SPECTRUM

THE JOURNAL OF THE ILLINOIS SCIENCE TEACHERS ASSOCIATION

IN FOCUS: SCIENCE TECHNOLOGY SOCIETY

WINTER 1992

ILLINOIS SCIENCE TEACHERS ASSOCIATION

SPECTRUM

JOURNAL OF THE ILLINOIS SCIENCE TEACHERS ASSOCIATION
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ISTA NEWS

WINTER PRESIDENT'S LETTER

What a fantastic convention!! Congratulations to Doug Dirks, Convention Chair, and his hardworking and talented committee: Raymond Dagenais, Gary Zeller, John Kent, Shelly Peretz, Fred Tarnow, Barbara Sandall, Robbin Rietveld, Gerald Foster, Gretchen Alexander, Gwen Pollock, Marianne Kot, Jane Russell, Nan Cassettari, Rion Turley and Dottie Krett. The 1993 ISTA Convention "The Challenges of Change" held on October 1-3 at the Pheasant Run Resort and Convention Center was our best attended and one of the best organized and executed conventions ever!!

For those of you who missed the 1992 Convention, set your calendars now for next year's premier science teaching fest, the 1993 ISTA convention to be held October 1 and 2 at the Collinsville Convention Center in Collinsville Illinois. Ask your principal now to set aside some of your district's Eisenhower funds to help you attend this worthwhile staff development event. Better yet, bring your principal along so she/he will see firsthand all of that equipment available through our commercial exhibitors and become a advocate of hand-on science after attending our exciting and informative workshops. For those of you who think Collinsville is too far to drive, stay tuned to future issues of *SPECTRUM* for information about group travel arrangements. Transportation Chair Joanne Gray has promised to make getting to the convention almost as much fun as being there.

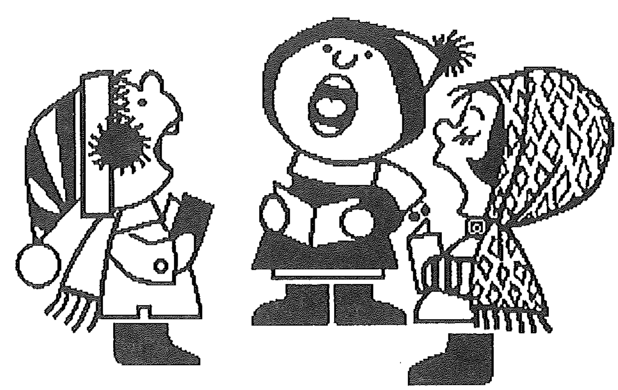
At the convention, the ISTA Board of Directors met to conduct the business of the Association. I will report to you some of the important features of the meeting. Membership Chair George Zahrobsky reported that we have 3208 members, an increase of about 200 from last year. The breakdown of our members is: 24% elementary teachers, 23% junior high teachers, 34% high school teachers, 4% college teachers, 9% students and the rest various miscellaneous categories. The geographic distribution of our membership is as follows: 62% Region I; 7% Region II; 11% Region III; 9% Region IV; 5% Region V; 3% Region VI and 3% out of state. I encourage all of you to continue to recruit new members and to keep your own membership current.

Treasurer Wayne Green reported that we had expenses that exceeded income by about $4000. While this means that we lost money last year, this is in some ways a relief. For the last several years we have been taking in more money than we have spent, an embarrassing trend for a non-profit organization. By holding the line on membership dues (yes, no new taxes) and by increasing our expenditure for projects such as recognition of excellence in science teaching, conducting workshops on important issues such as performance assessment and continuing to upgrade the quality of our journal, *SPECTRUM*, we have avoided yet another year of profit making. Despite this years deficit, we still have a comfortable cushion provided by our reserve funds.

President elect David Winnett reported that ISTA has received another Science Literacy grant from the State Board of Education. We will continue our strenuous advocacy for performance-based assessment by conducting assessment seminars to disseminate information and demonstrate sample testing stations that we have developed through previous grants.

In addition to the Board meeting held at the convention, ISTA also held its annual membership meeting on Saturday afternoon as the convention was winding down. Most of the business consisted of reports similar to those presented at the Board meeting and reported to you above. When the floor was opened for new business, however, one interesting idea was proposed. Katherine Taft proposed that we create an ISTA scholarship for a deserving science education student. The idea was discussed for quite some time. While it was generally agreed that the idea has much merit, it seems that the logistics of implementing such an award are complicated. Many student aid programs require applicants to disclose all scholarships and our contribution toward a student's tuition or expenses might simply reduce the amount that they would receive from other sources. In addition, it was pointed out that conducting a fair and thorough search would cost the association more that the award itself. It soon became clear that the spirit of the proposal was still alive, but the means would have to be discussed at a future meeting, probably the Winter Executive Board Meeting to be held in January. Various possibilities presented to the members at a future date. Thanks Katherine for sharing your ideas and your concern for the plight of science education majors across Illinois.

In closing I would like to give you a MAX update. By now any regular reader of this column knows that I always end with my favorite metaphor for the state of science education, my son Max. Max turned two just a few weeks ago. Need I say more? He has taken a dramatic shift in interest. Max has turned the thrust of his attention away from exploring the physical world to the other important component of science teaching — interaction between children and

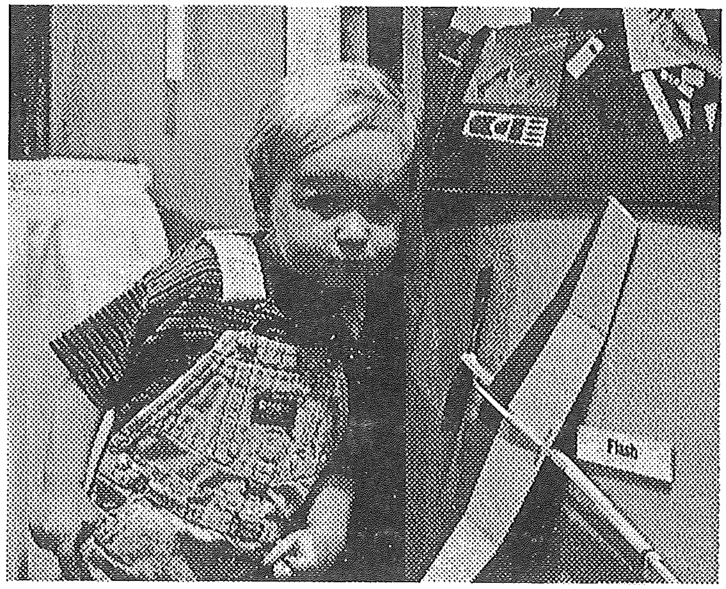


adults. It is this aspect of the teaching profession that probably distinguishes us from our Colleagues in the world of science research. We shape, and are shaped by young people. Much of Max's current studies include testing the limits of human behavior. How many times can he say "I don't want to..." before his mother and I lose patience. What will happen if he demands pancakes for dinner and spaghetti for breakfast and how far can he run before we come chasing after him. Max is reminding me daily that as science teachers we must not only be masters of science content, but we must be masters of child psychology and above all be infinitely patient and understanding.

Respectfully,

Mark Wagner

Mark Wagner
ISTA President



Max Wagner inspects a model airplane in the exhibit hall of the 1992 ISTA Convention. Photo courtesy of Jim Szezol.

NSTA'S FUTURE NATIONAL CONVENTIONS

(IF YOU HAVE NEVER ATTENDED ONE, PLAN ON GOING TO KANSAS CITY — IT WILL PROVE TO BE AN AWESOME EXPERIENCE!)

KANSAS CITY, MO
APRIL 1–4, 1993

ANAHEIM, CA
MARCH 30–APRIL 2, 1994

PHILADELPHIA, PA
MARCH 23–26, 1995

1992 ISTA CONVENTION VENDOR LIST

COMMERCIAL VENDORS

Academic Advantage
Academic Technology Corporation
Addison-Wesley Publishing Company, Inc.
Aidex Corporation
Alpha Publishing Company, Inc.
American Science & Surplus
Amsco School Publications, Inc.
Buckeye Heat-Pack
Carolina Biological Supply Company
CASL, INC.
Childrens' Press/Goldencraft
Cuisenaire Company of America
D. C. Heath and Company
Delta Education
Encyclopedia Britannica
Equitable Financial Services
Fisher Scientific
Flinn Scientific, Inc.
General Binding Corporation
GeoLearning Corporation
Glencoe Publishing Co.
Globe Book Company
Holt, Rinehart & Winston, Inc.
I BM
J. M. Le Bel Enterprises
Kendall/Hunt Publishing Company
Lego Dacta
Leica
Look-At-Me Records, Inc.
MacMillan/McGraw-Hill School Division
Midwest Products Company, Inc.
Nasco
National Teaching Aids, Inc.
Nebraska Scientific
Nystrom Company
OHAUS Corporation
Optical Data Corporation
Pasco Scientifc
Pencils & Play, Ltd.
Pheasant Run Resort
Prentice Hall
Sargent Welch Scientific
Satellite Data Systems, Inc.
Scholastic, Inc.
Science Kit Inc.
Scott, Foresman and Co.
Showboard, Inc.
Silver Burdett & Ginn
Swift Instruments, Inc.
The Educational Group, Inc.
The Scope Shoppe, Inc.
Tri-Ed Enterprises, Inc.
Videodiscovery, Inc.
Ward's Natural Science
Wm C. Brown Publishers

NONCOMMERCIAL

American Chemical Society
Argonne National Laboratory- Div. of Educational Programs
Chicago Academy of Sciences
EarthTime Scholars Program
EMC / University of Hawaii
Environmental Education Association of Illinois
Facilitating Coordination in Agricultural Education
FERMI National Accelerator Laboratory
Field Museum of Natural History
Forest Park Nature Center
GEMS WIU-Science Education Center
ILEED - ENR - Chicago
Illinois Corn Marketing Board
Illinois Department of Energy & Natural Resources
Illinois Earth Science Teachers Association
Illinois Jets
Illinois Medical Technology Association
Illinois Science Teachers Association
National Association of Biology Teachers
National Diffusion Network
National Science Teachers Association
National Wildlife Federation
Southern Illinois University at Edwardsville
University of Illinois Film Video Center
Young Entomologists' Society, Inc.

Open Letter to the General Membership

ISTA would like to encourge its members to support the commercial and non-commercial vendors listed here. They contribute to our organization by exhibiting at our annual conventions and by advertising in the SPECTRUM.

Sincerely,

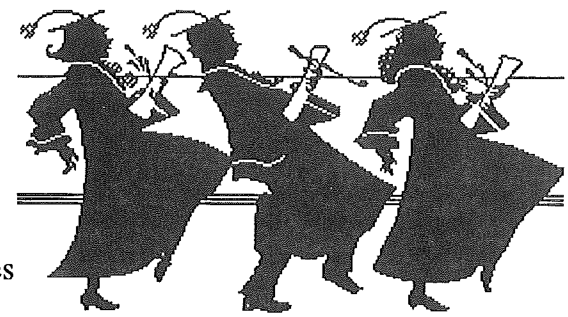
John A. Kent
Coordinator-Commercial Contracts/SPECTRUM
708-3 54-3 289

GREAT NEWS!

CAROL VAN DE WALLE'S HIGHLY ACCLAIMED "CELEBRATING SCIENCE" IS ABOUT TO BE REPRINTED

NEW FEATURES INCLUDE:
SEPARATE SECTIONS FOR PHYSICAL SCIENCE, EARTH SCIENCE, LIFE SCIENCE
NEWLY ADDED INFORMATION/TIPS FOR EACH ACTIVITY
NEW FORMAT FOR EASE IN FILING/ DUPLICATING

Every Elementary and Middle School teacher should have a copy of this outstanding collection at his/her fingertips. These activities represent a synthesis of dozens of the best science ideas of the Honors Science Teachers of Illinois,
presented in an attractive, easy-to-use format.



These activities:
*actively involve students
*provide concrete and real world experiences
*relate new information to old
*use science process skills and problem solving strategies
*relate well to student lives

In addition, many of these activities can be easily adapted for older students. Pre-publication cost is only $10.00. This price includes all shipping and handling. We are planning publication for early 1993 and your issue will be sent to you at that time. All profits will go toward the cost of free ISTA promotional items (e.g., mugs, folders) for future ISTA Conventions.

To take advantage of this special pre-publication offer, fill out the bottom half of this form and return with a check or money order for $10.00 made payable to Illinois Science Teachers Association. Send to:

Diana Dummitt
SPECTRUM
College of Education
University of Illinois
1310 S. Sixth Street
Champaign, IL 61820

Yes! Send me ______copy(ies) of "Celebrating Science" at the special pre-publication price of $10.00 per copy.

Name:____
Address: (name of school or business) ________________________________
(street) ______________________________
(city, state, ZIP) ___________________________
(telephone) (____) __________
Home: (address) ______________________________
(city, state, ZIP) ___________________________
(telephone) (____) __________

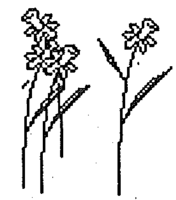
1993 ISTA Convention

October 1–2
Collinsville, Illinois

Rion Turley

Convention Chair

(618)632-3507

CAUTION

Re: Paperwhite Narcissus Bulbs

Attention: Teachers attending the Presidential Awards session at 11:30, Saturday, October 3, 1992 at the ISTA Convention at Pheasant Run, Illinois.

If you picked up a handout titled "Plant Assemblies," you will find in the handout a description of using paperwhite narcissus bulbs in assembly programs. The author of the handout has now learned that paperwhites may cause nausea or dizziness if eaten.

If you did obtain one of the handouts, please discard it.

For further information, please contact:

Fred Segner
7 Nassau Ct.
Park Forest, IL 60466
(708)748-2217

Call for Papers

1993 Annual Meeting
Illinois Science Teachers Association
October 1-2, 1993
Collinsville, Illinois

Deadline for submitting papers: April 1, 1993

PLEASE COMPLETE A FORM FOR EACH PARTICIPANT (You may duplicate this form.)

I wish to be a ☐ presenter ☐ presider

I can be available for ☐ Friday's program ☐ Saturday's program ☐ either day

Please print or type:

______________________________ ( ) ______________

name day phone

____

affiliation (school or organization)

____

address (of above organization)

____

city, state, zip code

______________________________ ( ) ______________

home address home phone

____

city, state, zip code

Subject: Biology ☐ Chemistry ☐ Physics ☐ Earth Science ☐

Other ______________

Title of presentation (10 word maximum) ______________________________

____

Program description as you wish it to appear in the program book (25 word maximum) ______________

____

____

Due to limited space, presentations must be limited to 50 minutes.

Type of presentation:

☐ traditional oral presentation ☐ hands-on workshop ☐ lecture/demonstration

☐ audiovisual presentation ☐ other (specify)

Level of principal interest (check as many as apply): ☐ pre-kindergarten

☐ elementary ☐ junior high ☐ high school ☐ college ☐ general

Special arrangements requested (audiovisual equipment, etc.) ______________

____

NOTE: Convention will furnish overhead, screen, VCR/monitor, and 35 mm slide projector. All other equipment, including computers, will be furnished by presenters.

- Applications should be accompanied by an abstract of your proposed presentation. The abstract should not be more than one page, typed, single spaced.
- As a professional, nonprofit organization, the Association is unable to reimburse participants for travel or other conference expenses.
- ALL PARTICIPANTS, INCLUDING PRESENTERS, ARE REQUIRED TO REGISTER FOR THE CONFERENCE.

____

signature date

Send to Mike Schneider, ESC #16, 500 Wilshire Dr., Belleville, IL 62223

ARTICLES

Bob Burtch
J.B. Nelson School
William Wood Lane
Batavia, IL 60510

10 WAYS TO BECOME AN EXEMPLARY ELEMENTARY SCIENCE TEACHER

Teachers represent an important component in describing a total science education. One cannot describe the characteristics of a successful program without examining its teachers. Describing the attributes of exemplary teachers represents a major component that must be documented if we are ever to provide a path of excellence in science education. The continued collection of data regarding teacher attributes will lead to greater understanding and insight into the teaching-learning environment. This article is a summary of a particular study (2) which focused on attributes of exemplary science teachers K-8.

Although numerous studies (1, 4, 5, 8, 10) indicate that the teacher is the most important instructional variable, this study utilized the data from the "Teacher Survey" questionnaire developed as a part of "A Study of Schooling" (ASOS) (Goodlad, 1985). Ten attributes were recognized as exemplary.

An Exemplary Science Teacher (EST) uses *"hands-on" instruction* with activity-based manipulatives for students to explore. These teachers might use science displays on tables, cages of live animals such as gerbils and hamsters, plants planted and/or cared for by children, mobiles, science bulletin boards, and shelves of science related books. Other science resources used by EST might include items such as thermometers, dry cells, seeds, aquaria, microscopes, magnets, etc. These teachers also see to it that sufficient quantities are available to enable all students to do "hands-on" experiments with them.

EST use a *variety of teaching techniques*. This attribute is associated with the persistent research finding that students learn science best when they are involved in a variety of engaging activities for learning science as opposed to reading about science out of a textbook everyday. McConeghy's (1985) study reported that students who were exposed to a greater variety of teaching methods were more likely to be ranked higher in achievement than were students who reported exposure to a more limited variety of teaching methods. These methods include cooperative learning groups, class demonstrations, whole group instruction, field trips, visuals such as slides, films, video, laser disks, computer simulations, outside speakers, etc. In particular problem solving, student planned experiments, and "hands-on" experimenting are most preferred for science teaching.

EST *spend time* teaching science. The NSTA suggests 1 1/2 hours per week for primary level students and 2 1/2 hours per week at intermediate level. It seems a good "hands-on" science program at the elementary level would require at least the commitment of time suggested by NSTA.

EST *encourage risk taking*. This teacher serves as a role model to students by learning along with the students, by admitting error, by examining values and confronting areas of their own lack of knowledge. They aim high, go the extra step and do whatever is necessary to accomplish their objectives.(6)

An EST *values student input*. Science teachers should be encouraging more questions from students. Yager (11) reports that effective teachers welcome questions and recognize them as essential to science. These teachers have students involved with "hands-on" projects during their science class. They encourage students to think for themselves. These teachers recognize the uniqueness of each student.

An EST has a *classroom atmosphere* conducive to science inquiry. This should be a place to excite students' curiosity, to build interest in their world and themselves and provide them with opportunities to practice the methods of science. Classroom climate stimulates a thorough exploration of objects and events, rather than a need to finish the text.

EST are more inclined to have had recent (within last 3 years) *inservice training*. EST were much more positive about inservice sessions in their own schools than teachers in general. These teachers feel positive about their teaching, about science, about students and their schools. They are active learners who are constantly searching for new ways to improve their programs and teaching approaches. These teachers seek out new ideas and view inservice as an opportunity to grow professionally.

EST have participated in some type of *professional involvement* such as enrollment in college courses within the last 2 years, professional books and journals read, advanced degrees, having served on district committees, attending and/or making presentations at professional conferences. Thus EST are active professionally.

EST use a *variety of resources* in their science teaching. There are a number of resources at a teacher's disposal. These include district consultants, state or district recommended textbooks, state curriculum guides, commercially prepared materials, a teacher's own background, interests, and abilities, and other teachers. These teachers are particularly more aware of national curricular materials such as AIMS, GEMS, OBIS, TIMS (to name a few of the recent programs) and more likely to use them than teachers in general. The teacher of exemplary programs often used as many as six different programs — picking and choosing the best ideas in each program.

EST use student projects, simulations, computer programs, field trips, and resource people to vary the traditional format in which students master facts and concepts by reading and listening to the teacher talk. These activities are referred to as *classroom extensions.*

In summary, prospective teachers and teachers currently "in the field" need to be aware of the attributes found to be most useful for science instruction. Not only should these teachers be made more aware, but they should learn and be shown such things as how to vary teaching methods, what kinds of resources to use and how to use them, how to become professionally involved and what the components for that are, and to take advantage of inservice situations.

These 10 attributes were then grouped into 4 components which comprised the construct of the EST. Analyses of these 4 components concluded that only 13% of the teachers in the K-8 sample met the criteria for being an EST which seems a reasonable outcome since Stake and Easely (9) estimated that probably only 10% of the current teachers spend time on inquiry teaching. Also, there are not many EST in the existing population if the ASOS teacher sample can be generalized to the general population.

The attributes that EST meet most easily have to do with the mechanics of teaching. Three-fourths of the teachers met the attributes "activity-oriented" and "variety of teaching techniques." The teachers in this sample seem to be doing much better with the practice of teaching rather than the philosophy and attributes of teaching. Those things associated with the selection, nurturing, and preparation of teachers do not develop the components of "philosophy and attitudes" and "personal growth" attributes of EST. Postgraduate courses and current inservice activities are not doing what is needed to develop EST.

More has to be done to develop a larger proportion of EST through preservice and inservice preparation. An obvious implication that can be drawn is what we need to inservice our teachers in science. Perhaps once teachers are in the field and instructing students they see the need for more knowledge and skills in the science area.

We must heighten the awareness of administrators to their vital role in teachers' encouragement and program support. Administrators need to be educated to the type of inservice that is needed to instill "philosophy and attitudes" and "personal growth" rather than the current structure of inservice which oftentimes supports what teachers are already good at. In addition, we need to develop better selective processes for getting desired teachers. Rather than higher ACT scores and a focus on knowledge, the screening process should include screening measures that include philosophy and attitudes.

We should establish a type of program whereby qualified teachers in a district are selected to teach teachers who request assistance in science. Students would receive an enriched program and the regular classroom teacher would be able to see other methods of teaching in their classrooms and pick up ideas and materials and genuine collegial support from a fellow classroom teacher.

If we are to produce scientifically literate citizens, then learning must become more student-centered. It is only when material is presented to students in ways that are meaningful to them that they can master the content of the subject. Since the literature states clearly that the teacher is the key variable in what is learned in the classroom, it is important that they be given opportunities to develop attitudes to allow that learning to take place.

RESOURCES

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2. Bredderman, T. (1983). Effects of activity-based elementary science on student outcomes: A quantitative synthesis. *Review of Educational Research,* 53 (4), 499-518.

3. Burtch, R. L. (1989). Attributes of exemplary science teachers among K-8 teachers. Doctoral dissertation, Northern Illinois University, DeKalb, IL.

4. DeRose, J. R., Lockhard, D. J., & Paldy, L. G. (1979). The teacher is the key: A report on three NSF studies. *Science and Children* 16 (7), 35-41.

5. Goodlad, J. I. (1985). *A Place Called School.* New York: McGraw-Hill.

6. Harms, N. C. & Yager, R. E. (Eds.). (1981). *What research says to the science teacher* (vol. 3). Washington, DC, National Science Teachers Association.

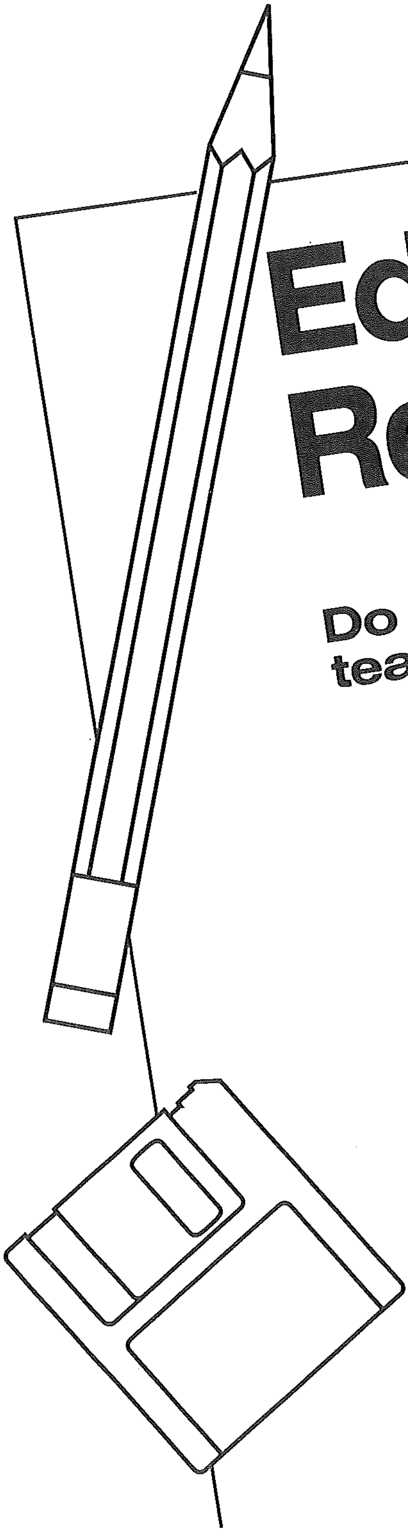
7. McConeghy, J. I. (1985). Learning experiences and achievement of 17-year-old high school students as assessed by the national assessment of educational progress: 1975-1982. Doctoral dissertation, Northern Illinois University, DeKalb, IL.

8. Rubin, L. J. (1985). *Artistry in teaching.* New York: Random House.

9. Stake, R. E., & Easely, J. (1978). *Case studies in science education* (Vols. I & II). The Case Reports, Washington, DC: U.S. Government Printing Office.

10. Walberg, H. J. (1983). Scientific literacy and economic productivity in international perspective. *Daedalus,* 112 (2), 1-28.

11. Yager, R. E. (1987). Wanted: more questions — fewer answers. *Science and Children,* 25 (1), 22.



IN FOCUS

SCIENCE
TECHNOLOGY
SOCIETY

STS has been a buzzword for a while whenever science educators get together. It certainly is an attractive idea and we all would agree that getting students involved is one way to sensitize them to important issues facing our society in the 21st Century. However, because the actual implementation is much more complicated than the broad concept, many questions remain. What is the best way to present STS? Is science really being taught through these activities? Is the "science" being taught based on a solid theoretical ground? Where does content come in? Where can I find ideas that students can relate to? Why is this approach important? Is it more important than teaching the textbook basics I always have taught?

In this *SPECTRUM* we attempt to grapple with some of these issues by presenting a sampling of articles which address the theory behind STS, some ideas for coming up with your own projects, and examples of topics that have been successful for other teachers. Some of the above questions can only be answered for you personally through trial and error in your classrooms. However, it is hoped that by reflecting on the nature of STS topics and their relationship to science, we all can be better equipped to evaluate materials we are considering, whether in planning our own lessons or in looking at the myriad of prepackaged lessons widely available to teachers. If you have fouund success with STS in your classroom, consider sending it to the *SPECTRUM* for publication in an upcoming issue.

George R. Stanhope
Department of Curriculum and Instruction
University of Illinois at Urbana-Champaign

WHO DECIDES WHAT TO DO WITH SCIENCE-TECHNOLOGY-SOCIETY MATERIALS?

Science-Technology-Society (STS) oriented materials are a great way to get students enthusiastically involved in science. However, you will find that students can be turned off to science by these types of materials, as easily as they can be turned off to science by more traditional science materials. What makes the difference is who gets to decide what will be studied.

It is important that students have the opportunity to raise their own questions and decide for themselves how they should try to answer them, and then take action. A powerful pedagogical point can be made from this type of instruction because it deals with engaging higher levels of intellectual development, which are difficult to affect through any one experience. The right question at the right time can result in real intellectual excitement and development. If the setting is right, children can raise the right question for themselves; raising the right question at the right time is a task that might be nearly impossible for a teacher that is concerned with a classroom of children. Once the right question has been raised, children are more likely to tax themselves to find an answer because they are the ones who decided that the question was important and are responsible for investigating the answer (Duckworth, 1987). "Having confidence in one's ideas does not mean "I know my ideas are right;" it means "I am willing to try out my ideas (Duckworth, 1987, p.5)." Let me give you an example of a child having his own wonderful idea, and acting on it.

> Then came Kevin. Before I said a word about the straws (10 cellophane drinking straws), he picked them up and said to me, "I know what I'm going to do," and proceeded, on his own, to order them by length. He didn't mean, "I know what your going to ask me to do." He meant, "I have a wonderful idea about what to do with these straws. You'll be surprised by my wonderful idea" (Duckworth,1987, p.1).

This passage by Elenor Duckworth, may seem a trivial incident, and alone, isn't a Science-Technology-Society (STS) activity, but it illustrates what all to often is missing in science education classrooms. In this example, a child came up with and proceeded to implement the objective that she had already set for him, through the nature of the materials provided. There are many other intellectually developmental activities that one can do with straws, and given some time, and possibly a few playmates and other materials, Kevin would probably have thought of most of the activities that a teacher might think to do with straws in the classroom, even activities thought of by only the most creative of teachers. What is important is that the student made the decision on what was to be done with the straws, and he took responsibility for carrying out the appropriate action with enthusiasm.

Science is an attempt to understand the world as it exists. Technology is the application of scientific knowledge to fulfill human needs, wants, and desires. Both science and technology take place within the context of social norms, morals, and political and religious beliefs. This relationship between science, technology and society is what sets the stage for science-technology-society (STS) curriculum as a reasonable means of teaching science in schools. In fact, with the dependence of our society on science and technology for our current economic, environmental and living standards, and our dependence on science and technology for our future success as a nation, it would seem difficult to avoid some aspect of STS curriculum in the teaching of any science concept or related topic. However, it is not enough for STS materials to contain a science concept, examples of related technology, and examples of the benefits and detriments of that technology to society. Any more than it is appropriate to ask a student to do an experiment following a set procedure, with a specific, predetermined outcome (the "right" answer), and claim that the student has had a "hands-on" phenomenological experience. In both cases, what is missing is the students' opportunity to make decisions and take responsibility for their learning outcomes, which will probably include some mistakes.

STS courses are expected to affect students' beliefs, attitudes and positions about science, technology, and how it is used in society, based on value clarification and acquired knowledge. An important attribute is that students raise questions, make decisions and take responsible actions accordingly. This should be done through relevant science education in terms of goals, content and teaching strategies, not socio-political preaching or indoctrination (Zoller, 1991). If teachers have faith in their students' ability, and provide a classroom climate where the nature of the materials and teaching strategies provide paths for students to follow, I think they will find that students will usually cover the objectives that have been set for them, without being dragged to them, and probably add a few good ideas of their own (You can learn a lot from students).

STS curriculum can help make science relevant to students because it involves phenomena that they have had experience with, and can easily access for further experience. It also provides a setting in which to try out their own wonderful ideas. One day, following a class discussion about water conservation, a student came up to me and told me that he had measured the amount of water that would normally have gone down the drain while he was brushing his teeth. He was very excited, and proceeded to tell me about the method that he had used, the results, and his analysis and conclusion. He decided that he should turn off the water, except for when he needed to rinse his tooth brush, and that would save several gallons of water every day. This "experiment" was discussed with the class as well as other ideas that they had or did at home to conserve water. I know I no longer let the water just "run" when I brush my teeth. What is important, is that it is the students ideas about a topic or concept that are being explored.

I know there are a lot of good science teachers out there, and I also know that there are a lot of kids and adults that have been turned off to science because of their experience with what we call science in schools. What I am emphasizing here does not diminish the need for lectures, notetaking, readings, problem sets, work sheets, and guided labs. However, it is the preponderance of these activities and the focus on getting the "right" answers as a result of these activities, which appears to turn people off to science. Science-Technology-Society curriculum is no different. It seems to be human nature to want to share information and ideas that are interesting and exciting to us. However, few people, including children, like to be lectured to when they have no interest in a topic, or like doing a "canned" activity to help them see the point. Does this sound like some inservices that we've all had to attend? If you look at why you, the science teacher, find science interesting, I think you'll see that it's because you get to choose what aspects of a topic will be covered; you get to read whatever journals and books on the topic you want; and, you get to choose the labs and "mess about" with them. The lab doesn't have to turn out perfectly the first time, you can do it over again; if you find something interesting in the lab, you can further explore it; and, if the lab doesn't interest you after you have tried it, or doesn't seem to lead you where you thought it would go, you get to say, "this lab is no good (or boring)," and choose another lab to try.

Giving students more control to ask their own questions and make decisions, and to take responsibility for their actions in solving a problem, is not an easy way to teach, at first. It's as much a learning experience for the students as it is for the teacher to operate in this type of a classroom. However, if you stick with it, I think that you will find that the students are more interested in science and will have a better understanding of what they learn. (It only took me a year to feel comfortable with cooperative and group learning, and I'm kind of slow sometimes). I think you'll also enjoy teaching more because there will be more opportunities to observe children learning and more enthusiasm and "ah-ha" experiences from the children (and isn't that what being a teacher is all about?). STS materials can make it easier for students to begin asking their own questions because they already have some experience with the technology, from what they do in everyday life. Also, "experiments" can be done more easily because the materials and equipment can often be found in the child's home, or at the local grocery store. Just remember, let the student share in having wonderful ideas.

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INTERDISCIPLINARY STS INSTRUCTION

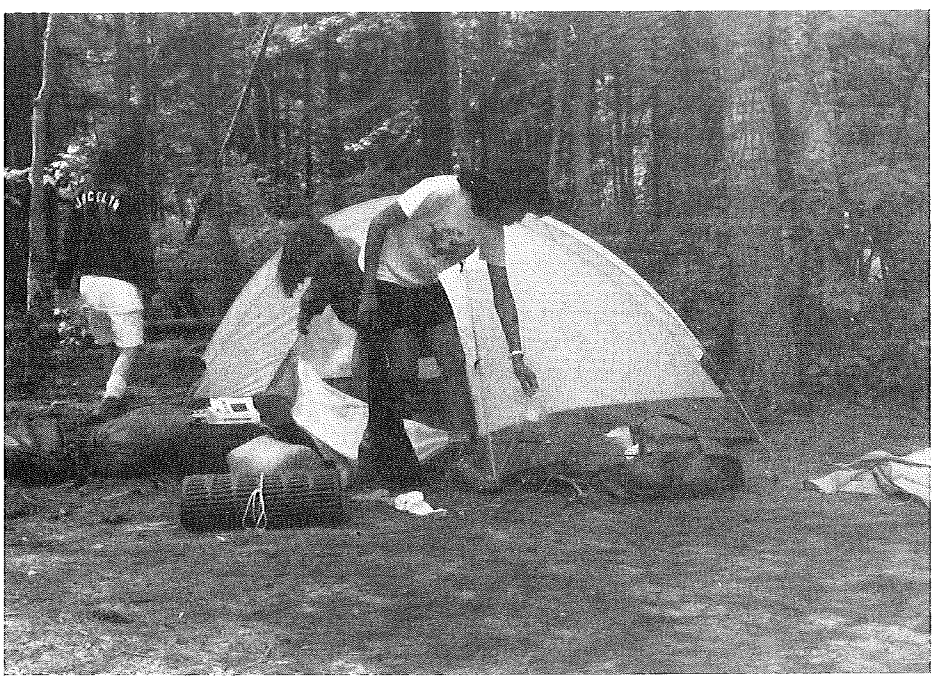
Students at Marie Murphy School are involved in some unusual activities for a middle school. They are meeting with scientists about a proposed solution to an energy use problem, or backpacking along the wilderness shoreline of Lake Superior, or perhaps, checking Lake Michigan water samples for pollutants. These students are participating in the *Interdisciplinary Science Technology and Society Curriculum Project*

Our experiences developing, piloting, and refining STS curricula have brought us to the conclusion that STS is fertile ground for interdisciplinary instruction at the middle school level. The purpose of this article is to tell the story of how an interdisciplinary approach to STS instruction has transformed not only the science curriculum, but the entire program at Marie Murphy Middle School.

The Interdisciplinary STS Approach

At the inception of the curriculum project writing, social studies, and technology teachers participated on the planning team as advisors to assist the science teachers in their development of a STS course focused on study of the Great Lakes. Eventually, it became apparent that defining the course as science was not appropriate. The course developed around a focus on scientific problems which have political solutions. So social studies became a vital discipline. Plans for student investigation required reading and library research skills. Writing and oral communication were necessary for students to present their information and ideas. The result was a STS course curriculum that was integrated across traditional discipline boundaries. The activities are structured around creative problem solving of scientific-societal issues. Students develop responsible positions upon which positive citizenship action can be taken. The interdisciplinary nature of the program promotes application of multiple skills in realistic problem solving situations and also addresses the affective domain of learning.

The *Great Lakes Study* course includes issues such as: the impact of the introduction of exotic species into the Great Lakes ecosystem, the management of shoreline development, and the treatment of contaminated lake sediments. Each issue is taught in a three lesson format: in the first lesson students build scientific understanding of the problems, during the second lesson students develop creative solutions by modeling a political process, and in the third lesson students are challenged to evaluate their solutions. The students' science knowledge of the Great Lakes is built through field trips to the lake shore, data interpretation exercises, demonstrations, and experiments. During the creative solutions lesson students write legislation, simulate a city land-use hearing, establish a lobby. Students evaluate their solutions by simulating congressional committee meetings, writing letters to public officials, and participating in a mock trial. The culminating event of the Great Lakes Study course is a backpacking trip to the Pictured Rocks National Lake Shore in upper Michigan. Students spend four days camping along the wilderness lake shore where they conduct investigations, talk with visiting scientists, and experience the native condition of the Great Lakes. The Great Lakes Study is currently a twelve week, interdisciplinary elective course for seventh and eighth graders. The course is continually oversubscribed due to its popularity among the students.

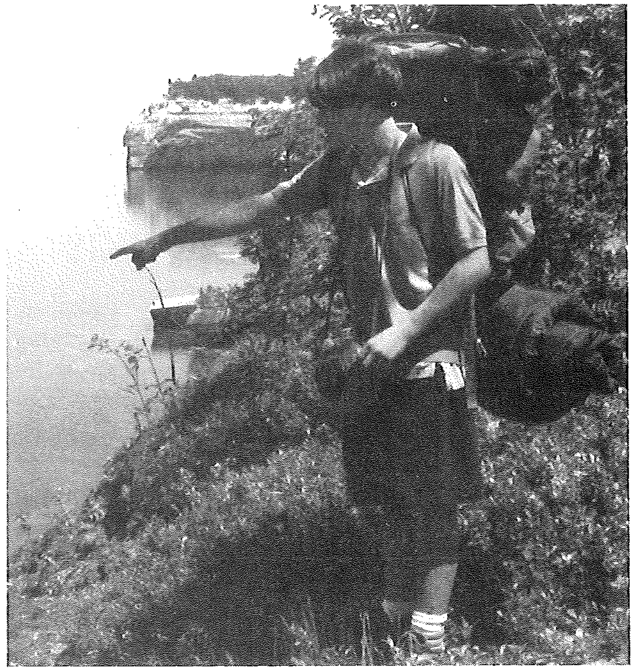


The planning team of teachers judged the interdisciplinary STS approach as very successful, and subsequently elected to utilize the Great Lakes Study as a model for developing a grade-level-wide interdisciplinary program having an STS focus. The result was an eighth grade program called *Energy: Issues and Answers*. The purpose of this unit is to engage the students in an interdisciplinary study of energy issues. Science, social studies, language arts, and technology skills are used. The Energy Unit focuses on the scientific understanding of energy, society's use of energy, and the societal conflicts associated with changes in energy use. This unit initially is discipline-based where the science, social studies, and language arts teachers concurrently infuse energy as a topic into their existing curriculum. While all the eighth grade teachers agree to focus on energy during the course of the program, they continue to meet the curricular objectives of their disciplines. For example, the language arts curriculum calls for students to research a topic and give a persuasive speech. The language arts teachers cooperated by asking the students to deal with energy issues in their speeches. The social studies teachers built a civics lesson around a simulation of hearings on alliterative energy development. The science teachers developed basic energy concepts, leading the students through investigations of energy transformations. Students collected data on their personal energy consumption and wrote an energy conservation plan for their family. They also conducted research on public attitudes toward energy issues using a student generated survey, and compared local results with results from across the country and internationally using a telecommunications network. Technology played an important role in the gathering of information through on-line data bases, and in the preparation of written documents. The purpose of the discipline based activities was to build student knowledge and interest in contemporary energy issues.

An interdisciplinary energy project was used as the culminating event for the unit. Students utilized the skills and knowledge gained in the specific disciplinary based activities on energy to complete a cooperative group project. In this Energy Unit project each group's task was to develop a media presentation that encouraged citizens to take action to solve a specific energy problem. Regular classes were suspended for two half-days in order to give groups sufficient time to work together on this project. Resource persons were invited to school to interact with the students. Scientists, professors, and engineers held informal discussions with the students about their ideas and helped the students develop solutions to problems. Some examples of student products were video taped documentaries illustrating energy waste, pamphlets offering energy conservation tips, a hypercard stack displaying data on energy supply and demand, and live skits promoting energy conservation. The students' media presentations were shared with their classmates at an all school assembly, and with their parents at an evening program.

Successful Science Learning and the Integrated STS Approach

Evaluation of the impact of the *Interdisciplinary Science. Technology, and Society Curriculum* on student learning led to some interesting conclusions. Though the STS activities are designed for students to apply their conceptual knowledge of science to societal issues, there frequently is little evidence within student products that demonstrates their application of the science concepts to the problems being studied. Students often fail to apply the important science concepts to the issues under study. Observation of



student behavior reveals that students frequently rely on their "TV" knowledge of an issue or subject, rather than applying information learned in science class. For example in political simulations, such as a mock trial, students will prepare comments, but the comments will not reference critical science concepts. Students must be coerced to include library research, or even use their textbook to find science information that would support their argument. Issue study gives students practice in applying scientific information to societal-technological issue resolution. Observations indicate that this goal is often missed.

It is essential that application of science concepts be emphasized by the science instructor during integrated STS projects. Experience with STS instruction consistently results in the observation that the transfer of science concepts to issue resolution is not a natural occurrence. Activities which prepare students for thinking about the science behind the issue are one way to help students apply scientific thinking and information in their projects. For example: sketching a concept map as an initial step in an investigation can help students use scientific arguments during the activity. Requiring use of a specific list of terminology during a group's presentation can also direct student attention toward science thinking. Teachers incorporating STS into their science curriculum or in interdisciplinary projects should promote application of science understanding and processes to issue study.

This effort, which was funded by the Illinois Center on Scientific Literacy, demonstrated that an integrated Science, Technology, and Society curriculum is a successful method for integrating academic disciplines. Our recommendation is that STS provides a perspective for integrating disciplines forming meaningful learning opportunities.

E. J. Piel
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SCIENTIFIC LITERACY AND THE PROBLEMS OF SOCIETY AND TECHNOLOGY

One way of approaching a situation involving science, technology, and society is to ask ourselves the following questions:

Is it a problem? Are people, animals, societies, the environment adversely affected by the situation? Will future generations be adversely affected?

How did it become a problem? What brought the situation about and how does it or will it affect society?

What are some alternative solutions? These alternatives fall into one or more of the following categories:

•*Educational.* How can people be convinced to modify their behavior in order to alleviate the problem?

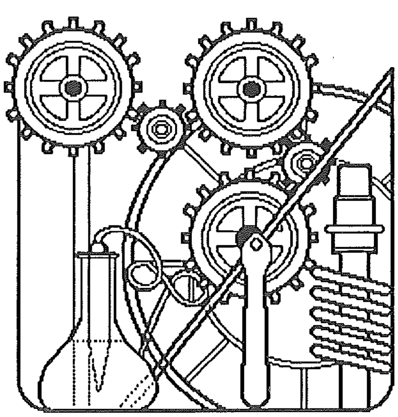
•*Legislative.* What regulations might be promulgated in order to force people to modify their behavior in order to alleviate the problem?

•*Technological.* What technologies might be employed in conjunction with or independent of the first two in order to alleviate the problem?

Assessment. How might the implementation of any of the suggested alternatives affect people, animals, the environment, and/or society? What are the potential second or third generation situations which might grow out of the implementation of the suggested alternatives?

Is there a problem?

The general population is being asked to make decisions both personal and political in the areas of technology and society interactions. Among these interactions are global warming, auto safety, food additives, energy use, water supply, and waste disposal. The problem is that the general population is not perceived as scientifically literate enough to make rational decisions on many of the questions involved.



How did it become a problem?

In each of the above situations we are encouraged (often in opposite directions) to make personal or political decisions by what we read in the public press or see on television:

•Are we or are we not experiencing global warming, and what should we do about it?

•Should we buy large cars because they are safer or small cars because they save energy and are less polluting?

•Is the radioactivity from a smoke detector more risky than not having one, or is there another alternative?

•Does turning down the thermostat at night really save on energy, or does is use more fuel to heat the house up again in the morning?

•Should we ban all incinerators now?

In order to view the situation from a common perspective, we need to define scientific literacy of the general population. This is not to be confused with the scientific literacy of the nuclear physicist, microbiologist, or biochemist, any more than a language literate person should be able to write well enough to earn a Pulitzer Prize, but it does include some aspects which are common to all of the above. The members of the general population should be scientifically literate enough to be "crap detectors" as they listen to opposing views. The scientifically literate member of the general population should be able to demonstrate understanding

•of a controlled experiment.

•of conservation of matter and energy (there is NO FREE LUNCH).

•that all life is connected.

•that all motion is described by one set of laws.

•that the surface of the earth is constantly changing.

•of basic human biology.

Alternative Approaches

As we prepare students in schools and colleges to be crap detectors, we have a variety of approaches available to us:

Educational: We can start teaching the basic principles, vocabulary, and concepts of the various disciplines as presented in the science texts now available. Tell the students that they will "need this later." We can discuss the situation without any prior preparation and tell the students to look up the science they need to understand the situation. Or we can encourage the development of curriculum materials and teaching strategies which combine the two previous systems with appropriate activities that reinforce the basics of scientific literacy as they encourage the students to look for ways to solve the questions that *they* ask about the situation.

Chemistry. A chemistry teacher might introduce the problem of the effect of acid rain on materials, especially marble. A discussion of how sulfuric acid (H2SO4) and nitric acid (HNO_3) react with marble ($CaCO_3$) to form calcium sulfate ($CaSO_4$) and calcium nitrate ($Ca(NO_3)_2$) would precede study of the table of solubilities of calcium salts. A further study of a table of solubilities of barium salts would show that $BaSO_4$ and $BA(NO_3)_2$ are much less soluble than their calcium counterparts. A laboratory exercise in which marble chips are immersed in hot barium hydroxide is performed. The treated marble is then immersed in sulfuric acid or hot nitric acid and there is very little activity because the barium has replaced the calcium on the surface of the marble. This lab is followed by a discussion (with pictures if available) of how this technique has been used to protect the surface of marble on a number of statues including the lions in front of the New York City Public Library. This is followed by further discussion on how this technological system would need to be modified to protect entire buildings such as the Taj Mahal from the acid rain produced as India becomes more industrialized.

Biology. The question "What is a pacemaker and what does it do?" would become the basis for a study of how the heart muscles contract at just the right time to send blood from the atria of the heart to the ventricles and from the ventricles to the lungs and the rest of the body. The problem of heart block would be discussed. Heart block is the situation in which the signal which tells the heart muscles to contract does not come at the correct time or does not come regularly. How can we combine a scientific discovery of the eighteenth century with the electronic technology of the twentieth century to solve the problem?

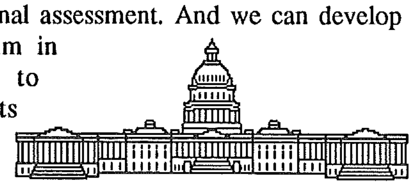
The biology teacher might now explore the history of how Galvani's experiment with frog legs and electricity led to further research on the nature of the nervous system and the conclusion that muscles are stimulated by electrical pulses which flow along the nerves. Films, videos, and lectures by first aid personnel or doctors would show how the scientific study started by Galvani was coupled with the miniaturized electronics developed in the space program to result in the pacemaker. The pacemaker through its miniature electronic feedback circuit senses the need for an electrical pulse to the heart muscle and sends it there at exactly the right time to provide appropriate operation of the heart muscles.

Earth Science. How are earthquakes predicted and how can we construct buildings to be earthquake resistant? This question in an earth science class can lead to a detailed study of plate tectonics, location of a point by triangulation, and how different soils act under various stresses. What type of soil or rock formation is found in earthquake zones? Is it the same type of rock and/or soil in all zones? In order to answer these and other earthquake related questions, students are encouraged to learn more earth science.

Physics. The physics teacher might have students explore the various technological systems for cushioning bridge abutments such as using plastic barrels filled with sand to reduce damage to cars and injury to passengers. Or they might examine the systems of padding dashboards or using air bags to reduce injury to passengers in head-on collisions. These explanations along with laboratory experiments with model cars lead to an examination of Newton's Laws of motion. The equation $F = ma$ is applied to the abutment cushioning system. "F" is the force of the car, "m' is the mass of the car, and "a" is the acceleration, the rate at which the car slows down.

Acceleration can be expressed as change in velocity divided by the time interval ($a = Dv/Dt$), in which Dv is the change in the velocity of the car and Dt is the time it takes for the car to come to a complete stop. What the cushion or air bag does is to increase the time it takes the car to come to a stop. If $F = ma$, and $a = Dv/Dt$, we can substitute Dv/Dt for a and get $F = mDv/Dt$. It now becomes easy to show that as the time interval Dt is increased, the value becomes less, and all cushioning of vehicles and/or passengers becomes a matter of increasing the time it takes to bring them to a stop, whatever the interaction is. Padded dashboards, air bags, bumpers, and collapsible steering columns are all technologies based on the scientific concept $F = ma$.

Legislative: We can provide the necessary support to assist teachers in their preservice and inservice education to develop the knowledge and skill necessary to develop, evaluate, and implement appropriate systems for acquiring the necessary scientific literacy. We can pass laws and rules which require every student to be "scientifically literate" in order to graduate from high school. We can measure scientific literacy with a national assessment. And we can develop a national curriculum in science literacy to which all students must be exposed during their time in school.



Technological Fix: We can provide interactive video developed by experts in regard to all possible technology-society interactions. We can replace present science teachers with experts from universities who will teach all the science necessary to be successful in their specific field. Or we can provide the school environment which allows for experimentation and change in the classroom and laboratory operation. Will any of these really work?

Evaluation and Assessment

As with all approaches to the solution to any problem, the evaluation of the approach with the accompanying assessment of the effect of its implementation is difficult. In the short term we might be able to provide a set of hypothetical problems and analyze the way the graduates of the program attempt to solve them. In the long term we need to see how good the general population has become at "crap detecting" by looking at the people they elect to office, to see what personal choices they make in the various areas of technology-society interactions.

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ACID RAIN TELECOMMUNICATIONS PROJECT

Michelle's study group becomes excited when I return to the classroom with mail for them. The mail is in the form of a six inch cube box from a school in California. The contents are what they have been waiting for: ground water samples from California. Tamika's study group is in the process of analyzing water samples they received yesterday from Pennsylvania. And Aaron's group is working at the computer transfering their water analysis results to a spreadsheet in preparation to sending the results back to a class in S. Carolina via E-Mail. All of this activity is part of a hands-on science/environmental awareness/telecommunications project which involved my fifth graders and students in eight other schools including one in Canada.

The Acid Rain Telecommunications project is a hands-on science project that strongly utilizes computer technology and telecommunications in order to actively involve students in authentic learning. Instead of just studying about acid rain and other environmental problems from the textbook, or even making it hands-on by testing local sources of water, we wanted to do something more exciting and meaningful. Fifth grade students at Thomas Paine used the power of telecommunications to break down the four walls of the classroom, and invlove students and classes from across the nation and Canada in an important environmental science issue: Water Contamination.

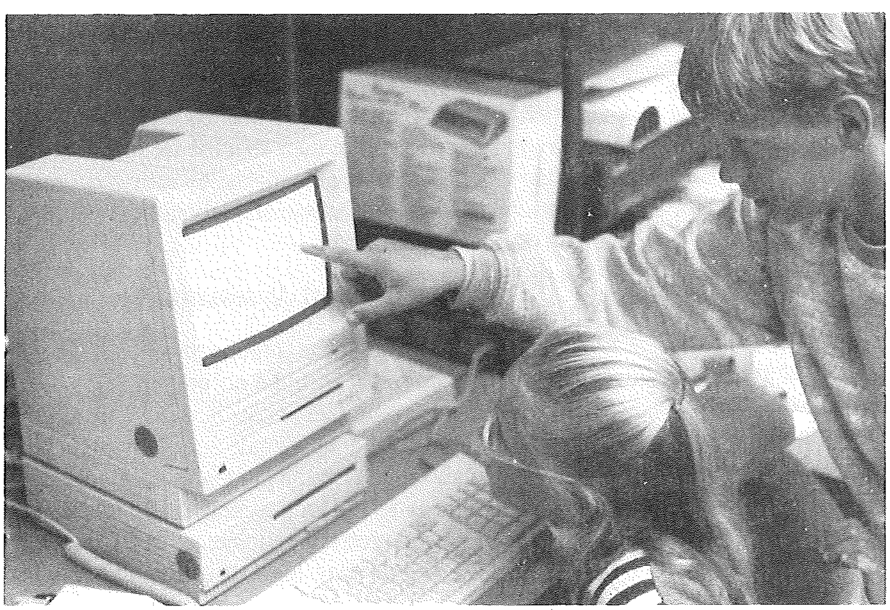
Getting Started

In our enviromental studies unit we planned to use a water quality test kit to test local sources of water. I challenged my students to expand their thinking and try to figure out ways to increase the scope of the project and obtain water samples which were from distant locations. Many ideas were generated including bringing water back from trips students may take over the holidays and writing relatives. As we explored the concept of a telecommunications network it became apparent that this would be a perfect vehicle for our goals. We chose Fred Mail as our network. I have been active on the Fred Mail network for a number of years. Fred Mail is a national/international network devoted to providing a low cost/no cost network for teachers and their students. The founder of the network, Al Rogers, envisioned a telecommunications network which would allow teachers and students the ability to directly communicate over long distances and collaborate in joint projects of mutual interest.

First Steps

The Fred Mail network is composed of different parts or components. There is a bulletin board system which operates just the way it sounds. Messages are posted and read just as you would on a bulletin board for the general public. There is also electronic mail or E-Mail. E-Mail transmits private messages between specific parties.

Our first task was to get others interested in participating in the project. I began by posting a message describing the project on the bulletin board and inviting classes to participate. I also looked on the bulletin board for other classes which were looking for projects. I sent a message to these people inviting them to participate. It wasn't long before we had several participating schools from across the country.



Our next task was to send out water collection kits so the distant sites could begin collecting samples. This kit was of our own design. Inside a six inch cubic box were four small plastic bottles, directions on collecting the water and a log for recording the location and source of the water collected. Also included was a bottle filled with some of our local water and some pH paper so that the participants on the other end might be able to test our water if they were interested. Finally a return address label and return postage was included. We felt that to insure success and a high rate of sample return we needed to make this project as easy for the recipient to complete as possible.

Addresses were obtained through the E-Mail exchange. Kits were readied and mailed out. Upon return the kit was opened and tested by the study group who was responsible for a specific collection site.

The Process Begins

Upon reciept of a test kit with water, the study group responsible opened the kit and read the source from which the water was taken from. They then began using a Lab Aids Water Quality Test Kit to analyze the sample. The Lab Aids Kit has the chemicals to conduct eleven different tests on a sample of water. These include: pH, ammonia, nitrates, sulfates, cyanide, and more. Students would measure out the water for each test, conduct the test, and record the results.

Upon completion of the test, students used the computer to record their findings on a spread sheet which was then sent back as E-Mail to the host site. At the end of the project all the results were compiled and posted on the bulletin board so that all the participating schools could share in the project to a greater extent.

Acid Rain Lesson Plan

Grade: 5th

Instructional Goals: Students will use computer technology, hands-on science, and geography to address an environmental problem we face globally: acid rain.

Software: *Fred Writer, Fred Sender* (telecommunications software)

Audience: Fifth grade class at Thomas Paine. Eight classes from grades three through high school from around the U.S. and Canada.

Materials: Water Quality Test Kit, Water Samples from distant locations, Atlas, Apple IIe computer, modem.

Procedure

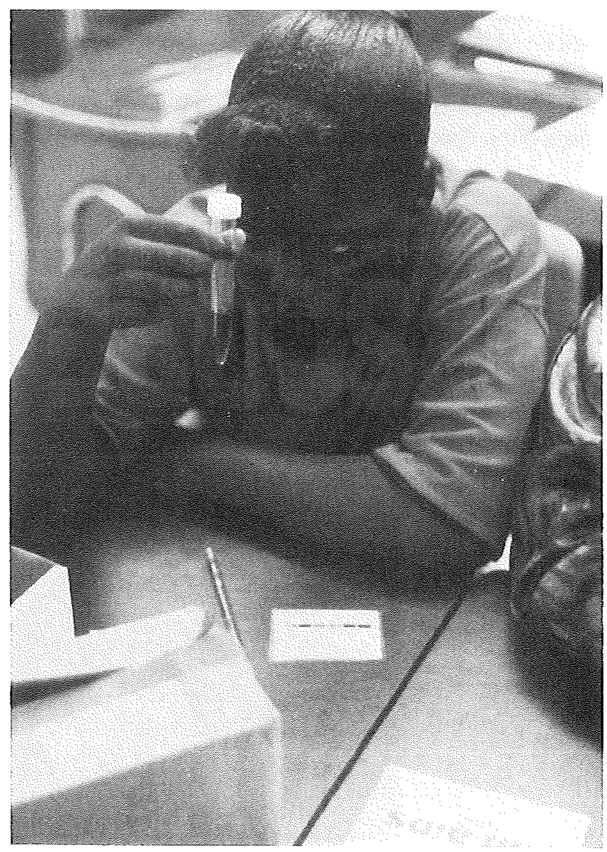
Precomputer: Students were introduced to the problem of acid rain as part of an environmental studies unit. They adopted classes from around the country that indicated interest in project participation. Upon receiving the water samples from their distant partners they conducted water quality tests on the samples. Once results were récorded they prepared to transfer them by word processor to the computer.

Computer: Students transferred their data by word processor to the computer and saved it to disk. Most sites sent more than one water sample. Tests were conducted on all samples sent from one class. Students compliled their data into batch files in preparation for electronic mailing back to the distant project participants. Once the data had been organized in this fashion it was sent back to the participating class via Fred Mail. At the end of the project, the data from all the water tests from all eight schools were compiled into one large file. This was put on the Fred Mail Bulletin Board as a file so that all the participating schools (or other interested schools) could have access to all the data for their own study. In this way a school that didn't have access to the water test kit could still include the results into their own environmental studies unit and enhance their own efforts to study environmental problems.

Post Computer: Since the computer was used in various ways throughout this project, I'm not sure there is a point that can be called "post computer." However, once the project was completed, there was much class discussion about all the aspects of this project. This included discussion on the computer's ability to link our class with other classes around the country and around the world. We talked about other uses of telecommunications such as businesses sharing information, scientists or scholars sharing data, tapping into data bases and retrieving vast ammounts of information, and corresponding with distant audiences.

The use of the word processor as a writing tool and its ability to manipulate and organize information in an easy fashion was also discussed. Students liked using the word processor but were aware that they could write faster with pen and paper at this point. Once they learned typing skills then the word processor would be even better.

Evaluation: This unit or project was evaluated on several aspects. The common tread that tied the different aspects of this project together was the focus on **acid rain pollution.**



1. Did students successfully use computer technology as a tool to help them complete an assigned task? Students used telecommunications to contact and share data with students in other distant locations. They involved these distant students in a project that required their participation. Without this cooperation it would have been difficult to obtain water samples from distant locations. Students also compiled their information and data using the computer as a word processor. This made it possible for their information to be compiled and sent back to its destination via electronic mail.

2. Did students become actively involved in learning about a science related topic? Upon obtaining water samples from distant collection sites, students in my class used the Lab Aids Water Quality Test Kit to conduct eleven different water quality analysis tests on each sample. This hands-on activity gave them first hand knowledge about the quality of the water they tested. It gave them confidence in their ability to study and analyze a scientific sample. And it allowed them to experience methods used by real scientists who study and collect data on similar types of experiments.

3. Did students' knowledge of geography increase as a result of this project? Students in my class became much more interested and aware of geography as a result of this project. All students were interested in knowing where all the cooperating schools were located on a map, how far away they each were from our classroom, and other related information about each site. I became aware of a much higher level of interest and I believe this is due to the fact that the students perceived they had a real reason to know where these distant participants were located. They located the participating schools on an atlas and they plotted their positions on blank maps of N. America so they could refer back to them.

4. Did students become aware of some of the environmental problems we face as a result of this project? As a result of this project students became much more aware and interested in environmental problems we face. By corresponding with students across the nation they became aware that these problems are large scale and effect everybody. By conducting the analysis of the water samples themselves they bacame aware of some of the methods used to detect and understand these environmental problems. And by participating in a project of this nature their interest and understanding in environmental problems other than acid rain also increased. They became more interested and informed on **Ozone Depletion, Water Pollution, Solid Waste Disposal, Air Pollution,** and other related topics.

For my students this was a very successful project which linked many different subjects together by a common theme. My students became more aware of environmental issues. They used hands-on science to solve problems of water contamination. They used telecommunications and other computer skills to expand the scope of this unit and make it more meaningful. And the became interested in geography and wanted to know the location of their project partners.

I was very pleased with how this project turned out. I will run it again each year and will also have my students participate in related projects that utilize telecommunications.

Marlene Gregor
Secretary of ISTA

A REPORT ON THE CONFERENCE FOR ILLINOIS TEACHER-LEADERS IN MATHEMATICS, SCIENCE AND TECHNOLOGY EDUCATION

In March of 1992, a major gathering of math and science teacher-leaders was held in Bloomington as a part of a Fermilab-sponsored project. The purpose of the weekend meeting was to assemble grassroots opinions about the existing needs in math, science, and technology education for the Principal Investigators (PI's) of the National Science Foundation Teacher Enhancement Program from the State of Illinois.

The conference first broke into various groups by grade levels to discuss the needs to enhance science and math education. The participating teachers were asked to survey their schools prior to the meeting about local needs, as well as bring suggestions for encouraging "the reluctant teachers" to enhance their teaching skills. Lists were made, then compiled for analysis. Many of the same needs surfaced in each grade level group. Some of the commonly-shared needs were: class size of 20-24, compensation for staff development and staff development with follow-up, current materials and equipment, assess to technology, released time for professional growth, on-going curriculum development, interdisciplinary curriculum, parent education, administrative support, teacher networking grades K-16, budgets for science and math, hands-on science and math, peer workshops, having a math-science specialist, critical thinking and problem solving skills, equity in state funding and community involvement.

Next, the groups were divided into disciplines (either math or science, including technology) and asked to review the suggestions made previously, then generate a consensus report reflecting K-12 ideas on the following questions:

What does your school need to enhance science and math education? How can we encourage reluctant teachers to enhance their teaching skills and use of effective instructional materials? Some of the suggestions were: smaller class size (20-24), mentor system, staff development, resource specialists, funding, math/science standards, support network, parent and community involvement, increase instructional time, supplies and materials.

Action plans for local, state and program providers were generated around six main goals:

1) Develop a network for the State of Illinois to facilitate and encourage communications among teachers and related professionals.
2) Enhance the professional development of teachers' knowledge, attitudes, and classroom practices as they relate to content, pedagogy and assessment strategies.
3) Involve teachers in planning, developing and implementing math, science, and technology curricula that meet individual student needs to function in an ever-increasing technological and global society.
4) Require that every school district implement appropriate alternative assessment plans, including but not limited to performance-based assessment.
5) Establish logistical support for change at the school level.
6) Promote collaboration, planning efforts, and partnerships between the schools and their communities.

In order to implement these recommendations, an organization is to be established to provide M/S/T support to every teacher in Illinois, share information and discuss new ideas, provide an infrastructure to develop collaborative proposals, evaluate implementation efforts, and serve in an advisory capacity to ISBE, IHBE, and Center for Scientific Literacy. The next meeting of this organization is scheduled for October, 1992. An important local component is also needed, that being at least one professional M/S/T contact per school.

An evaluation will be made to determine if a coordinated effort over a period of time offers improvement on the local school level, and impacts on student education via teacher enhancement programs. Hopefully we will be seeing positive results of this conference's outcomes and its plan to enhance science and math education in Illinois.

Specific Recommendations That Will Enhance Science and Mathematics Education in Our Schools

ADMINISTRATORS AND ADMINISTRATING

Class Size: We recommend that the class size be 20-25 children per classroom.

Equalized Funding: State and Federal monies must be equalized among ALL children and schools.

Current Textbooks, Materials, Kits: The administration needs to provide current, up-to-date materials, textbooks, kits, and manipulatives. Also replenish consumable annual and refurbish kits.

Stipends, Grants, Scholarships for Teachers: Providing the teachers with in-services, stipends, grants, and scholarships are essential.

Administrative Support for New Programs:
Administration attend the in-services in Science and Math along with the teachers. Attend their own conference sessions in these areas. Learn to evaluate good teaching in these areas. Support strong Science and Math curriculum featuring hands-on methods.

Increase the School Year to Ten Months: The students would attend the usual 9 months, but the teachers would be on contract for ten months (being paid extra for the additional month). The teachers would develop, plan, evaluate current programs, and receive in-service.

Utilization of State Universities: Free access would be granted to teachers for continuing education.
Across-District Access: Adjacent districts would share each other's in-service offerings, workshops, special speakers, experts, etc.
Update Curriculum on a Regular Schedule
Equipment Fund/Petty Cash: Each classroom would be given a fund to buy consumable, special project items, etc.
Positive Media Images: Work to reduce negative press regarding schools. Invite press to school functions. Work to eliminate violence on TV, and negative models, such as Bart Simpson.
Research Needed: A body of research is needed giving feedback showing that hands-on methods in science and math, whole language approach, and integrated learning effectively produce the needed achievement.
Realistic Achievement: Each child's progress is individually measured and monitored. No comparison is made between students, but rather based on a student's year-long progress of his/her work.

PARENTS AND PARENTING

More Community/Home Involvement Through Parent Education: Making Science and Math a family affair, such as through parent-come-to-school nights, science kits for home check-out, a parent and child hands-on science night at school.
Value Program for the Home: This program would start at birth to develop positive attitudes in children. A leverage is needed to encourage parents to support this program with their attendance and action. Children need to be taught self-discipline, and other character-building traits.
Parent and Grandparent Volunteer Corps: Helping with housekeeping chores, giving individual student attention, monitoring students, non-teaching jobs, etc. would free teachers for instructional tasks.

TEACHERS AND TEACHING:

Teacher Mentors: Teachers helping teachers would encourage the reluctant teacher to try hands-on approaches and avante garde methods. It would also offer peer encouragement, feedback, and a healthy verbal exchange.
Teacher Accountability: Teachers would be evaluated every three years in science and math instruction.
Released Time: Released time would be given teachers for planning, curriculum building and revision attending professional meetings, and professional improvement programs.
Willingness to Change Instructional Methods:
An attitude change. Seeing positive role models by visiting other classrooms. Use of peer support and encouragement, such as a master teacher or mentor situation.
Handicap Training for Teachers: Working with mainstreamed children who are handicapped physically, socially, emotionally impaired is a reality, and special training is needed by the teacher. Drug damaged children are now appearing in the schools, as well as a higher population of abused children (drug, sexual, violence).
Expanded Field Trip Schedule: Bring the classroom beyond the four walls. Many children lack experiences within their communities.
Using Science/Math Experts for Assemblies: Bring the experts into the schools.
Elimination of Non-teaching Activities: Use of aides, volunteers, PTA type groups as a provider of non-teaching services.
Cross-Curricular Programs: Use of whole language, interdisciplinary teaching, cooperative learning, skills through content.
Child Centered Learning: Children who claim responsibility for their learning, who are truly motivated are eagerly needed in today's classroom. Gearing children to be lifelong learners is a new task for the teacher.
Teacher as a Facilitator: A change in the teacher's role from autocrat to facilitator is needed to achieve the child centered learning, as stated above.
Greater Student Recognition: The society needs to send a message that academics are of value. Concerted ways to recognize students' achievement and involvement are essential for positive reinforcement. The media is an important element.

RECOMMENDED SCIENCE AND SOCIETY EDUCATIONAL RESOURCES

Reprinted from Teachers Clearinghouse for Science and Society Education Newsletter, Fall 1991

1. James J. MacKenzie, "Breathing Easier: Taking Action on Climate Change, Air Pollution, and Energy Insecurity," World Resources Institute, 1735 New York Avenue, N.W., Washington, DC 20006. 24 pp. $5.00 (1988). According to this attractively illustrated full-color booklet, "Three of the most serious, long-term challenges the United States faces today" are climate change, "persistent" air pollution, and growing dependence on imported oil, all derived from burning fossil fuel. A common solution entails replacing fossil fuels with alternative fuels and energy conservation.

2. Lee R. Lynd, Janet H. Cushman, Roberta J. Nichols, Charles E. Wyman, "Fuel Ethanol from Cellulosic Biomass," ***Science*****, 251, 1318-1323 (15 March 1991).** After recounting present U.S. energy use by source, amount, percentage imported, and remaining supply, this article espouses the advantages of producing ethanol as an alternative liquid fuel from cellulosic biomass. The energy output/energy input ratio, less than one for corn-based ethanol, is about five for the cellulose-based process; and the cost is expected to decrease to that of the gasoline equivalent by 2000.

3. **WEST-Superior Science Units, Wisconsin Academy of Sciences, Arts and Letters, c/o Mary Brand, 1923 N. 53rd St., Superior, WI 54880, (715)-394-7167. $5/disk.** Each disk contains three complete units appropriate for a particular grade level from K through 7, and there are two disks for each grade level (A and B). The disks are written in Appleworks 2.0, and units run up to 40 pages. A listing of the unit titles can be obtained from Mary Brand at the above address.

4. **Office for Interdisciplinary Earth Studies, *The Climate System*, University Corporation for Atmospheric Research (UCAR), P.O. Box 3000, Boulder, CO 80307-3000, (303)-497-1682. 21 pp. free.** This is the first in the "Reports to the Nation On Our Changing Planet" series of booklets, brought to you by the publishers of *EarthQuest*, listed as a resource in our Spring 1991 issue. This full-color booklet, handsomely illustrated with diagrams highlighting in three dimensions what happens to incoming sunlight and the circulation of water in the oceans and air in the atmosphere, is printed on recycled paper and divided into eight sections. "What is Climate?" is answered as the interworking of atmosphere, ocean, land, and living organisms on earth, just as the functioning of living organisms derives from the interworking of their various body systems. "The Light from Above" describes the effect of clouds, land, and atmosphere on incoming sunlight. "The Global Heat Engine" discusses how the oceans and atmosphere (like fluids in a heat engine) transfer energy from the earth's "waistline," where most of the sun's energy is absorbed. "Water, Water Everywhere" examines the role played by water in determining climate and to be played by water in possible climate changes. "The Oceans" are characterized by sluggish thermal behavior which tempers climatic extremes; on the other hand, when an El Niño arises, it can cause havoc. "Climate By Computer" describes the difficulties of modeling earth climates accurately by computer. "The Fire and Ice Before" refers to evidence of climate changes in ages past from records of tree growth, ice ages, air bubbles in glacial masses, volcanic activity, and changes in earth's orbit. "Warmer Than We've Ever Known" points out that increased carbon dioxide over the last century has warmed the earth as much as 0.5% of the sun's energy input. It also cites other greenhouse gases and notes that reduced fossil fuel combustion through energy conservation could alleviate greenhouse warming. Finally, "The Challenge Ahead" is presented: ". . .the needs of a rapidly growing population have begun to stress the limits of the natural system. The nations of the world now face a great challenge—to anticipate future climate change and develop a rational program for protecting the environment."

5. ***April 22, 1991 Earth Day*, Seventh Generation Products for a Healthy Planet, Colchester, VT 05446-1672. 40 pp. $2.00.** This catalog of "more than 200 products to help protect the Earth," printed on recycled paper, contains information on products designed to be friendly to the environment. This information can be used by students to launch their own STS research projects, including comparison of the economic costs of using these items and their traditional equivalents.

6. ***LEONARDO*, Journal of the International Society for the Arts, Sciences, and Technology, 2030 Addison St., Suite 400, Berkeley, CA 94794, (415)-540-5900. $60/year (includes associate membership in ISAST and the *Leonardo Music Journal* with CD).** This quarterly journal describes itself as "the foremost international forum for artists and others interested in the application of contemporary science and technology to the visual arts and music." It "features articles written by artists about their own work, as well as discussions of new concepts, materials and techniques."

7. **Robert L. Olson, "The Greening of High Tech," *The Futurist*, 25, 28-34 (May-June 1991).** This article attributes the current controversy between industrialists and environmentalists to three misconceptions:
1) "A truly advanced technology already exists."
2) "Advanced technology is always big, complex, and environmentally destructive."
3) "There is only one kind of advanced technology, and it just happens."

By contrast, the author suggests a "technology shaped by environmental values . . ."—what Freeman Dyson refers to as "green" technology (as opposed to current "gray" technology). "Green" technology is characterized by being sustainable, based on a safe and inexhaustible supply of energy, highly efficient in the use of energy and other resources, highly efficient in recycling and the use of by-products, intelligent, and increasingly alive. A separate box portrays the evolution of photosynthesis and oxygen-using organisms as steps in nature's biotechnological evolution which epitomizes "green" technology.

8. **Alan Durning, "How Much Is Enough?" *Technology Review* 94, 56-64 (May/June 1991).** According to this article based on a chapter in *State of the World 1991*, a team headed by José Goldemberg concluded that the whole world could enjoy the quality of life of Western Europe but NOT that of the United States on a sustainable basis: "In the final analysis, we might be happier with less. Accepting and living by sufficiency rather than excess offers a return to the human cultural home: to the ancient order of family, community, good work, and good life; to a reverence for skilled handiwork; to a true materialism that cares for things, not just about them... For the lucky, a human life encompasses perhaps a hundred trips around the sun. Regardless of religion, the sense of fulfillment received on that journey has to do with the timeless virtues discipline, hope, allegiance to principle, and character. Consumption has little part in the play that inspires

the young or the bonds of love and friendship that nourish adults. The things that make life worth living, that give depth and bounty to human existence, and infinitely sustainable."

9. J. Madeline Nash and Dick Thompson, "Crisis in the Labs," *TIME*, 138 (8) 44 (26 Aug 91). The interlocutors at the Scientific Literacy Seminar (see separate article in this issue) may have concluded that science has "a unique potential with respect to educating people with respect to the truth," but this *TIME* cover story presents an image of science tarnished by mistakes and unfounded claims that have been funded by taxpayers' money. With twice the scientists receiving only 20% more funding that in 1968 and the course of research increasingly impacted by political activism, the morale of the scientific community is portrayed as depressed, with many resorting to lobbying. Mindful of the value of scientific research as an investment in our future, *TIME* counsels: "Scientists would do well to put their house back in order. They should avoid cutting corners or misusing funds in a desperate effort to make financial ends meet. They must come down hard on transgressors, give whistle blowers a fair hearing and not stonewall in defense of erring colleagues. And they should discourage the ill-conceived practice of hastily calling press conferences to announce dubious results that have not been verified by peer review."

10. New York City Department of Environmental Protection, 5917 Junction Blvd., Elmhurst, NY 11373-5107. Two videotape programs are available for free short-term loan or purchase: "Dripnet," a nine-minute parody of "Dragnet" that teaches children how to conserve water (purchase price $10) and "Wastewater Treatment: The Impact on Our Waterways," a 10-minute step-by-step tour of the sewage treatment process (purchase price $12.50). A special New York City edition of *The Magic School Bus at The Waterworks* is available for $4.00, and the following free publications can also be obtained: *Be a Water Watcher: A Resource Guide for Water Conservation*, a curriculum guide developed by the Board of Education with assistance from the Department; *The New York WaterSaver's Workbook*, filled with activities for children and illustrated with award-winning entries from the 1989 Water Conservation Art and Poetry Contest (open each year to fifth and sixth graders); *The New York Water Saver's Guide to Gardening*, published by the Mayor's Committee on Water Conservation and the Department, shows how to establish drought-resistant plants and gardens; *Household Conservation Tips*, a short guide to conserving water in the home. To request materials or videotapes, contact Stefanie Silverman, Deputy Director, Education and Information Programs, at the above address or (718)-595-3482.

11. The Woodrow Wilson National Fellowship Foundation 1989 Chemistry Institute, *Chemistry in the Environment*, The Woodrow Wilson National Fellowship Foundation, P.O. Box 642, Princeton, NJ 08542-0542. 341 pp. free. This compilation of 75 activities, mostly designed for high school chemistry classes, was developed by the fifty teacher participants in the Institute on High School Chemistry administered by the Woodrow Wilson National Fellowship Foundation.

The Teachers Clearinghouse for Science and Society Education, Inc., was founded at the New Lincoln School on 11 March 1982 by Irma S. Jarcho, John L. Roeder and Nancy S. Van Vranken. Its purpose is to channel information on science and society education as well as data on available materials and other resources. To these ends it publishes a Newsletter three times a year. This is available free of charge. The Clearinghouse is sponsored by the Association of Teachers in Independent Schools, Inc., and is affiliated with the Triangle Coalition for Science and Technology Education. To get more information, write or call:

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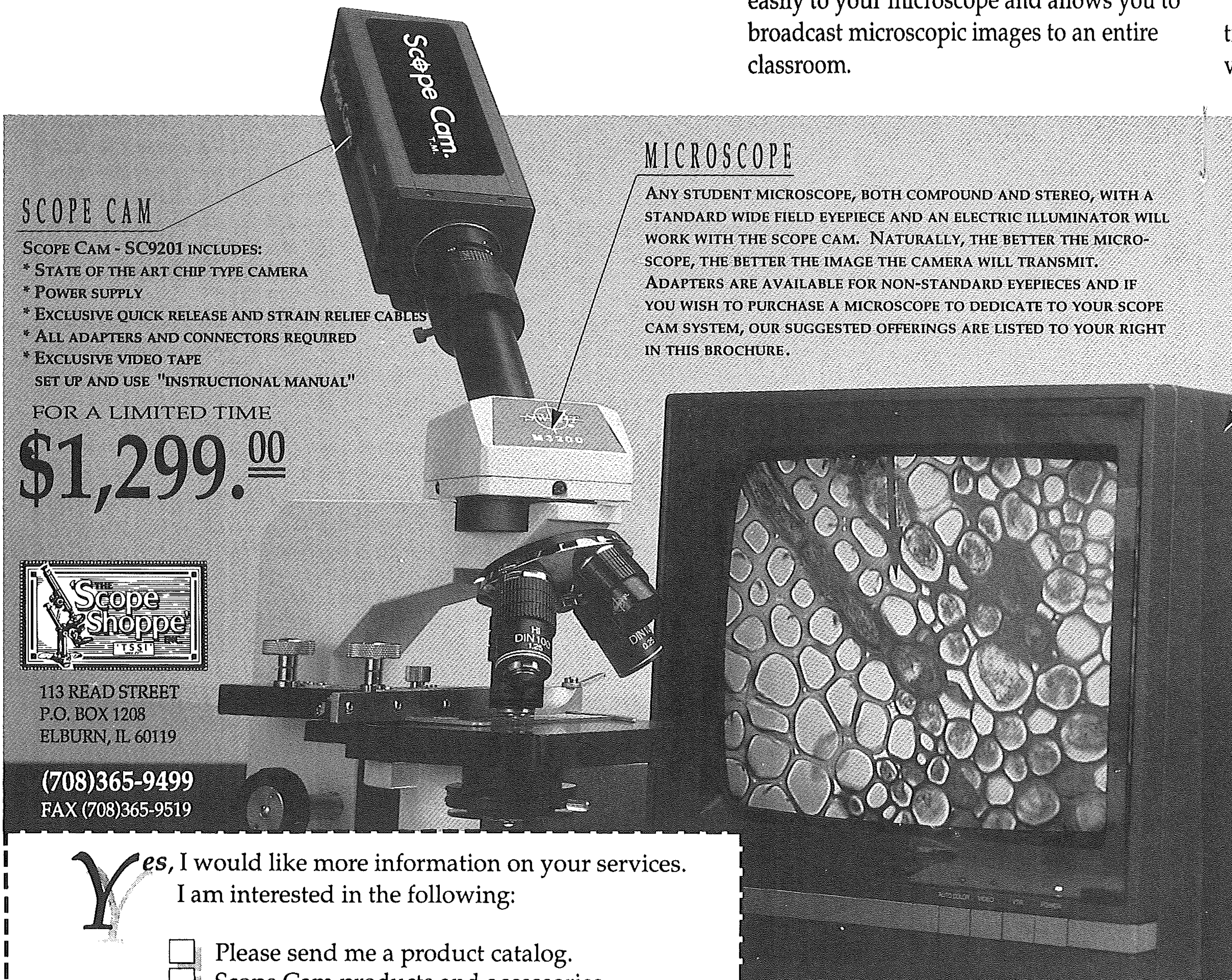

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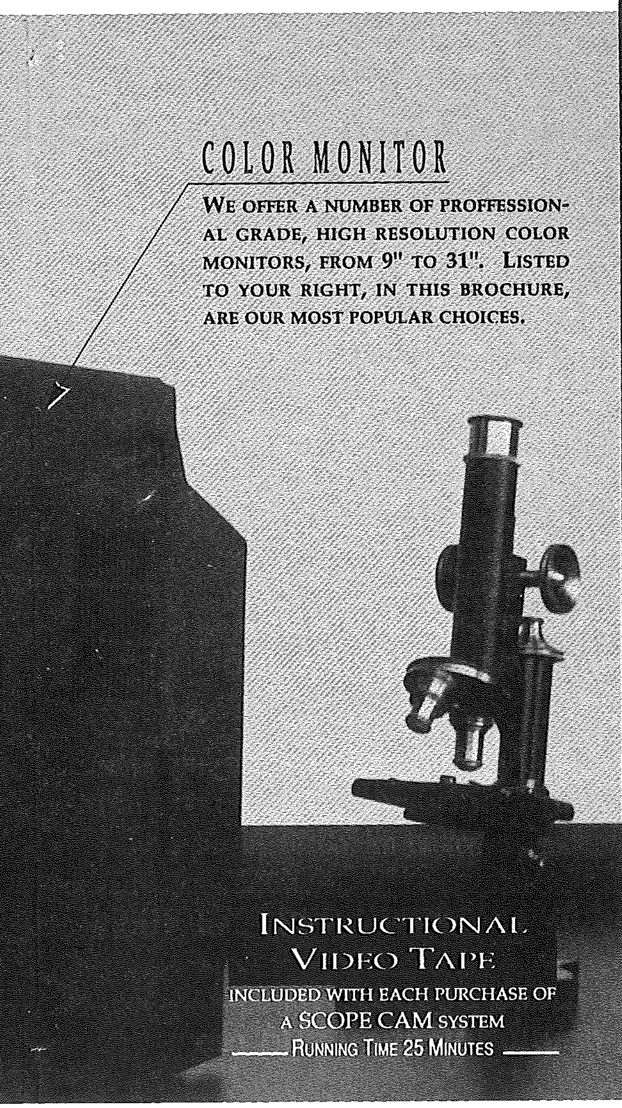

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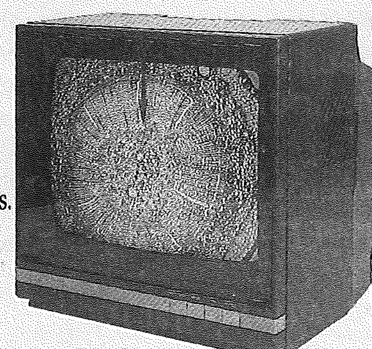

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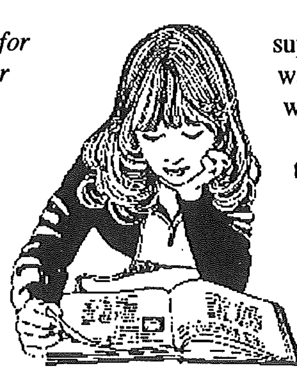
SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE.

Bill Aldridge
Reprinted from *Teachers Clearinghouse for Science and Society Education Newsletter*



SOME OF WHAT EVERY 9TH GRADE AMERICAN STUDENT SHOULD UNDERSTAND ABOUT BASIC SCIENCE

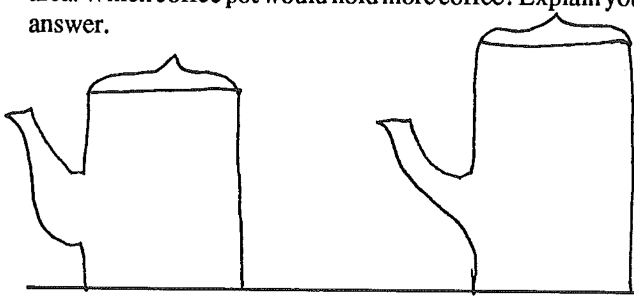
(*Clearinghouse Editor's Note*: The following is a reprinting of the 10-question Science Quiz NSTA Executive Director Bill Aldridge brought with him to his "debate" with Bob Yager at the Seventh Annual Technological Literacy Conference. Bill has graciously permitted us to reprint that quiz, although it is still in draft form. Bill also notes that recent possible evidence of acquired characteristics of bacteria would require rewording the last question.)

1. It is 10:30 p.m. in late September, and when you look into the night sky in the west, slightly southwest, you see the moon just above the horizon. Sketch a picture of how the moon will appear at that time. If it is not a full moon, show which side of the moon is dark and which side is illuminated by the sun. Where will the moon be the next night at the same time? Higher or lower in the sky?

2. You are driving a car along a long straight part of an interstate highway. You drive 10 miles at precisely 60 mph, when you come to some highway construction. You then slow immediately to 30 mph and drive at precisely 30 mph for the next 10 miles. What was your average speed over that 20 miles of interstate highway? Show how you arrived at your answer.

3. You are riding in a car with your window open. The car is traveling at 30 mph along a straight, flat road. You drop (but do not throw) an apple core out the window. In terms of where the car was when you let go of the apple core, where does the core hit the ground? Where the car was? Behind where the car was? Or in front of where the car was? In terms of where the car is at the instant the core hits the ground, where does the core hit? Where the car is? Behind where the car is? or in front of where the car is? Explain how you arrive at your answers. If necessary, use sketches to show the apple core and car.

4. The illustration below shows two coffee pots. They are both cylindrical in shape and have the same cross-sectional area. Which coffee pot would hold more coffee? Explain your answer.



5. Suppose that you weigh a glass full of water. Then suppose that you weigh an identical glass that is full of water but has a wooden block floating in it. Which would weigh more? Explain your answer.

6. A large tank is filled with water. Salt is added to the tank of water until a person of mass 80 kg can just float freely in the tank. In other words, the person, holding his breath with a normal amount of air in his lungs, does not sink to the bottom of the tank or rise to the top. He is suspended. A 100 mL sample of the salt water has a mass of 105 grams. Using this information, what is the volume of this person's body? Show how you arrive at your answer.

7. When a 120 gram mass is placed on your wrist, you cannot perceive an increase in pressure until an additional 4 grams are added. When 30 grams are placed on your wrist you need an additional 1 gram to perceive the change. How many grams would have to be added to a mass of 600 grams on your wrist to be perceptible? What would you feel if a weight of 64 ounces on your wrist had added to it an addition weight of 1 ounce? Explain how you arrived at the latter answer.

8. A 1 gram seed is put into a pot of moist soil, and the pot is placed where it can receive regular sunshine. Water is added to the soil periodically to maintain precisely the same level of moisture, and the seed sprouts, producing a green plant. At the end of several months the entire plant, including the roots, is removed from the soil and found to have a mass of 82 grams. Approximately what amount of mass has been removed from the soil in terms of nutrients used by the growing plant? Explain in some detail what matter is utilized to form the mass of the plant and its sources.

9. Movies are often based upon monsters created by some mutation induced by some chemical or radiation. The creatures are usually scaled-up versions of ants, flies, apes, or even people. Such giant monsters are shown to be scaled up proportionately. The giant ape would be 10 times longer, 10 times wider, and 10 times higher. Thus it would have all of the same relative proportions as a regular size ape. But is this possible? Suppose that an ant 4 mm long, 2 mm high, and 2 mm wide is scaled up by some means to create a giant ant 4 m long, 2 m high, and 2 m wide, an increase of all linear dimensions by a factor of 1000. How much more will this ant weigh? How much stronger will its legs be, which must support that weight?

10. A person has a bacterial infection. The doctor decides to use a broad spectrum antibiotic to treat the infection. Was this decision made because with repeated dosage of a single, specific antibiotic the bacteria become resistant to it by getting "acclimated" or "used to" the antibiotic and it is therefore no longer effective? Or was it because the doctor did not want to bother with producing a culture and identifying the specific bacterium so that he could use the correct antibiotic? Or is there some other reason?

A SET OF STS QUESTIONS TO PARALLEL BILL ALDRIDGE'S SCIENCE QUIZ

(*Clearinghouse Editor's Note:* After Bill Aldridge called attention to his 10-question Science Quiz during his "debate" with Bob Yager at the Seventh Annual Technological Literacy Conference, Irma Jarcho asked Bob Yager to submit a set of 10 STS questions. At Bob's request, Larry Kellerman and Karen Wellner have formulated the following set of questions. Bob also invites comments by *Clearinghouse Newsletter* readers at the Science Education Center, Van Allen Hall, The University of Iowa, Iowa City, IA 52242.)

1. Recently Mrs. Tomasic's classroom pursued the issue of which material (clothing) was the best to wear for the cold Iowa winter. Theyidentified five fabrics: 100% wool, 100% cotton, 100% rayon, 100% polyester, and 100% nylon with a 100% polyester filling. The students hypothesized the material that would be best to wear in the Iowa winter must be able to keep cold out and keep the typical body temperature (37°C) inside under the cloth at a constant temperature for a longer period of time than the other materials. The students picked one classmate to wear a coat made of each material and sit in the school freezer until the cold became unbearable. The length of time for each stay was recorded and the material that allowed the student to stay in the freezer the longer period of time was declared the best material for cold weather insulation.
Explain whether this is a valid experiment, then provide documentation supporting your particular viewpoint. Your answer would include positive and/or negative results that may accrue from this experiment.

2. Students in the ninth grade at XYZ high school have determined a very pressing issue they want to study: the potential depletion of the ozone. They have begun the study by collecting various magazine and newspaper articles about ozone depletion and pictures taken by satellites orbiting the earth. The students have determined that it would be very impractical to do an experiment in the classroom which would show how certain chemicals are depleting the ozone.
Without an experiment to see what materials deplete the ozone, how can the students determine that there is an ozone depletion problem? When simply publishing pictures taken by a satellite and saying that they prove that the ozone is being depleted, are there any possible reservations someone could have if confronted only with those pictures and the written description accompanying them? If this is not enough evidence to convince someone that the ozone is being depleted, what evidence is missing?

3. A group of students has hypothesized that the sun appears to change direction as identified by the lengthening and subsequent shortening of the shadow. The students have read that the length of the shadow of a stick placed in the ground increases until December 22 and begins to decrease after that date.

If the students resolve to perform this experiment to determine its validity, what potential problems may theyface? Will this experiment provide solutions to the students' hypothesis? Explain the reasoning behind your answer.

4. As a family project, the Ricciardis built a deck onto the back of their home. Upon its completion the two teenagers of the family were asked to seal the wood to protect it from weathering. The teenagers discussed the procedure with their parents and determined the best way to choose the most efficient sealer was to do a simple experiment. They got a board left over from the deck project and cut it into five pieces. They took the five pieces down to the local lumber yard and talked the manager into letting them paint one side of each board with a different sealer. They labeled each board and took them home to dry.
If they want to determine which sealant would be best to seal the deck, what type of experiment should they perform, and how should it be executed? Keep in mind it needs to be done quickly so they can seal the deck before the next rain. List some of the factors the two teenagers should consider prior to purchasing the best sealant. Once they make the decision, what could they do to ensure others make the same wise choice?

5. The thirty students in Miss Bair's class have really been doing a good job studying the local environment. On one of the schoolyard habitat studies, John and Lindsey spot an organism crawling across the trail. They watch it carefully and observe that its rounded body appears to be made up of segments and that it has numerous legs. It crawls into the grass and disappears before they can decide what the organism may be.
What could help them determine what the organism may be? Examine various solutions to this problem and describe likely alternatives. Include solutions that may take advantage of skills developed outside the science classroom.

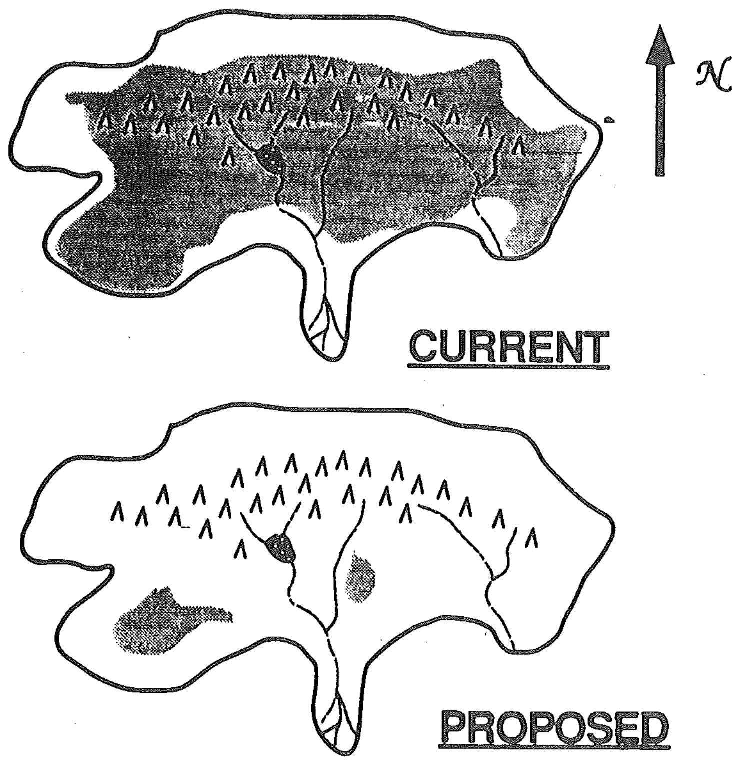
6. A severe drought became a focus for Mr. B's room. One of the issues was relative humidity and the effects that extremes cause. One group of students decided to study the longevity of bubbles under various humidity conditions. Two extremes were selected, 80% high and 20% low. The students found that various soaps produce less suds when humidity is low. The students hypothesized that the longer the life of soap suds, the better it would be for cleaning. They decided to "enhance" various soap mixtures while keeping them safe and nontoxic and cost effective.
What type of hygroscopic substances should be tested (e.g., sugar, salt, glycerin)? How will the amounts of hygroscopic substances be kept the same? How will suds longevity be measured? What other factors will play a role in the testing of different solutions? List possible reasons for informing others what solutions have been added and possible reasons for keeping them "in the dark" about the solutions added to the water.

7. Oil spills spell disaster for ocean inhabitants and are an issue often brought up by students in the classroom. Cleanup procedures vary depending on the size of the spill and its location (*i.e.*, near shore *vs.* open ocean), but students in Hartford Middle School's 7th grade class feel that it is possible to find the best cleaning agent available. They decide to venture into the realm of studying various materials and the oil absorbing properties of those materials. The materials to test include sponges, paper, foams, baby powder, actual oil-absorbing polymers sent to the class from clean-up companies, and styrofoam. In the end, styrofoam peanuts are found to absorb the most oil in the shortest amount of time.
What are the ramifications of using styrofoam peanuts for oil spills? List possible benefits and drawbacks to this solution and explain why each may cause problems or reap rewards.

8. Students in Miss Jordan's class have noticed that the grocery stores are full of packaged food claiming to be non-fat, low-fat, and light. The students decide to investigate how butter and margarine compare in terms of water and fat content. Each student is responsible for testing a particular margarine or butter (*e.g.*, light margarine, light butter, regular margarine, low-fat butter). After investigating the chemical and manufacturing differences between the two and how the FDA mandates food labeling, the students begin experimenting. Slowly heating the margarine/butter turns it into a liquid which can be poured into centrifuge tubes (or graduated cylinders if a centrifuge is not available). Upon centrifugation, the students measure the volume of water, curd, and fat that was separated out.
How might a table or graph be used by consumers in the school? Explain how consumers might be able to use the information gained from this problem to purchase these products (for example, by the cost per ounce or by the amount paid for water in the product). What conclusions can be drawn about the label "light" versus "non-fat" versus "very low-fat", it any?

9. The 6th grade class in Fowler School has chosen a pollution in the city's skies as its topic to study. One of the students has read that automobiles are the major cause of air pollution, and the class has proposed several experiments to determine the validity of the following hypothesis: *one can find evidence that air pollution is primarily caused by automobile exhaust.* One experiment will be carried out by the "A" group. Each day for ten days Michael will take out a new 2" square section of cardboard, covered with wax paper and a thin coating of petroleum jelly, place it on top of the cafeteria roof, and place the square previously there into a plastic bag and return it to the classroom. The students determined that they need to count the number of particles per observation area and view that area with a microscope at 10x. The particles will be sketched and the sketches grouped together with the particle count.
What potential information can come from this experiment? Examine the relationship between the number of particles coming from car exhaust and that coming from other potential causes and describe your conclusions. What can the students do to ensure that the particles they have collected are indeed from car exhaust?

10. After students at Garland Middle School had studied the cause and effect of soil erosion, land management policy, and water cycles, they were presented with the following problem and questions. You have just been elected to the ten-year president of a new and mythical island continent (see maps below). Your first decision is on a new logging policy. Most of the vegetation on the island is dense forest (the shaded area on the maps below). The loggers want to cut many of the trees down
What effect could this have on a) yearly rainfall; b) erosion; and c) native animal populations (which ones?). Create your own forest plan. Explain all your answers.



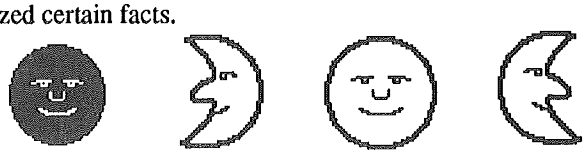
Answers to Bill Aldridge's Science Questions

1. This item can be answered using two sources: knowledge of the relative positions and motions of the earth-sun-moon system, which is far more complicated than most people think; or by recalling observations that you have made. In the former case, one is using a model or theory to account for or predict an observation. In the latter case, one is summarizing observations, with no attempt to explain or account for what is observed. Every child should have had the experience of keeping an earth-moon-sun log. Making such observations daily and over a period of a year provides extremely valuable insights into simple astronomy. From such observations, if carefully made, one can create models of various kinds to account for what has been observed. Only through such activities can a person come remotely close to understanding how difficult it is to use evidence from observations to create even a simple model of our part of the solar system.

In this item, if the moon were in the southwestern sky just above the horizon at 10:30 p.m., then it must have been approximately overhead (toward the south) at sunset, some 4.5 hours earlier. If the moon is nearly overhead at sunset, then the sun must have been (and continued at 10:30 p.m. to be) shining on half of the moon, that part of the moon that is to the right, with the darker half of the moon to the left. Whether the illuminated part is lower right, and the degree to which this is true, depends upon where you are located in the northern hemisphere. An 11 year old child would have recalled how the moon appeared during that part of the year and at the time of day and probably would even have noted the proper location of the illuminated region.

Notice that the question does not ask for the phase, the quarter, or other such terminology. Those terms can be given, once the experience has been provided. Where will the moon be tomorrow night at the same time? Again, by theory, one can conclude that since the moon is revolving around the earth in the same direction as the earth's rotation, the moon should be higher in the sky. By observation, one would recall the same result, but could offer no explanation of why. Such questions like this could be asked for several different seasons of the year and times of the day, leading students to recognize conditions required in relative positions for a full moon, and for the various moon phases, but without using those terms.

As a mature adult, who has observed the moon hundreds of times, you may be surprised that you cannot answer this item correctly. If you also believe that you understand the relative positions and motions of the earth-sun-moon system, but could not answer the question, then I would suggest that you do not in fact understand it all, but have instead memorized certain facts.



2. This item is most often done incorrectly because of a preconception. Most people have a preconception regarding the concept of average. To them an average is found by taking two or more numbers, adding them, and dividing by how many you have. But even though this same method could be correct if applied to motion, the application must be made at every instant of time. The concept of average speed is very specific. It requires that you find the total distance divided by how long it takes to travel over that distance. In this problem, the first 10 miles is traveled at 60 mph, or one mile per minute. Thus it takes 10 minutes to travel 10 miles. The next 10 miles is traveled at half that speed, or 30 mph. It must take 2 minutes for every mile for that 10 miles. Thus for the latter 10 miles, it required 20 minutes. The total time traveled was therefore 30 minutes or one half hour. Traveling 20 miles in 1/2 hour means that your average speed was 40 mph. Note that this is not the same as taking 60 mph plus 30 mph and dividing by 2, which would give 45 mph, an incorrect answer.

The importance of this item is in the fact that average speed is a fundamental concept. Without an understanding of such fundamental concepts, one cannot properly understand more complex phenomena or problems or issues involving quantities derived from this concept, quantities like acceleration, force, kinetic energy, and power. Those who think otherwise will need merely recall how they did when thinking about our moon-earth-sun system in item 1.

3. This item tests your understanding of the concept of relative velocity. When the apple core is dropped, it continues to more horizontally (ignoring air resistance) at the same speed as the car, 30 mph. But it accelerates downward at the rate given for that location on the earth, nearly 32 f/sec/sec. The core will hit the ground ahead of where the car was when you dropped the core. From the point of view of the moving car, the apple core falls straight downward. From the point of view of an observer standing on the ground outside the car, the apple core will follow a parabolic path, like that of a projectile fired horizontally at 30 mph.

4. This is not just a trick question. It tests one's understanding of Pascal's Law, the fact that liquid pressures are applied in all directions in the liquid. It also tests your observational and analytical skills somewhat. You must recognize that the spouts are at the same level. Then you must recognize that liquids in the two pots will move under pressures to the same levels because any excess will spill out of the spouts. The two pots therefore hold the same amount of coffee.

5. This item tests your understanding of Archimedes' principle. In the first case the glass full of water and has a certain weight. When a wooden block is placed on an identical glass full of water, the block displaces an amount of water equal to the block's weight. This water overflows and is no longer in the glass. But the weight is the same as before the block was placed in the glass. Thus the two glasses of water, one with and the other without the block, weigh the same.

6. This item is a take-off on a common method of determining percentage of the fat in one's body, as done in physical fitness centers. There are tables of densities and other variables that enable you to determine your fat content versus other kinds of tissue. In this item, if one is suspended in the salt water, then one's average density is the same as the water. Of course this density would change according to how much air you have in your lungs. In this case the density of the person must be 1.05 g/mL. With a mass of 80 kg, or 80,000g, there must be 1 mL volume for every 1/1.05 g, or .952 cubic centimeters per gram. Thus the person's volume must be 80,000 g multiplied by .952 cc/g, giving the result 76,160 cc, or 76.16 liters.

7. This is a very important item. It is one example of a very general empirical law of science which transcends different disciplines, especially biology, chemistry, and physics. The law is called the Weber-Fechner law of biology. This is an empirical law which summarizes the observation that a stimulus is detectable only if it exceeds an amount that is proportional to the stimulus already acting. For light, the proportionality constant is about 1/120. For sound it is about 1/9, and for tough it is 1/30. There are similar ratios for other senses, like that of taste in terms of bitterness. When the relationship involves the fact that the needed stimulus must be proportional to the stimulus already acting, the behavior is logarithmic. Hence the use of decibels in sound, pH in acidity, and our method of ascertaining the magnitude of stars, which is logarithmic.

In this particular problem, involving pressure, the basic information is given. To be perceptible, 1/30 of the amount acting must be added. Thus for 600 grams, one must add 20 grams to be perceptible. If 1 ounce is added to 64 ounces, you will not notice the additional weight because it is below the perceptible threshold of 1/30 of 64 ounces, or 2.1 ounces.

8. This item relates to a common perception that plants draw "food" from the soil and thereby gain their mass (found in studies by R. Driver). Instead, the plant, through photosynthesis, creates solid carbohydrate matter from the synthesis of hydrogen from water, carbon from carbon dioxide, and oxygen from water, with an excess of oxygen being released into the atmosphere. The "nutrients" taken from the soil by the plant are negligible in mass, although essential to the process.

9. A giant ant, whose linear dimensions were increased by a factor of 1000 would have its mass, and therefore its weight, increased by a factor of one billion. It would have 1 billion times more mass than the regular size ant. The strength of its legs would be increased by only 1 million. Thus its ratio of weight to strength would go up by a factor of 1000. It would be like placing 1000 ants on top of an ant and expecting the legs of the ant on the bottom to support this enormous weight. The giant creature's legs would be crushed under its own weight—hardly something to fear. This item illustrates one of the most fundamental principles of natural law: Scaling. Scaling up or down changes volumes and areas in ways that change essential characteristics of the object being scaled. For example, heat flow in and out of objects, including organisms, is proportional to surface area which is proportional to the square of the scaling factor. Volume of organisms, in which the metabolism of living material produces heat, goes up with the cube of that scaling factor. These two physical facts create both the upper and lower limits for the size of warm-blooded creatures. As shown in this particular problem, the strength goes up with the square of the scaling factor and the weight goes up with the cube. This means that scaling up or down must necessarily change the appearance. Surface to volume ratios are fundamental to understanding much of living and non-living phenomena in science. Items like this one test such understandings.

10. The common preconception, Lamarckian in its nature, is that the bacteria become "used to" or resistant to the specific antibiotic. But in fact that is never true. Within any colony of bacteria of a specific kind are a small number of bacteria with pre-existing mutations of resistance to that antibiotic. As all of the normal bacteria are killed, these few that are resistant to the antibiotic would find nutrient and room to grow rapidly. These new resistant bacteria produce the same infection effects; therefore, the single antibiotic would be insufficient. By using a spectrum of antibiotics, essentially all of the bacteria, including those few with the mutated resistance to the particular antibiotic would be killed by one or the other of the remaining antibiotics. Such items like this one could include asking what kind of experiment would one use to establish this conclusion.

Answers to STS Questions

1. As students work to answer the questions in problem 1 they will develop an understanding of the following science concepts: temperature, insulation, fabric construction, heat exchange, methods of doing science, personal preferences, human body regulatory systems, interaction of freezer and outside environments, humidity, consumer product testing, and hypothermia. Students will arrive at several alternative explanations for these questions. Each explanation will be grounded in current scientific understanding of these concepts and the scientific processes needed to analyze them as well as the ability to apply critical thinking skills to the experiment's possible benefits and drawbacks.

2. Developing valid solutions to these problems will require students to gain a solid understanding of current scientific thought pertaining to the following concepts: detrimental effect of ultraviolet light on the human body, refrigeration/air conditioning system and the role of CFCs in their design, weather systems, jet stream, ozone, chemical reactions, technical systems (satellites, cameras, and satellite dishes), ultraviolet vs. infrared, photography, role of evidence, and space flight. We know that even with the many facts already known to professional scientists there is still a real debate as to whether the ozone is being depleted. The students, with a developing knowledge of the aforementioned concepts, will be able to develop answers paralleling

the validity of scientists' solutions. This set of problems will also allow students to be creative in their problem solving, helping them to address similar issues they may encounter.

3. Students working on this particular problem will find themselves forming an understanding of the following concepts, some of which may be eluding students in current science classes: light, diffraction, shadow, triangulation, revolution of the earth, rotation of the earth, geometry, history of alternative conceptions (Ptolemaic *vs.* Copernican), and the seasons. If students know the way past astronomers have viewed this problem and have a hands-on experience solving these questions, the basic concepts listed above will become more meaningful.

4. This problem makes use of many concepts, some embedded within the context of other more prominent concepts. The list of concepts includes types of wood, porosity *vs.* nonporosity, chemical reactions, chemical bonding, product labeling, rain water chemistry *vs.* treated water chemistry, water pressure, advertising techniques (buyer psychology), consumer product testing, and water absorption/warpage. Students will encounter the aforementioned concepts and many of science's processes as they try to solve this problem. Using their creative abilities as well as their ability to apply what they do learn to a particular situation will make this formative evaluation an interesting one.

5. This question is a good one to take advantage of students' observation skills and recall of pertinent characteristics in order to make a proper identification. They will develop an understanding of the following concepts as they try to determine if they have been "good" scientists: identification of body systems (such as abdomen, antennae, and exoskeleton), color differentiation, methods of locomotion, habitat, potential eating habits, classification skills, and recording of sensory input. The answers to these problems are dependent upon the students learning the aforementioned concepts and making full use of their ability to apply certain processes, possibly learned in reading and in art, as they work their way to the solutions. Although this seems to be a simple exercise, it can be one made appropriate for all grade levels by the complexity of the expected outcomes.

6. This is not as easy a question as it may appear on first reading. The potential for serious problems is high unless the students gain an understanding of the following concepts: chemical bonding, tension , structure of molecules, measuring and measurement systems, time of exposure to environment, humidity, barometer, sling psychometer, determination of ingredients by testing for pH and chemical makeup, pressure (low or high), and pygroscopy. Students developing an understanding of these concepts and utilizing creative skills fostered in the classroom will have a handle on the various problems presented and will be able to determine the solutions without these abilities.

7. This highly controversial issue is being hotly debated even now, and that debate may get hotter if these students' findings are indeed valid. The students will need to have an evolving understanding of the following concepts in order to convince others of their findings: solubility of oil in water and in salt water, characteristics of absorbency, chemical bonding, molecular structure of the materials tested, disposal properties of cleaning agents, cost of each cleaning agent, public understanding of styrofoam and its benefits and drawbacks, and elementary geometry (to determine various areas). With a working knowledge of the aforementioned concepts as developed through the STS module, the students would be able to choose the best solution to a complex problem, just as oil disposal companies, governments and private corporations have had to do. They could also determine the best way to apply their skills as problem solvers to local situations that may be important, such as oil spills at the gas station or the disposal of waste oil by their parents.

8. Concepts important to solving the problem identified here include density, emulsification, polarity, definition of butter, butter fat, and fat, melting points, freezing points, measuring/measuring systems, chemical identification, labeling requirements, types of heat transfer (radiation, conduction, convection) and chemical and material bonding/nonbonding. Several of the concepts listed here can be found in previous questions and problems. As students build on their knowledge base, problems such as these will be easy to solve as the STS issues are identified.

9. To answer the problems in this question students will need to acquire an understanding of the following concepts: measuring, experimental controls, particulates, use of microscope, sketching observed phenomena, difference among dust, pollen, and airborne particulates, operations of internal combustion engines, role petroleum jelly plays in data collection, humidity, air pressure, wind direction, and human respiratory systems. This experiment alone should lead students to a solution for the final problem under #9. The understanding of the concepts listed above will allow students to hypothesize about possible activities that will fill in gaps left by this particular experiment.

10. The concepts that students need to acquire an understanding of as they try to solve this problem include runoff of water, compass directions, soil and wind erosion, prevailing winds, meteorology, humidity, forest ecosystem, food webs, animal/plant physiology, listing of and rating of potential consequences, and planning/utilizing both conceptual and procedural abilities. This problem is unique in that the students are being asked not only to comment on what may occur if some event takes place but also to design their own plan of action. The application of prior conceptual understanding, creative talents, and certain scientific processes will be a big help for this job.

University of Illinois
College of Engineering
Summer Program for
High School Students

ILLINOIS AEROSPACE INSTITUTE

PROGRAM DATES: July 11-17, 1993

WHERE: University of Illinois at Urbana-Champaign

PARTICIPANTS: Eligible students are those who will enter the 9th, 10th, 11th or 12th grade in the Fall of 1993.

PROGRAM DESCRIPTION:
Aeronautical Engineering: Explore theory of flight, aerodynamics, and the principles of aircraft design.

Propulsion: Examine propeller, jet engine and rocket propulsion systems. Experiment with model rockets.

Astronautical Engineering: Explore space flight from launch, through mission orbits, to reentry.

Communications in Space: Investigate the need for communication and the types of electronic systems that have evolved to meet these needs.

Aviation Technology: Explore navigation, atmosphere and weather, and air traffic control. Includes simulator and actual flight time.

CONTACT PERSON/ADDRESS/PHONE NUMBER:

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Illinois JETS
1308 W. Green St., Room 207
Urbana, Illinois 61801-2982
(800) 843-5410

Diane Jeffers
Dept of Aero/Astro Engineering
104 S. Mathews St., Room 104
Urbana, IL 61801
(217) 244-8048

IMPORTANT DATES:

Deadline for application	April 15
Notification to participants	May 10
Deadline for receipt of acceptance package and deposit	June 1

Costs - $650.00 Financial aid is available based upon need.

Jeff Yordy
Richard Goodspeed
Warren Bjork
Glenbrook South High School
Glenview, IL. 60025

STS ME, ASAP!

The time comes to teach the unit on Fungi. What's the difference between a Basidiomycete and an Ascomycete? Quick! We better look it up before biology class starts! In fact, we have to look it up every year. We haven't even had to *think* about the difference between a basidium and an ascus since teaching the Fungi unit last year.

If we who are really interested in science need to look these terms up every year, why are we teaching this vocabulary to high school students? Why should a high school student care? How often will the average person use such information?

It is about time that science teachers re-evaluate curriculum and instruction. Few of the students we teach will end up being research chemists or biologists. In fact, the vast majority of our students will *not* be employed in technology and science careers. But, all students should become scientifically literate citizens. Science courses for general students should be focused on contemporary societal issues to which students can relate. Relating useful science concepts to meaningful issues that students recognize leads to higher retention as well as better application of those concepts. Making science courses more relevant leads students to have a greater affinity for science.

Since adopting an STS (Science-Technology-Society) approach to chemistry, biology and environmental science, the teachers at Glenbrook South High School have observed that students enjoy their science classes more and are able to apply science concepts more readily. Students have been more enthusiastic and the attitude in the classroom has been more positive. According to the Constructive Learning Theory, concepts to be learned must fit into an existing mental framework or schemata. Where and how new concepts are mentally filed determines how accessible they will be and how long they will be stored. If information is filed under, "stuff that will be on the next chemistry test", it is less likely to be retained than if it is stored under, "information dealing with the quality of my drinking water". After the next chemistry test, the first schema will tend to cause the chemistry concepts to atrophy. The second schema, however, may be triggered every time the student sees a news report about lead in the water or watering restrictions, maybe even when she takes a drink at a water fountain. The way the concepts are taught influences the way that they are applied and retained.

At Glenbrook South, we are developing STS courses in biology, chemistry, and environmental lab science with units focused on issues which bombard our students. A few examples of these issues are: filled landfills, deer overpopulation, water quality, natural disasters, trauma care, nuclear power, and AIDS. Concepts within these units are selected on a need to know basis. Teachers select science concepts that a student needs to know in order to make an informed decision on the unit's issue. In this way, a lot of extraneous facts are avoided, and instruction concentrates on what will help the student make decisions in today's world. Issue oriented concept selection is valid and pragmatic.

This selection of concepts based on need has changed the content of our courses somewhat. Some conventional concepts have been eliminated. It is difficult for teachers to cut some of their cherished topics. But, gone are ascomycetes and fern life cycles; gone are Hess's Law and LeChatelier's Principle. While these may be important for someone with a job in botanical research or organic chemistry, they have very little meaning to an accountant, psychiatrist, computer programmer, or lawyer. Teaching an interesting and socially relevant course heightens awareness that science is related to 'real life'.

Our STS classes use cutting edge technology to make our presentation precise and stimulating. Videodiscs provide images focused on a single concept. Very few students get much information out of the last 5 minutes of a 25 minute film or filmstrip. With videodiscs we are able to cut directly to the most useful sections of video. Computers help us access the video images efficiently. On our teachers' desks are Macintosh computers linked to office laser printers for high quality word processing and professional looking handouts. This allows our new STS curriculum to be standardized and easily revised. Computer gradebooks are used to keep students immediately aware of their progress. We often work computer simulations into our units and are at the present time developing computer interfaced lab exercises.

Student expectations have changed. By reducing the number of multiple choice scantron tests and quizzes, we have recovered time to allow students to display their multiple talents. Instead of spending time grading fill-in worksheets and tear-out lab reports, we assign essays and research papers, posters and pamphlets, and we expect active participation in dramas and debates. This change in expectations has encouraged some students without previous positive experiences in science to excel in some aspect of chemistry, biology, or environmental science.

trauma care for Illinois citizens, includes objectives on the human circulatory, respiratory, nervous, skeletal, muscle, and integument systems. The issue, providing adequate trauma care, attracts student attention. The TV show, Emergency 911, demonstrates the current popularity of dramatized emergency situations. One day of instruction is devoted to setting the issue, with students locating trauma centers on an Illinois map, comparing this system with other trauma systems, and viewing a portion of the CBS 48 Hours videotape, "Trauma". The next ten class periods are devoted to learning human physiology and related medical technology. Trauma care is discussed on the unit's final day when a team of Glenview Fire Department paramedics interacts with the biology classes.

"The Des Plaines River" is the second unit in our freshman STS environmental laboratory science course. During this unit, the students measure Des Plaines River water quality and evaluate the river water. Our students monitor the river at the Allison Forest Preserve, just west of where Milwaukee Road crosses the Des Plaines in Northbrook. During the course of this unit, students learn to measure 9 different water quality indicators with Hach Kits. Students sample water, measure temperature, pH, dissolved oxygen and turbidity, and collect and classify macroinvertebrates and even collect and remove refuse from the area. They also collect river water for additional tests in their classroom laboratory. These measurements are shared with the Illinois River Study centered at ISU-Edwardsville. During the course of the school year, these students will each have another opportunity to sample and measure Des Plaines River water, as the classes continue a monthly water quality monitoring program. At the end of this unit, our students demonstrate an improved understanding of the state of their local environment. Most students are surprised to find that the water quality in the Des Plaines River at our site is reasonably good.

The culminating activity for the STS ChemCom nuclear power unit has the students debating, "The State of Illinois should promote and support the use of nuclear power". Students in each class are assigned to affirmative and negative teams. They collect pertinent information from literature searches and using the background developed in the unit, participate in a debate. Teachers' evaluations of debate participation provide credit only for supported statements, and this inducement keeps the debate rational. The student's interest and commitment keeps the debates spirited. We believe that our students complete the nuclear power unit with an improved appreciation for the complexity of energy issues.

STS courses at Glenbrook South cover significant science concepts which are selected for student relevance. Our students complete STS courses understanding that science is meaningful to their lives. Understanding increases through frequent review of crucial concepts. Engagement is demonstrated by thoughtful student reports, posters, and videotapes. We urge you to consider STS science As Soon As Possible.

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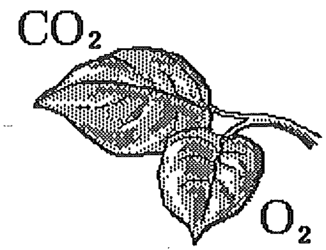

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GROWBUCKETS PUT A GREENHOUSE IN EVERY CLASSROOM

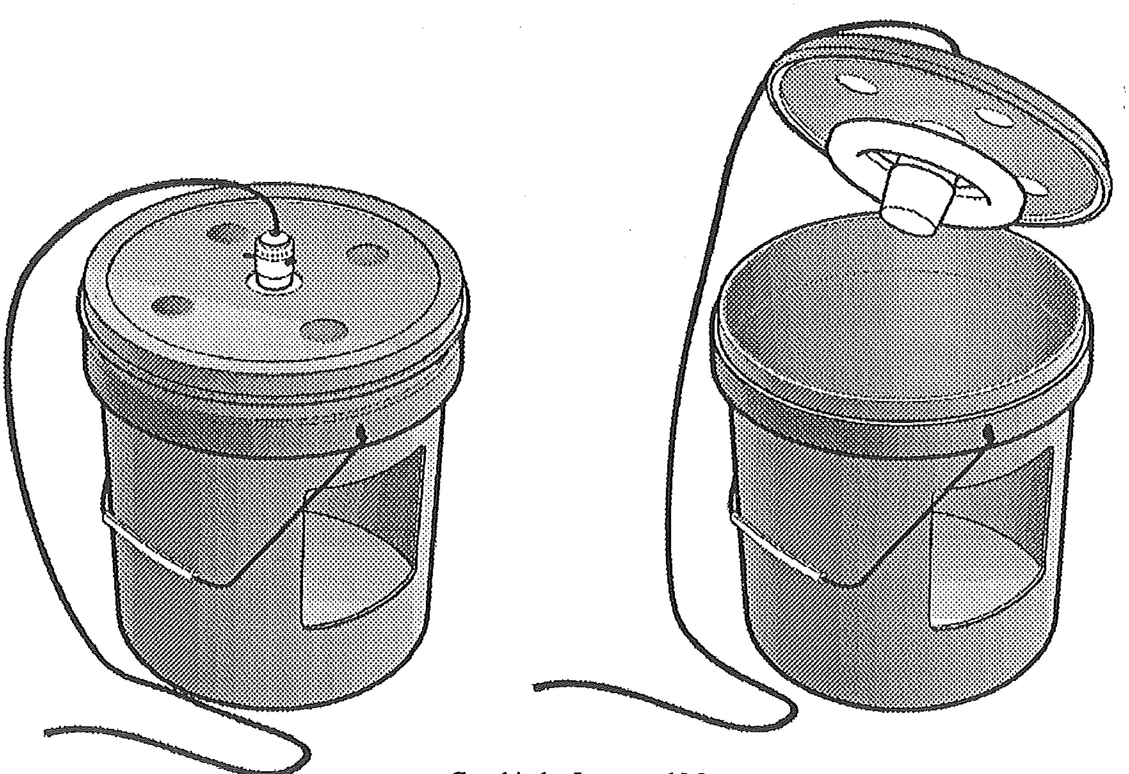
Just imagine all the ways a portable greenhouse could expand hands-on science activities in the classroom! Students could germinate seeds, start seedlings for developmental studies, grow plants from cuttings to study vegetative reproduction, test the effect of light by covering some leaves with black paper and comparing them with uncovered leaves. It would be possible to maintain algae-rich pond water samples to look at under the microscope in the dead of winter. Students could plan and carry out experiments on the effect of different amounts of fertilizer on corn seedlings, investigate the damage done by salt or other pollutants to Kentucky bluegrass, or compare root growth of beans using different soil samples. For windowless classrooms a single portable greenhouse could provide a small opening into the green world of plants, while two or three greenhouses in a room would allow several experiments to progress simultneously.

An inexpensive greenhouse bucket has been developed by the Bottle Biology/Wisconsin Fast Plants™ staff in the Department of Plant Pathology of the University of Wisconsin, Madison. A 5-gallon white bucket with its plastic lid is the main requisite for a "GrowBucket." Buckets of this type are used in shipping pickles to fast food restaurants frosting to donut shops, and cleaning supplies to janitorial services, and in many other ways. Recycling these sturdy containers as pieces of classroom equipment seems as justifiable as having them recycled by the plastics industry.

A **GrowBucket** can be assembled in 30-40 minutes at a cost of \$12-\$17 and can then be put into use immediately. This low cost puts it in the reach of the average teacher's budget for locally purchased supplies. The bucket uses lowcost, energy efficient white fluorescent lighting and can be left on 24 hours a day when experiments are in progress. The reflection of light from the white inner surface of the bucket greatly intensifies the amount of light received by the plant compared to plants sitting beneath hanging light fixtures.

Materials :

1 5-gallon white plastic bucket with lid (a shorter **GrowBucket** can be made using a 3-gallon bucket)
1 6-, 9-, or 12-ft extension cord
1 screw-in lightbulb socket
1 screw-in circular white fluorescent light bulb
(Lights of America 22 watt bulb or GE 27 watt bulb)
electric drill with hole cutter attachment
heavy-duty utility knife or keyhole saw



Graphic by Lynwood Ma

Procedure:

1. Using the electric drill and hole cutter, cut one hole in the center of the lid of the bucket and 4 other holes spaced equidistantly around the top of the lid for ventilation. Additional ventilation holes about 7 cm from the bottom of the bucket allow more air circulation.

2. Mark a rectangular door 20 cm wide by 26 cm tall on the side of the bucket. Use a heavy-duty utility knife or keyhole saw to cut this out. (This requires a steady and strong hand. Use a nail, awl, or reamer or the electric drill to start hole at a corner.) Save panel cut from the side of the bucket and use waterproof tape (duct tape, electrical tape, etc.) to form a hinge on one side of the door. The opposite side can be secured with a hardware hook and eye if desired.

3. Using the utility knife or wire cutters, cut off the receptacle end of the extension cord and wire the cut end to the light socket. Placing the socket above the center hole of the bucket lid, screw the circular fluorescent light bulb into the socket, sandwiching the lid between socket and bulb. The lid can now be placed atop the bucket. Plug in the cord, turn on the light switch, and the bucket is ready to serve as a greenhouse. Position plants in the bucket so that their tops are 5-10 cm from the bulb.

Suggested Activities:

• Start dwarf marigold seeds in a small pot. When they have true leaves, transplant them into paper cups filled with soil. Send these home with students as gifts for holidays during the school year.

• Have students plan garden plots for their own yard or for the school grounds. Four to six weeks before the last frost is expected start seeds of cabbages, broccoli, onions, and other early garden plants. Transplant seedlings to ever larger containers. As the weather warms up, harden off the young plants by putting them in a sunny spot outdoors with the nighttime protection of a wooden frame covered with construction plastic. When the frostfree date for your area arrives, send plants home with students or plant them in a school garden plot.

• Test the effects of competition on a plant population. Use four small flowerpots of the same size. In them place 5, 10, and 20 corn seeds. Do NOT give plants fertilizer, and give each pot the same amount of water twice each week. Make observations on their rate of germination, size, and general appearance over 2-3 weeks. Is it helpful or harmful to have a large population?

• Invite students to bring in their parents or grandparents for an evening or Saturday workshop to make their own **GrowBuckets** to use for 4-H, Girl-Scouts, or Boy-Scouts projects.

• Start a "sharing garden" in the classroom **Growbucket.** Have containers of houseplants that root easily. On a regular basis allow students to cut off small pieces so they can start their own plant at home.

• Plant three or more **GrowBuckets** to represent conditions and vegetation in different biomes: desert, prairie, tropical rainforest, temperate rainforest. Allow groups of students to plant dioramas of scenes representing stories in their reading books.

• Adopt a retirement or nursing home near school. Either 1) grow plants to give to the residents or 2) visit the home to make or give **GrowBuckets** for the recreation program.

Reference:

"Growbuckets and bottle reservoirs: Plant growth systems made from recycled materials," *Fast Plants/Bottle Biology Notes,* University of Wisconsin Department of Pathology, 4(2), Spring, 1991. 8-10.

MINI IDEAS

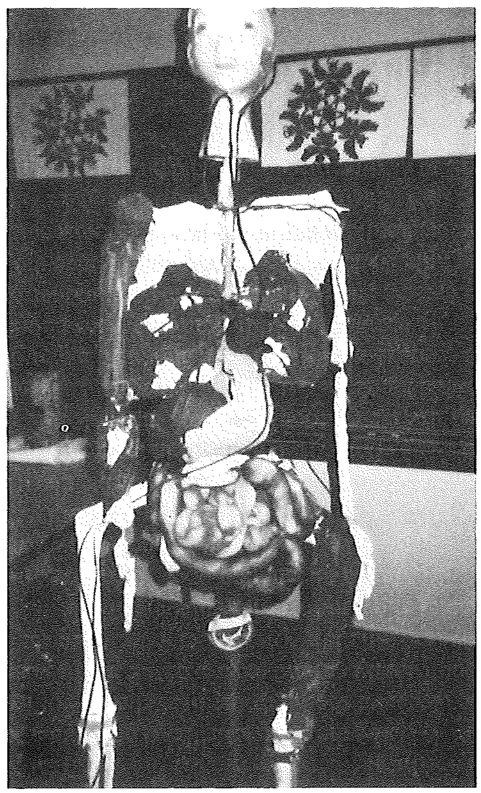
Kim Pittman
Springman Junior High
Glenview, Illinois 60025

CONSTRUCTION OF A HUMAN BODY

Objective: To identify the anatomical structures and relationships amongst the different systems that comprise human physiology.

Background: In addition to meeting these objectives, this activity shows the interdisciplinary nature of science and art. This is a cooperative learning experience that incorporates the entire class. The students really enjoy working on this project and they learn *so much* constructing it. At the end of the year, we have to raffle it off, because they all want to take it home. The finished product is a wonderful life-size human body that has been built accurately according to human dimensions. The students are also recycling scraps from home, so it allows them to be creative in their construction.

Materials: (Suggestions—Many different supplies could be used)



1. Newspapers
2. Masking Tape
3. Paper mache mix (or flour and water)
4. Butcher Paper (outline of body and skeletal structure)
5. 2-Liter soda pop bottles (stomach, pancreas)
6. Old nylons (small and large intestines)
7. 1/2 gallon milk jugs (lungs)
8. 25-cm tube with cartilage-like rings
9. IV tubing/red & blue yarn (circulatory system)
10. Popcorn (alveoli in lungs)
11. Balloons (gall bladder, lung structures)
12. Sheet packing material for the muscular system.
13. 7 foot pole cemented into a coffee can (support structure)

Procedure:

1. Using the butcher paper, trace the outline of a student's body. Artists of the class can draw the bones (to scale) on the butcher paper.
2. Cut out the bones (you should have two femurs that are identical) and distribute 1-2 bones to each student. They use this template to make a paper mache bone at home.
3. When all of the bones have been brought in, paint them white and designate a group of students to be on the skeletal crew (include the artists in this group). This group is now responsible for the assembly of the skeleton. Use wire and masking tape.
4. Assign the next groups to the following systems: Digestive, Circulatory, Respiratory, Nervous and Muscular. Attach the systems in this order.
5. Digestive System - Allow the students to be creative but stress that the dimensions must be very accurate, as this is the purpose of the activity. It is easiest if the digestive system is attached first, so that the blood vessels can be run from there to the heart. Students can use cardboard for the liver, cheesecloth for the pancreas, etc. Nylons work great for the intestines, stuff with cotton rags to give them peristalsis. Paint the organs so that the finished product is more aesthetically pleasing.
6. Circulatory system - IV tubing flushed with red and blue food coloring makes an excellent system, however, some classes used red and blue telephone wire, and this worked just as well. Clay can be used for a heart.
7. Respiratory system - Use tubing for the bronchus, popcorn for the air sacs, and balloons and straws to replicate a lung model. Two half gallon milk jugs that have been cross-sectioned (handles removed) work great.
8. Nervous system - Clay can be used for a brain, yellow yarn for the cranial and spinal nerves, a wig holder for the head (with half of cut away), eye and ear models. This can become as detailed as the class permits.
9. Muscular system (optional) - Sheets of packing material works great. They label and paint the tendons etc. - only on one half of the body, to allow viewing of internal organs on the other half.
10. Culminating activity - have students follow a piece of pizza and a can of Pepsi through their bodies, using the model as a guide.

Virginia Malone
The Texas Science Teacher

PH OF PEPPERS

> ...be careful how I adopt a view which jumps with my preconceptions, and to require strong evidence for such belief than for one to which I was previously hostile. My business is to teach my aspirations to conform themselves to fact, not try and make facts harmonize with my aspirations.
>
> Thomas H. Huxley

Laboratory activities that do not have expected answers are exceedingly rare in the classroom. Outside the classroom they occur all too frequently. This experiment allows most students to draw conclusions that will be different from their expected results. This is a very difficult task and requires scientific integrity on their part

To the Student:

pH of Common Peppers

Objective:

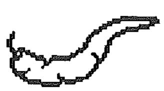
Determine the relationship between the pH of peppers and the pepper's hotness, length, and color.

Materials:

Hydrion paper, extracts of peppers prepared by soaking chopped pepper in water overnight, e.g. Jalapeno, chilies, serrano, green bell, golden bell, banana pepper.

Procedure:

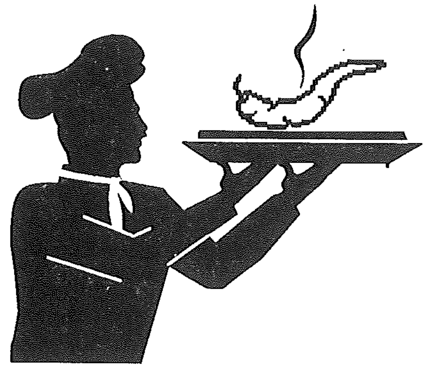
1. Write and turn in your hypothesis and safety precautions before beginning.
2. Test the pH of each of the pepper solutions.
3. Chart and graph the results.
4. Write conclusions.


To the Teacher

After handling the peppers be certain that the students wash their hands thoroughly. If they rub their eyes after handling the peppers they will experience intense pain.

The title of the experiment is essential to the success of this lab. Students usually use the title to make their hypothesis. This time hopefully they will make a hypothesis that is not supported by the data. Most students will say that the more acidic the pepper the hotter it will be. A few will think color or size is related to pH. Many students will be so sure that their hypothesis is correct that they will try to fix the data to prove their own idea of what is correct. In reality pepper hotness, length, or color has nothing to do with pH. Your postlab discussion should center on scientific integrity. How easy is it to overlook data that conflicts with preconceived notions? How easy is it to change data to make it look "right?" What was Thomas H. Huxley talking about?



Other Discussion:

Students develop their own method of testing all solutions. Some students will approach the testing randomly and therefore miss a solution or two. A discussion about planning and systematically gathering data should be included after the lab. Students lean heavily toward the use of line graphs. However, this data is most appropriately graphed using a bar graph. A discussion about the types of graphs and their uses would be appropriate. Placement of variables on the axes of the graph might also be important in your class discussion.

Vanillylamides, not acids, are responsible for the power of peppers. Capsaicins act specifically on nerve endings for pain and heat. They lack color or flavor, but one part per million is perceptibly warm. Really hot fruits can contain 10,000 times that amount. The capsaicin does not blister the skin. The tissues that secrete the capsaicins are situated where the seed bearing tissue joins the outer pod wall: the cross wall partition contains most of the compound.

Karin M. McElvein
F. W. Cox High
Virginia Beach, VA.
Missouri Science News
December 1991

DEMONSTRATE A POLYMER

Fill a Ziploc bag 1/3 to 1/2 full of water, and seal it. Quickly insert a sharp pencil through both sides of the bag below the water level. (I like to do it over someone's head.) The bag will not leak! Try two pencils!!

WHY: Polymers are long chains of molecules which are wrapped around each other. When a hole is punched in the bag the polymers separate. However, the chain of molecules simply retighten around the pencil forming a seal.

AWARDS AND RECOGNITION

TOSHIBA NSTA EXPLORA VISION

AWARDS

NSTA announces the Toshiba/NSTA ExploraVision Awards Program, an exciting new annual competition for students of all grade levels (K-12) and all skill levels. It is funded by Toshiba Corporation, Toshiba America, Inc., and the Toshiba America Foundation, and administered by National Science Teachers Association.

The purpose of the program is to encourage students to combine their imagination with the tools of science and technology to create a vision of the future. Students will work in groups of four, known as "R&D teams," along with a teacher advisor and an optional community advisor. Each team should be comprised of students who are creative, good researchers, artistic, good writers, and who possess imagination and vision.

There are four entry categories for R&D teams: Primary Level for students in grades K-3, Upper Elementary Level for students in grades 4-6, Middle Level for students in grades 7-9, and High School Level for students in grades 10-12. Each entry category will be judged separately, based on the abilities of students in those grades.

Student Entries

Each R&D team will select a technology that is present in the home, school, and/or community. This technology may be as simple as a light bulb or as complex as a nuclear generator. They will explore what it does, how it works, and how, when, and why it was invented. Students must then project into the future what that technology might or could be like 20 years from now. Finally, each team must communicate its vision to others through a description and a storyboard.

Descriptions may include a combination of text and visual elements which describe the present technology, its history, the team's vision of the future technology and its consequences. The storyboard is a series of illustrations and a script for a would-be video presentation of the R&D team's vision for the future. Each team will create ten frames of an imaginary video which conveys their vision. Storyboard frames can include items such as an illustration of a prototype for the future, a diagram showing how the prototype works, a photograph or drawing of the current technology, a graphic display of the advantages of the prototype over the current technology, and any other illustrative graphic material.

Judging Criteria

Projects will be judged on creativity of design and creativity in communicating the vision in description and storyboard formats are important factors. The historical perspective, scientific accuracy of the design, and feasibility of the future technology will also be considered by the judges.

Regional competitions will be held in each of NSTA's 12 districts. A regional winning team will be selected for each grade level category in each of the districts. Each of the 48 regional teams will receive funding to produce a five-minute videotape based on the storyboard they created. All team members must contribute to the production of the videotape. A national judging committee made up of leading science educators will review the videotape and storyboard entries of the 48 regional winners and select three finalist teams in each grade level category for a total of 12 winning teams.

Students in the 12 finalist teams, along with their parents and academic advisors, will be invited to attend an expense-paid gala weekend in Washington, D.C., in June, culminating in an awards banquet. Four wining teams, one in each grade level, will be announced at the banquet.

Awards and Prizes

Each student in the four winning teams will receive a $10,000 United States savings bond, and students in the eight runner-up teams will each receive a $5,000 United States savings bond. Teacher advisors and schools of the 12 finalist teams will receive preselected Toshiba products. Schools of 48 regional winning teams will receive televisions and VCRs. Every student team member and teacher advisor who enter the competition will receive an entry gift. Every student team member will also receive a certificate of participation. The deadline for entries is February 1, 1993. NSTA mailed application packets to teachers throughout the United States in September. If you did not receive one, write to: Toshiba/NSTA ExploraVision Awards, 1742 Connecticut Avenue, N.W., Washington, D.C. 20009.

Mary Kelly Lamb, an environmental educator from Park Ridge was recognized with a groundwater protection award for her pioneering groundwater education work. In 1987, the Illinois Groundwater Protection Act had been recently enacted and part of it called for a groundwater education program. Very little groundwater educational material for teachers and students was available. With the support of the Department of Energy and Natural Resources, the EEAI under Mary's leadership, convened a groundwater writing conference at a scout camp in Brown County. Educators, geologists and hydrologists developed basic understandings and outlined groundwater educational needs. Following pilot teacher testing of the resulting material, the *Buried Treasure: Education Activity Guide* emerged and was published. Under Mary's leadership over 100 workshops have been conducted, over 4000 free guides were distributed, and *Buried Treasure* has been adapted and published in *The Earth Scientist.*

MEETINGS AND CONFERENCES

ICE INSTITUTE FOR CHEMICAL EDUCATION
1993 Summer Workshops

Chemistry Activities

Learn hands-on science activities that you can share. Open to teachers and supervisors, Grade K-12. College instructors may apply to attend the workshop and initiate similar programs. Two weeks.

Chemistry Fundamentals

Investigate in-depth those topics in chemistry commonly covered at the middle school level. Explore demonstrations, laboratories, and problem-solving techniques. Open to physical science teachers (Grades 6-9) with limited training in chemistry. Four weeks.

Chemistry Instrumentation

Work with modern chemical instruments, study the theory of their operation, learn about cutting-edge research involving the equipment, and build low-cost models to take back to your school. Open to experienced high school chemistry teachers. Two or three weeks.

Super Science Connections

Practice hands-on science activities and find the science connections to other aspects of children's lives. Integrate children's literature, art, and writing skills with science content and observational and problem solving abilities. Open to teachers of Kindergarten through grade 3. Six days.

For more information write or call:

Natasha Aristov
Department of Chemistry
University of Wisconsin-Madison
1101 University Avenue
Madison, WI 53706-1396
(608)262-3033

GEOLOGICAL SCIENCE FIELD TRIPS
Spring 1993

These trips are led by David L. Reinertsen, head of Educational Extension at the Illinois State Geological Survey. Each trip is designed to acquaint you with the geography, landscape and mineral resources of a specific are. Along the route, the caravan stops frequently for exploration, discussion and collection of rocks and fossils. A field guidebook, describing and explaining the geology and topography along the route and at the stops, is given to each participant. Trips begin at 8:15 a.m. and end about 4:00 p.m. Tours are held rain or shine. Wear comfortable clothes and walking shoes. Bring a hard hat and safety glasses, if you have them and pack a sack lunch. For more information about these and other field trips, call write, or visit the **Illinois State Geological Survey Natural Resources Building., 615 Peabody Drive, Campaign, IL 61820-6964 (217)333-7372**

April 17
Harrisburg Area
Saline County

Meet at Harrisburg High School, 333 West College Street, eight blocks south of Poplar Street (Illinois Route 13) and in the fourth block west of Main Street (Illinois Route 37), extended south.

May 22
Lewistown—Spoon River Area
Fulton County

Meet at Lewistown Community High School on the north side of town, on the east side of Illinois Routes 97 and 100.

P E R I O D I C C A B L E
FROM THE CHEM WEST GROUP

ACS 26th Great Lakes Regional Meeting May 26-28 at Northern Michigan Univ., Marquette, MI. For info on program contact Richard Brown, Dept. of Chemistry, Michigan Technology University, Houghton, MI 49931 (906-487-2383).

CHEM ED 93 will be at Butler University, Indianapolis, IN August 6-9, 1993. To get on the mailing list write CHEM ED 93, Butler Univ., 4600 Sunset Ave., Indianapolis, IN 46206-3485.

The HPS/ST Teacher Network is a group of teachers interested in using historical, philosophical, and sociological approaches in teaching science. The aims are (1) To share our experience and resources through a newsletter and special sessions at science teachers conventions. (2) To develop and maintain links among science teachers, teacher educators, professional historians, philosophers and sociologists of science. (3) To build a central resource center for references, guides to resources (films, videos, lab equipment, etc.) and sample curriculum materials (lesson plans, "scripts." student forms, historical labs, etc.). To join the network and receive the newsletter, send $5 to Douglas Allchin, 666 Lincoln Avenue, D, St. Paul, MN 55105.

The first (in the last 20 years) four-year summer chemistry institute for secondary science teachers sponsored by NSF that I know of is at Univ. of WI-La Crosse. All course-related fees, including tuition, travel, room & board, and $300/week stipend will be paid by NSF. Credit applies towards a master's degree. GO FOR IT! A first rate high school teacher, John Whitsett, is a co-director so the program should meet the real needs of teachers. Call 606-785-8271 ASAP to get more information and registration forms.

CARING FOR THE LAND - EDUCATING THE NEXT GENERATION

Sponsored By:
Environmental Education Association of Illinois
Educational Service Center, Region 16
In Cooperation With:
Riverlands Area Office, St. Louis District Army Corps of Engineers

DATE: April 29 - May 1, 1993

LOCATION: Pere Marquette State Park, Grafton, IL

It is time to take a serious look at the most important economic resource in the Midwest, our land. We deforest it, pave it over, pour hazardous chemicals into it, and wash it down our streams. By focusing on sustainable land use, a practice that is critical to Earth's survival, this conference will help educators to make the vital environmental connection between science and social studies. Presenters will include information on problems as well as responsible and intelligent actions. Workshop participants will receive a set of instructional goals, methods to measure student achievement of these goals, and ways such a program will meet curriculum needs.

TENTATIVE AGENDA:

Thursday Evening - River Cruise	6:30 p.m. - 8:30 p.m.
Friday - Registration	8 a.m. - 10 a.m.
Concurrent Sessions I & II	9 a.m. - 11:15 a.m.
Lunch	11:30 a.m. - 12:30 p.m.
Concurrent Sessions III & IV	1 p.m. - 3:15 p.m.
EEAI Annual Meeting	4 p.m. - 5 p.m.
Banquet & Keynote Address	6 p.m. - 8 p.m.
Entertainment	8 p.m. - 10 p.m.
Saturday Morning -	
Concurrent Sessions IV & V	9 a.m. - 11:15 a.m.
Lunch, EEAI Award, Closing Remarks	11:30 a.m. - 12:45 p.m.
Field Trips	1 p.m. - 4:30 p.m.
- Riverlands Wetland Demonstration Area	
- Cahokia Mounds State Historic Site	
- ?????	

(Stay the night and take a Sunday morning bicycle ride along the limestone river bluffs.)

For more information, write or call: Science Literacy, ESC #16, 500 Wilshire Drive, Belleville, IL 62223 Phone: 618-398-5280

wiu SCIENCE EDUCATION CENTER

ANNUAL K-8 SCIENCE UPDATE CONFERENCE

APRIL 23, 1993

HORRABIN HALL

WESTERN ILLINOIS UNIVERSITY

SPONSORING AGENCIES: W. I. U. ELEMENTARY EDUCATION & READING DEPARTMENT
Educational Service Centers 8, 11, and 12.
ILLINOIS SCIENCE TEACHERS ASSOCIATION
NATIONAL SCIENCE TEACHERS ASSOCIATION

SELECTED PRESENTERS (MOSTLY CLASSROOM TEACHERS) WITH ENTHUSIASM AND EXPERIENCE FOR TEACHING ELEMENTARY SCIENCE HAVE BEEN INVITED TO MAKE PRESENTATIONS.

HANDS ON SCIENCE ACTIVITIES **TEXTBOOK DISPLAYS**

CURRICULUM RESOURCE DISPLAYS **SCIENCE TRADE BOOK DISPLAYS**

ACTIVITIES REPRESENTING NEW SCIENCE CURRICULUM PROGRAMS

- Activities that Integrate Math and Science (AIMS)
- Great Explorations in Math and Science (GEMS)
- Windows on Science (K-3)
- National Wildlife Federation's Naturescope
- Operation Physics (OP) (4-8)
- Chemical Education for Public Understanding Program (CEPUP)
- Big Books
- Delta Science
- Macdonald Educational
- Insights
- U of W FAST Plants

SCIENCE UPDATE CONFERENCE REGISTRATION FORM
(Register soon - limited Enrollment!)

NAME________________ SCHOOL________________ DIST#________

ADDRESS____________ CITY________________ STATE______ ZIP ______

SCHOOL PHONE________________

Registration Fee - $ 14.00

Confirmations will be returned, if received by April 9th, with a campus map and parking information.

Circle One: Payment Enclosed

Pay upon arrival

RETURN TO:
Dr. John B. Beaver, Director
Science Education Center
47 Horrabin Hall
Western Illinois University
Macomb, IL 61455
309/298-2065 or 298-1777

Registration fee covers refreshments, lunch, and handouts.

OPPORTUNITIES

DURACELL NSTA SCHOLARSHIP COMPETITION

WHAT IT IS: Students design and build working devices powered by *Duracell* batteries.
WHO IS ELIGIBLE: Students in grades 9-12 residing in the United States or U.S. Territories.
HOW AND WHEN TO ENTER:
1. Obtain Official Entry Form and rules from your science teacher, or write to NSTA at the address below.
2. Design and build a device which runs on batteries.
3. Write a two-page description *(in English)* describing the device and its uses.
4. Draw a schematic *(wiring diagram)* of the device.
5. Photograph the device.
6. Mail Official Entry Form, typewritten description, schematic, and photos *(DO NOT SEND THE ACTUAL DEVICE AT THIS TIME)* by the entry deadline to:
DuracellNSTAScholarshipCompetition
1742 Connecticut Ave., NW
Washington, DC 20009
7. The 100 top finalists will be notified to send in their actual devices for the final judging.
ENTRY DEADLINE: **January 22, 1993**
AWARDS GIVEN:
Scholarships: First Place (1) $10,000
Second Place (5) $ 3,000
Third Place (10) $ 500
Cash Prizes: Fourth Place (25) $ 100
Trips: The top six winners, their parents and teacher/sponsors will be flown to Kansas City, Missouri for an Awards Banquet held during the 41st NSTA National Convention in April.
Computers: Teachers of the six top winners will receive personal computers.
Personalized Award Certificates: For the top 100 finalists.
Entry Prize: Everyone who enters will receive a gift and a certificate.

Illinois Mathematics and Science Academy
1500 W. Sullivan Road
Aurora, IL 60506-1000
(708)801-6101

IMPACT II 1992-1993

IMPACT II is a teacher recognition and networking program which seeks to identify K - 12 Illinois public school teachers who have creative ideas in mathematics and science instruction. Interested teachers may apply for two different types of grants: adaptor and disseminator.

Adaptor grants of $200, $600, and $800 are available to those public school teachers who want to adapt a teaching idea(s) from the 1992 IMPACT II Catalog of Disseminator Teaching Ideas.

Disseminator grants of $500, $1,500, and $2,000 are available to those public school teachers who have developed innovative and successful classroom programs in mathematics, science and computer science.

The IMPACT II catalog and disseminator applications are available at Educational Service Centers. Adaptor grant application deadline is December 31, 1992. Disseminator grant application deadline is February 15,1993.

IMPACT II is funded by the Illinois State Board of Education through the Scientific Literacy Grant Initiative and administered through IMSA. For further information, contact Martha Taylor at the above address.

Toyota/NSTA TAPESTRY Grants

WHAT IT IS: Toyota's Appreciation Program for Excellence to Science Teachers Reaching Youth. Teachers propose innovative one-year programs with budgets of up to $10,000 that will enhance science education in their schools.
WHO IS ELIGIBLE: All science teachers of grades 6-12 residing within the 50 United States. "Science teacher" is defined as anyone who spends at least 50% of his/her classroom time teaching science.
HOW TO APPLY:
1. Obtain the TAPESTRY Proposal Cover Form and program rules from your science department chair, or write NSTA at the address below.
2. Design and plan a one-year long project that centers on either environmental education or physical science applications (applied physics, chemistry, and technology).
3. Projects should demonstrate creativity, involve risk-taking, possess a visionary quality, and model a novel way of presenting science.
4. Projects should involve hands-on activities, have an interdisciplinary approach and relate science to students' lives.
5. Write proposal according to TAPESTRY rules. Required proposal components include a Description, Rationale, Potential Impact, Evaluation Plan, Project Calendar, Budget (up to $10,000), Project Staff Vitae, and letters of support.
6. Mail completed TAPESTRY Proposal Cover Form, and typed proposal to:
NSTA/TAPESTRY
1742 Connecticut Ave., NW
Washington, DC 20009

APPLICATION DEADLINE January 15, 1993 (date varies slightly every year)
AWARDS GIVEN:
Grants: 30 grants of up to $10,000 each will be awarded this year.
Trips: This 30 project directors will be flown to Kansas City, Missouri for an Awards Banquet held during the 41st NSTA National Convention in April, 1993
SPONSORED BY: Toyota Motor Sales, USA, Inc. (administered by the National Science Teachers Association).
TAPESTRY Grants Expanded to Middle Level
Eligibility for Toyota/NSTA TAPESTRY grants is expanded to include the middle level this year. In its third year, the program is now open to teachers of grades 6-12. TAPESTRY (Toyota's Appreciation Program for Excellence to Science Teachers Reaching Youth) is also increasing the number of grants awarded this year to 30. With the increase in the number of one-year TAPESTRY grants, the competition for second-year funding will be eliminated (last year's awardees are still eligible for the second-year funding).
Proposals are accepted in the categories of Environmental Education and Physical Science Applications. Physical Science Applications includes any project using the principles of physics, chemistry or technology.

TAPESTRY

EDUCATIONAL MATERIALS

Focus on Science Being Released

The National Association of Broadcasters (NAB) will soon launch *Focus on Science*, a promotional campaign designed to encourage radio and television stations to develop and air science education-related programming. A *Focus on Science* brochure, to be mailed to over 9,000 commercial radio and television stations, is part of a larger NAB campaign called Focus on Literacy. A similar brochure was produced for a 1991 NAB promotional campaign called *Focus on Math*. Partial funding for both projects was independently provided by the Corporate Council for Mathematics and Science Education (CCMSE), which is part of the Coordinating Council for Education of the National Research Council.

The *Focus on Science* brochure and accompanying information is available to organizations interested and active in science education issues by calling the CCMSE at (202) 334-1361, or the NAB at (202) 429-5330.

AIDS EDUCATION

Flinn Scientific, Inc. has developed a new kit to provoke discussion and educate students about the transmission of this insidious disease.

AIDS - Transfer of Body Fluids Kit allows students to **simulate** the exchange of body fluids as a means of spreading the HIV virus and other communicable diseases. **No actual body fluids are used!** The results are striking! An unmistakable color change will reveal all "infected" individuals and leaves students dramatically aware of how the AIDS virus can be transmitted.

AIDS - Transfer of Body Fluids Kit (catalog #AB1210) is available from Flinn Scientific for $34.95 and contains enough material to perform the activity 15 times (for class size of 35). For more information contact:

Flinn Scientific, Incorporated
P.O. Box 219
Batavia, Illinois 60510
1-800-452-1261

This kit available to teachers at school locations only!

Tim Cashatt
Illinois State Museum Society
Spring & Edwards Streets
Springfield, Illinois
217-782-6689

COMMON SPIDERS OF ILLINOIS PUBLISHED BY STATE MUSEUM

The Illinois State Museum has published the first guide to Illinois spiders. *A Guide to the Common Spiders of Illinois* was written by Dr. Bennett Moulder, Professor of Biology at Illinois College in Jacksonville, Illinois.

Over 500 species of spider are found in Illinois and, despite the fears of many, only two are venomous. Those two and about 100 others apt to be found by casual observers and collectors are detailed in this new publication.

A Guide to the Common Spiders of Illinois provides lists, keys, descriptions and drawings to facilitate identification of common spiders by biologists and laypeople. This comprehensive guide also incluces basic life history information about each species, discussions of the economic and medical importance of spider, instructions on collection and preservation methods and suggestions for further reading.

The Guide is available for $10.00 plus $.72 Illinois tax and $1.00 shipping and handling by writing the Society at the above address.

Gary A. Dunn, Executive Director
Young Entomologists' Society, Inc.
1915 Peggy Place
Lansing, MI 48910-2553
(517) 887-0499

NEW INSECT STUDY SOURCEBOOK AVAILABLE

The Y.E.S. International Entomology Resource Guide (Fourth Edition), which has been updated, expanded and revised (with an emphasis on insect study through educational resources and materials), has been an indispensable source of information for teachers (science, biology and environmental education), librarians, extension agents, consultants, naturalists, professional entomologists, insect collectors and breeders, and insect enthusiasts of all ages. IMPORTANT FEATURES of this 95 page guide: lists over 1175 businesses, organizations and individuals (worldwide) that offer insect study products and services; listings and display ads in 16 major resource and service categories (163 subcategories); all listings complete with name, address, and phone number(s); and, includes world's most comprehensive list of insect zoos, butterfly houses, and entomological organizations. All of this information costs only $10.00 postpaid. (Canada and Mexico, only $12.00 postpaid; all other countries, only $13.00 postpaid by airmail.) Mail order and payment to Young Entomologists' Society, Dept. RGN, 1915 Peggy Place, Lansing, MI 48910-2553

Zero Population Growth
Pamela Wasserman or Susan Bryant
1400 Sixteenth Street NW
Suite 320
Washington, DC 20036
(202) 332-2200

ZPG RELEASES "ECO-TRENDS" CLASSROOM ACTIVITIES FOR THE COLUMBUS QUINCENTENARY

Just in time for the Quincentenary of Columbus' voyage to the Americas, ZPG has produced, "500 Years in the Americans: An Environmental Review." "500 Years" features a 39-inch longtime line wall chart which examines demographic changes in the Americas as well as several environmental trends including deforestation, buffalo population, cattle prevalence, urbanization, energy use and air pollution since 1492. Below the timeline are suggestions for ways students can help secure a healthy, sustainable planet for the next 500 years.

The publication also features several hands-on activities for the secondary social studies classroom and information on why it is important to consider environmental and demongraphic trends during this anniversary year.

ZPG mailed a free copy of "500 Years in the Americas" to all middle school, junior high and high school social studies department chairs in the United States. The mailer is also appropriate for science and environmental education classes.

For a free copy of "500 Years in the Americas," contact ZPG at the above address.

Illinois Dept. of Energy and Natural Resources
325 West Adams, Room 300
Springfield, IL 62704-1892

THE GROUNDWATER EDUCATION NETWORK

The Department of Energy and Natural Resourcesnow has an electronic bulletin board, the Groundwater Education Network (GWEN). GWEN contains the complete text of the newsletter, available for downloading for inclusion in your newsletter or correspondence. Also available on GWEN are groundwater-related stories, information, and editorials. Users of GWEN can also upload information into the network, whether it is an article or just a bit of news.

You will need a telephone and a modem-equipped computer to access GWEN. Set your system for 300 or 1200 baud, 7-bit word length, no parity, and 1 stop bit (7N1). Then dial GWEN's number—(217) 785-8572.

After you make the connection, you will be given step-by-step instructions on how to sign up. There is no charge for using GWEN. If you have comments on how GWEN can be improved, feel free to leave a message for the system operator (sysop).

JETS

Two-Week Summer Program In Engineering

PROGRAM DATES: June 27 - July 9, 1993

WHERE: University of Illinois at Urbana-Champaign

PARTICIPANTS: Eligible students are those who will enter the 12th grade in the Fall of 1993.

PROGRAM DESCRIPTION:

Research: Engage in faculty sponsored research projects

Laboratories: Hands-on and demonstration labs in a variety of disciplines

Round Table Discussions: College students and professional engineers share life experiences in the fields of engineering education and work.

Computer Aided Design: Approximately 10 hours of CAD instruction

Planning for College: Two hour session in all aspects of planning for college life

IMPORTANT DATES:

April 2: Deadline for application

April 15: Notification to participants

RESIDENCE HALL INFORMATION: Double occupancy in an approved residence hall.

COST - $400.00. Financial aid is available based upon need.

MITE

Minority Introduction to Engineering Two-Week Summer Program

PROGRAM DATES: July 11-23, 1993

WHERE: University of Illinois at Urbana-Champaign

PARTICIPANTS: Eligible students are those who will enter the 12th grade in the Fall of 1993.

PROGRAM DESCRIPTION:

Research: Engage in faculty sponsored research projects

Laboratories: Hands-on and demonstration labs in a variety of disciplines

Round Table Discussions: College students and professional engineers share life experiences in the fields of engineering education and work.

Computer Aided Design: Approximately 10 hours of CAD instruction

Planning for College: Two hour session in all aspects of planning for college life

IMPORTANT DATES:

April 2: Deadline for application

April 15: Notification to participants

RESIDENCE HALL INFORMATION: Double occupancy in an approved residence hall.

COST - $25.00

FOR MORE INFORMATION OR APPLICATION CALL OR WRITE:

David Powell
Illinois JETS
1308 W. Green Street - Room 207
Urbana, Illinois 61801-2982
(800) 843-5410

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SPECTRUM welcomes contributions from its readers. Won't YOU submit some of your GOOD IDEAS for one or more sections of the SPECTRUM?

ARTICLES
- Thought provoking ideas or commentary about science or science education
- Original research/curriculum development
- Reports of relevant personal experiences

IN FOCUS
IN FOCUS appears in every third issue of SPECTRUM. Topic is chosen by the editorial staff. Submissions are invited.

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- .Important news for specific audiences
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MINI IDEAS
- Instructional pieces
- Demonstrations
- Lab activities
- "Grabbers"

OPPORTUNITIES
Activities for professional and/or student involvement

REVIEWS
Your reaction to science-related books, films, audio-visuals, computer programs, curriculum materials, etc.

MEETINGS
Business and pleasure gatherings for science educators

AWARDS/RECOGNITION
Any legitimate honor bestowed upon educators or students of science

POTPOURRI

FIELD TRIPS/WORKSHOPS
Any relevant offerings by not-for-profit organizations

EDUCATIONAL MATERIALS
Free or inexpensive items offered by not-for-profit organizations

SUBMISSION DEADLINES

Fall	June 1 (to members in September)
Winter	September 1 (to members in December)
Spring	December 1 (to members in March
Summer	March 1 (to members in June)

GUIDELINES FOR SUBMISSIONS
- Copy should be typed or word processed in double-space format. SPECTRUM accepts word processed submissions on disk in either, Macintosh, or IBM format. All submissions on disk should be accompanied by a printed copy.
- Line drawings, glossy black and white photos and/or computer generated graphics are welcome. Receipt of all submissions to ARTICLES, IN FOCUS, MINI IDEAS, REVIEWS and POTPOURRI will be acknowledged by the associate editor.
- Submitted items, including computer disks, will not be returned unless accompanied by a self-addressed, stamped envelope.

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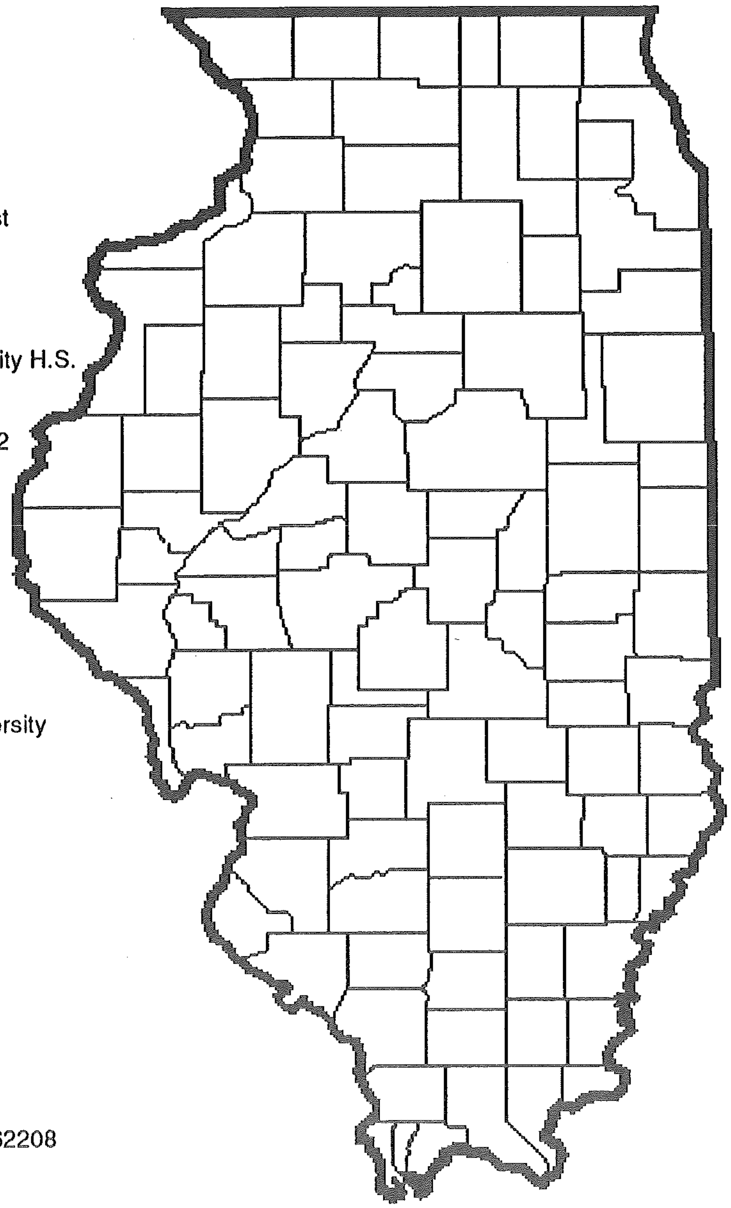

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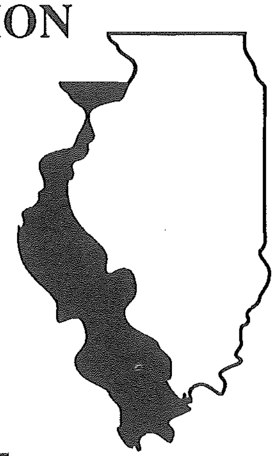

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WINTER 1992