SCIENCE EDUCATION

Chairperson: Linda Hamrick
The Canterbury School
5601 Covington Road
Fort Wayne, Indiana 46804
(219)432-7776

Chairperson-Elect: Gary Dolph
Indiana University at Kokomo
Kokomo, Indiana 46902
(317)453-2000

ABSTRACTS

Ideas Concerning the Use of Computer Data Acquisition Systems to Improve Teaching Effectiveness within the Laboratory. Marshall P. Cady, Jr., Department of Natural Sciences, Indiana University Southeast, New Albany, Indiana 47150.——The traditional molecular weight determination by freezing point experiment has been modified into an extremely short experiment and coupled with an HP-85 computer/HP-3438A digital multimeter data acquisition system. Educational benefits that result from this condensation of time and technology are discussed in this paper along with some aspects of laboratory philosophy. The benefits may be applicable in many different lab situations and to many different disciplines. They include (a) freeing the student from the time consuming tasks which do not develop skills, (b) clearly emphasizing skills which are to be developed, (c) forcing the student to focus on interpretation of data, and (d) making it possible to encourage students to plan the redesign of an experiment.

A New and Challenging Science Program from AAAS for Grades 7 and 8. Walter Cory, Coordinator for School Sciences, Indiana University, Bloomington, Indiana 47405.——A new program, Science Resources for Schools, is being distributed to schools in nine states and the District of Columbia by the American Association for the Advancement of Science. The development of the materials is supported by a grant of 3 million dollars from the Standard Oil Company of Ohio (SOHIO).

Packets mailed to the schools include copies of *Science '84, Science Books and Films*, a bulletin for the principal, pamphlets and fact sheets on science and science careers, posters, teaching notes and a project newsletter.

Titles of the teaching guides include:

Bubbles,
Maps and Mapping,
Image Markers,
Fluid Patterns,
Cooking and Science.

There are hopes that this program will be expanded into additional states in 1985-86, including Indiana; but that will depend upon the availability of new funding. Examination of some of these activities for students indicate that they would help students to understand science better, and to enjoy science. If you are a teacher of grade 7 or 8, you should write to AAAS Office of Science and Technology Education, 1776 Massachusetts Avenue, NW, Washington, DC 20036 to let them know you wish information on the Science Resources Program for Grades 7 and 8.

Determining Needs: First Step for Improving Science and Mathematics Instruction in Rural High Schools in Northwestern Indiana. G. EARLE FRANCQ AND JERRY M. COLGLAZIER, Indiana Department of Education, Indianapolis, Indiana 46204.——Fostering scientific and mathematical literacy for Indiana students is considered an essential goal for assuring economic and technological prosperity. However, adequate opportunities may not exist in many rural schools to develop these proficiencies because of unique conditions associated with the rural environment. Rural areas have financial and population characteristics which not only differ from urban communities, but also vary in comparison across other rural regions. Consequently, one must first identify the unique circumstances associated with a particular rural region before any procedures can be implemented to improve educational settings.

This report examines evidence pertaining to science and mathematical educational needs as indicated for selected rural high schools of northwestern Indiana. Superintendents, high school principals, and high school physics, chemistry, and calculus teachers responded to both a Science/Mathematics Needs Assessment and a Stage of Concerns Questionnaire. Results revealed that (1) available funds were inadequate for modernizing or replacing laboratory equipment to keep pace with current technology, (2) availability of qualified applicants who could satisfy the multi-subject needs of the schools was inadequate for filling physics, chemistry, and calculus teaching vacancies, and (3) teachers were not provided adequate inservice to keep abreast of instructional development in physics, chemistry, and calculus.

Educational institutions and agencies can help to resolve the equipment, teacher licensing, and inservice factors which are barriers affecting implementation of science and mathematics instruction. These efforts would certainly aid future rural citizens to develop their abilities to apply scientific and mathematical skills for personal, social, and economic advantages.

The Layered Classifier: A More Effective Method for Studying Seasonal Changes in Forest Cover Types Using Satellite Data. D. FABIÁN LOZANO-GARCÍA and Roger M. Hoffer, Department of Forestry and Natural Resources and Laboratory for Applications of Remote Sensing, Purdue University, West Lafayette, Indiana 47907.——Considerable interest has been generated in recent years concerning the destruction of forests in many countries of the world. There has been speculation concerning possible relationships between the increased level of carbon dioxide in the earth's atmosphere. Landsat multispectral scanner data provides a unique opportunity to study the earth's surface and the extent and condition of various cover types, including forest cover. Many different computer-aided analysis techniques have been developed to classify Landsat multispectral scanner (MSS) data. However, most of these techniques are designed to utilize a single data set. To determine changes in the extent or condition of the forest canopy that may occur over time requires overlaying multiple data sets and a different approach to the analysis of such a multi-temporal data set.

This research examines the effectiveness o f the Layered Classifier as a possible technique for analyzing multi-temporal Landsat data. The test site was near the Monroe Reservoir in the Hoosier National Forest. Landsat satellite data, obtained on four dates throughout the year were digitally registered and analyzed. The results show that the Layered Classification technique enable more accurate classification results to be obtained, and at far less cost (in terms of computer time needed) than were obtained by simply combining the data from two dates and applying a standard maximum classification algorithm. These results provide significant insights into effective techniques for using satellite data to monitor changes in forest canopy conditions or areal extent.

Synthesis Experiments for High School Chemistry. JAMES GEORGE, Department of Chemistry, DePauw University, Greencastle, Indiana 46135.——The preparation of compounds is an aspect of chemistry which can readily be incorporated into a high school chemistry laboratory program. While working with high school aged students during the past few years, I have had the opportunity to develop several such experiments. They can be performed quickly and inexpensively with simple laboratory equipment. They also require relatively little preparation time for the teacher. Included are the synthesis of potassium aluminum sulfate, aspirin and salicylic acid, potassium acid tartrate, potassium trioxalatoferrate, potassium chlorate, and cuprous chloride. Copies of the experiments will be available for high school teachers and students.

The International Challenge: A Comparison of Science Education Models from Four Nations. LINDA HAMRICK, The Canterbury School, Fort Wayne, Indiana 46804 and HAROLD HARTY, Department of Science and Environmental Education, Indiana University, Bloomington, Indiana 47405.——Within the curricular formats of the United States, it becomes relatively easy to lose perspective concerning standards, requirements and course options relative to other nations. This presentation will highlight the major underlying themes, the curricular requirements and program structures regarding science education in Hawaii (as a cultural sub-group/The Kamehameha Schools), Great Britain, Saudi Arabia and China. The conspectues will follow the results into each country's mainstream of life as their science education practices affect life-long approaches to education in general, the sciences specifically, and the society which they seek to educate. Summative statistics regarding course requirements contrasted with the United States will attempt to establish a perspective of our own practices in an international configuration. The viewpoint emerges highlighting the difficulty of managing to support a technological society in this country when our public secondary institutions generally require only about one third the number of science courses compared to other industrialized nations. Implications for changing the number and type of required courses are discussed.

A New Approach to Fostering Scientific Literacy among Indiana's Secondary School Students. SUSAN M. JOHNSON, Department of Biology, Ball State University, Muncie, Indiana 47306.——During the past summer millions of Americans sat before their televisions enraptured as Olympic athletes explored the limits of human physical strength and agility. The same sort of delight in viewing athletic competitions results in legions of avid sports fans who energetically support their favorite teams and encourage their children to develop athletic skills. Competitive sporting events have enormous popular appeal. For science educators who watch students and parents come alive at a basketball game but turn somnolent at the mention of science, or who watch school boards loosen the purse strings for athletic programs and close them abruptly when support for science programs is sought, the question arises: Is there a way to generate popular enthusiasm for science that approximates even a fraction of the excitement, support, and prestige associated with sports?

In answer to this question, leaders in Delaware and Michigan have established statewide Science Olympiads, which encourage students to explore the limits of their mental strength and agility. This paper describes the Science Olympiad concept and the effects of the Olympiad on school science programs in Delaware and Michigan. The paper also discusses the possibilities and practicalities of implementing a Hoosier Science Olympiad.

Science Training for the Industrial Environment (STIE). PAUL B. KISSINGER, Department of Physics and Astronomy and JOHN A. RICKETTS, Department of Chemistry, DePauw University, Greencastle, Indiana 46135.——This paper describes STIE, a new DePauw program developed specifically for science-oriented students who plan to have significant, future managerial or sales responsibilities. STIE is based on the premise that our society is growing more complex with greater technological orientation; consequently, managers who can "speak the language" of research scientists and understand the patterns, problems and time frames associated with industrial research and development should be extremely valuable in helping to direct and focus an institution's resources. Accordingly, broadly prepared individuals whose backgrounds include both strong scientific and managerial training will be increasingly in demand by basic industries, high-tech companies, government agencies and the like. The relationship of TIE to the DePauw Management Fellows Program will be outlined; in addition, various course syllabi, laboratory exercises and the role of off-campus internships will be stressed. A specially developed seminar to explore the interrelationships between society, science and technology also will be discussed. Although STIE has significant professional orientation because it is designed to give students specific preparation for the early, crucial stages of their business careers, it will be shown that STIE students will have no difficulty satisfying DePauw's broad, traditional, liberal education requirements.

Field Biology: A Blow to Provincialism. ROSALIE KRAMER, Department of Biology, Indiana University East, Richmond, Indiana 47374.——Students at small, nonresidential campuses tend to be older and more closely tied to their community than do traditional students. Often they lack experience with environments and cultures other than the ones on their immediate area. The field biology course at Indiana University East has provided the faculty with the means to expose students to environments that are totally new.

Through the vehicle of the course, students become acquainted with:

(1) new biological organisms and their environments,

(2) new subcultures and lifestyles, and,

(3) often new interpersonal interactions.

Students learn to work together, share living space, and take responsibility for themselves and others. All the students were amazed at the amount of biology learned in a two-week period as well as personal growth achieved.

Indiana University East's field biology course was conducted in the Florida Everglades and Keys.

Speaking of Sex—A Presentation on Terminology for Students in Reproductive Biology Classes. JOHN RICHARD SCHROCK. Association of Systematics Collections, Museum of Natural History, University of Kansas, Lawrence, Kansas 66045.——Just as different political groups use different vocabularies, groups of people use different vocabularies concerning sexuality. This brief classroom presentation describes the five general attitudes toward sexuality and accompanying vocabularies and explains the necessity of using detailed rationalistic terms in the explanation of current knowledge in reproductive biology and in future scientific research. This presentation has been found in reducing the conflict between students and parents on sex education.

Improving the Results of Molecular Mass Determination Experiments by Using a Microelectronic Thermistor Device. RICHARD E. SCHULEY, Seymour, Indiana 47274

and MARSHALL P. CADY, JR., Department of Natural Sciences, Indiana University Southeast, New Albany, Indiana 47150.——An inexpensive, easy to use microelectronic thermistor was developed for use in introductory chemistry labs. The specific purpose of the device is to collect data for use in freezing point depression studies of solutions. The device consists of an Omega 44006 thermistor interfaced with an Intersil 7106 evaluation microprocessor kit and an LCD display. Modification of the kit was necessary to alter the original function, the measurement of voltage, to display resistance. Over small temperature ranges, it was found that the resistance displayed by the LCD is related to the Kelvin temperature by the formula $1/T = A + B \ln R$ where T is the temperature in Kelvin units, R is the resistance in kilo-ohms and A and B are constants that vary with each thermistor. Each thermistor must be calibrated separately. In this case, the development of the values of the constants was done by computer, but can be done by simple substitution of variables when two temperatures and their respectively resistances are known. The device was found to be accurate to within 0.03 Kelvin units. Using the device, error in molecular mass experiments, which is normally high, was reduced to a value of under two percent. As of the middle of 1984, the cost of this device, which must be assembled by the operator, was under fifty dollars.

An Introductory Titration for First Year Chemistry Students: A Comparison of Antacid Effectiveness. KATHARINE SESSIONS, The Canterbury School, Fort Wayne, Indiana 46804.——High school students appear to learn abstract concepts more readily when those concepts are presented via demonstrations using familiar materials. The effectiveness of various antacids against stomach acid can be demonstrated with a simple titration. This experiment is effective in introducing the physical techniques of titration, as well as providing an opportunity to discuss proper choice of an indicator, selection of normality range for the standard solution, and potential difficulties encountered in titrations due to extraneous materials such as fillers found in antacid tablets. The experiment, as well as teaching basic techniques, also satisfies student curiosity concerning common advertising claims made by competing drug companies.

Using the Microcomputer to Teach Science in the Elementary Classroom. STANLEY S. SHIMER, Science Teaching Center, Indiana State University, Terre Haute, Indiana 47809.——In the third and fourth grade classes the unit on planets has been a typical one for many years. The presentation will demonstrate how the microcomputer with software can stimulate interest and motivate students to ask many questions. The software can provide students data to be collected on solar distances, rates of travel by various modes and their weight on the selected heavenly body. The program titled "Solar Distances" also helps students to learn the sequence of the planets from the Sun to Pluto. The worksheet was designed to be used with the software from Minnesota Education Computer Consortium (MECC) listed as Elementary Volume 4, Version 1 1983.

Computer Aided Classroom Presentations in Chemistry. JAMES T. STREATOR, Department of Chemistry, Manchester College, North Manchester, Indiana 46962.——Using a computer in the classroom frequently requires a lot of out-of-class preparation time. To minimize preparation time and to allow fairly spontaneous presentations in class, input to the game port of a Commodore 64 has been used to generate multicolor displays in class. The Koala Pad has been used to make presentations in beginning chemistry classes as well as in Analytical and Physical Chemistry. Topics in bonding and structure and the drawing of titration curves and phase diagrams have been enhanced using

this device. A simple analog interface developed at Manchester College has also been used in classroom demonstrations to show phenomena such as phase changes and oscillations. Both of these devices will be demonstrated and the impact of using such devices will be discussed.

Color Vision: A Lecture Demonstration of Afterimages. ALBERT A. WILLIAMS, Department of Biology, Manchester College, North Manchester, Indiana 46962.——To the majority of students, at any level of biology education, the areas of directly perceivable human physiology have always been the most interesting. How they see, hear, balance, feel pain, hunger, thirst, etc. captures the attention of students far more easily than the details of meiosis or the Krebs cycle. Instructors can capitalize on this inherent interest in order to lead the student deeper into the subject matter.

The area of visual perception lends itself exceptionally well to graphic demonstrations that illustrate some very basic physiological concepts. By sequentially demonstrating the nature of colored light and our ability to respond to, and differentiate between, a broad spectrum of observable colors we can lead a class into a discussion of how our retina/cortex complex recognizes individual colors. Generating a series of simple and complex afterimage patterns for the entire class clearly demonstrates two major physiological concepts: 1) that our visual sensory receptors are subject to exhaustion and 2) that our color perception depends on a mental interpretation of the stimuli rather than a direct stimulus/receptor relationship. These demonstrations can then lead into a discussion and subsequent verification of the cellular basis and tri-color theory of color perception at a level appropriate for the specific course.

A simple system for generating afterimages for an entire class will be demonstrated.