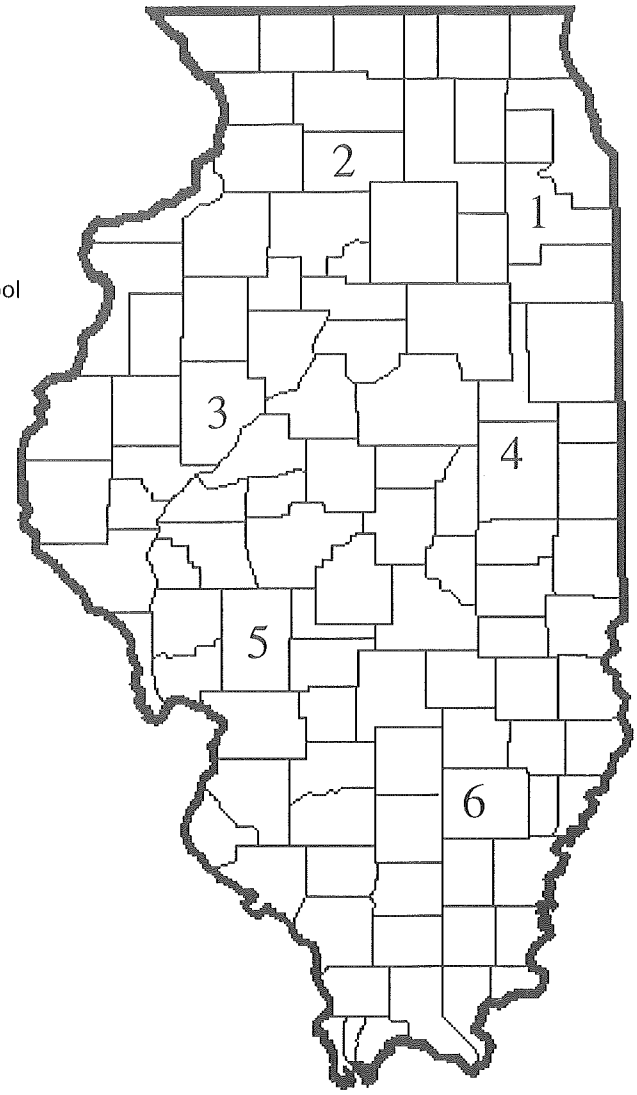

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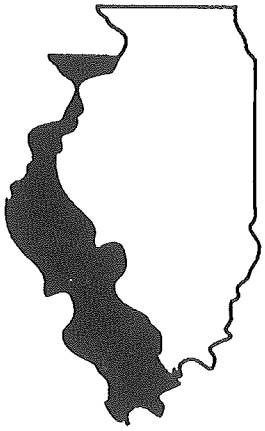

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DEVELOPING ACTIVITY-BASED SCIENCE CURRICULUM FOR THE ELEMENTARY GRADES: BUILD ON SCIENCE, PART 1

INTRODUCTION

During the past two years we have been working together with teams of elementary teachers from Thomasboro and Mahomet, two rural school districts in Champaign County, to develop activity centered, inter-disciplined K-8 science-based curriculum tailored to meet the unique needs of those respective schools. This paper presents an overview of the goals and rationale behind this curriculum development project. In a later issue of Spectrum, we will outline the project's implemetation and describe the curriculum the teachers developed and the results in their classrooms.

Many tales of in-service projects have been told in the past. Most reports of this nature write to describe and advocate a particular approach to working with practicing teachers to attain a set of goals. Rather than take a similar approach, in this set of papers we wish to describe our work more problematically: first describing what we did and why and then talking of structural, philosophical and personal problems which we needed to confront. We wish to write about how working with teachers to implement curricular change in their classrooms, even in settings ideologically supportive, confront multiple problems with which all must actively struggle.

HISTORY

Several years ago, Champaign Unit #4 School District was in the process of changing its K-5 science curriculum from text-based to a teacher developed program that was activity-based and inter-disciplined. Such a change was deemed necessary in light of the multitude of recent research which asserts that children need to *do* not simply read or be told about science in order to learn (for example: Aldridge, 1992; Bredderman, 1983; Rutherford and Ahlgren, 1990; Shymansky, 1989; AAAS, 1989, 1996). That such a curriculum be teacher developed reflects our beliefs that teachers need to be viewed as professionals responsible for the learning environment in their classrooms and as such need to be primary creators of that environment (Schon, 1983, 1987; Stenhouse, 1984; Hopkins, 1985).

In 1989, a Science Literacy Grant obtained through the state of Illinois was used to initiate this large project. Recognition of the need to provide teachers support in the development and teaching of this new curriculum motivated the district to garner the expertise of professionals from other local agencies. Through the combined efforts of teachers, the school administration and the local universities, Champaign elementary teachers were trained in curriculum development, then supported as they produced activity centered science units. Before the science units were implemented in the classrooms of the district, they were piloted on students in a two week summer science camp. As a result of this effort Champaign Unit #4 teachers produced 15(?) separate self-contained science units which now constitute the science curriculum in the district. These units include such subjects as: weather, simple machines, water, and structures and can be viewed at http://www.ed.uiuc.edu/BOS/.

Out of these early attempts at curriculum reform rose a conviction that the teachers in this school district needed to experience science learning themselves which was hands-on and activity oriented and to reflect, in a low pressure environment, on how to teach in such a manner. From this realization grew a larger program known as *"Grow in Science,"* also funded by the Science Literacy Grant program, which has provided in-service training in teaching activity-based science to more than 70 elementary classroom teachers from surrounding school districts (Brown and Sinclair, 1993). The program proved to be a leavening agent, raising the awareness of