Organized to improve science teaching—through research

NARST NEWS

NATIONAL ASSOCIATION FOR RESEARCH IN SCIENCE TEACHING

Thaddeus W. Fowler, Editor

Vol. 29 (4) December 1987

PRESIDENT

Linda R. DeTure
Education/Human Development
Rollins College, Winter Park, FL

NARST Doing Well

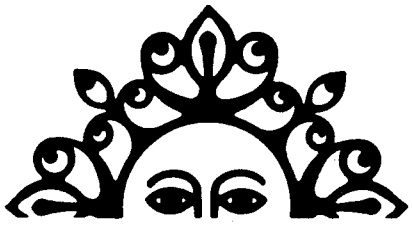
With the advent of fall NARST members continue to be active in all arenas of science education. Membership is climbing and, as an organization, NARST is doing well except that we are operating on a very narrow financial margin. The board recently held its fall meeting in Pittsburgh, PA, in conjunction with the NSTA Area Conference. A number of agenda items were discussed that I would like to share with the membership.

The plans for the 1988 conference are proceeding nicely. Travel arrangements between the Lodge of the Four Seasons and St. Louis are being finalized. Please be sure to make your travel reservations with registration. For a number of years the conference has not been breaking even financially. The luncheon costs, in particular, have been progressively subsidized as costs have risen but registration fees have not. After lengthy discussion on the merits of raising registration fees versus reducing services to members, the board voted to increase registration. This decision was promulgated by necessity to maintain NARST as a financially viable organization.

The research coordination of NARST and NSTA are working cooperatively to involve teachers more actively in research. Bill and Rodger have ERT sessions scheduled for each of the area conventions. The board also approved the election committee's outstanding slate of board candidates. See the announcement in this issue. Another board activity is to compile a NARST Policy and Procedures Handbook that should help facilitate the transition of committee chairs, officers and board members. I am soliciting your feedback and suggestions as active members and past board members for what needs to be included particularly in regard to operating procedures.

As a final item, preliminary plans have begun to establish a search committee for the new journal editor to succeed Russ Yeany whose term expires in 1990. The new editor will begin the transition year in 1989. The board voted to have the five year term include the transition year. Criteria for the individual and for the institutional support will be announced in the next newsletter.

It is with pleasure that I serve as your president and representative. Thank you for your continued support.



NARST 1988 CONFERENCE

April 10-13

Lodge of the Four Seasons
Lake Ozark, MO

Deadlines

Roommate Requests Diana Hunn, Indiana University	February 11
Preregistration Glenn Markle, University of Cincinnati	February 25
Hotel Reservations Lodge of the Four Seasons	February 25
Travel Reservations, Motor Coach London International Travel	February 25
Paper, Final Copy Discussants ERIC, The Ohio State University	March 21
Travel Reservations, Air Travel London International Travel, St. Louis	March 25

More Networking Groups Identified for 1988 NARST Annual Meeting

On Monday evening, April 11, at 7:30 NARST members will have the opportunity to choose among various networking groups meeting to discuss possible collaborative research activities. Two additional groups meeting on Monday evening relate to attitude research and to problem solving in the sciences.

Attitude Research: Robert L. Shrigley, Convener

The major focus of this discussion will be the comparison of persuasion theory (attitude-to-behavior) and self-perception theory (behavior-to-attitude) and how attitude research in science education has been generated, primarily from the former point of view. There will not be a formal agenda; those attending will drive the discussion after a brief introduction.

NARST members interested in attending or participating may want to contact:

Robert L. Shrigley
168 Chambers Building
Penn State University
University Park, PA 16802
Phone: (814) 865-5433

Problem Solving in the Sciences: Mike U. Smith, convener

Interest in problem solving in the scientific domains has increased dramatically in recent years. Many NARST members have been actively involved in research in physics, chemistry, and — most recently — in genetics. Interests range from documenting the problem-solving performance of various kinds of subjects to teaching problem solving and the development of artificial intelligence tutors. If you have interests related to problem solving, plan to join this discussion.

Students involved in problem-solving dissertations are especially encouraged to attend. We will discuss similarities and differences in our methodologies and our findings, as well as possible collaborations.

NARST members may want to contact the convener to suggest specific activities or other issues for discussion. To do so, write or telephone

Mike U. Smith
Mercer University
School of Medicine
1400 Coleman Avenue
Macon, GA 31207
Phone: (912) 744-2600

The descriptive information related to the Networking Group on Ethnographic or Naturalistic Research in Science Classrooms was not available for printing in the last issue of the NARST newsletter. Here is the current information.

Ethnographic or Naturalistic Research in Science Classrooms: Kenneth Tobin and James J. Gallagher, Co-conveners

Discussion will focus on investigating forces which influence the implementing curriculum, as well as on investigating the interacting roles of teachers' knowledge and beliefs on the way that science instruction is planned and implemented and the impediments which science teachers encounter when they endeavor to improve their teaching practices.

NARST members interested in suggesting specific questions for discussion should contact either

James J. Gallagher
Department of Teacher Education
Michigan State University
327 Erickson Hall
East Lansing, MI 48824
Phone: (517) 355-1725
or
Kenneth Tobin
Curtin University of Technology
Perth, Western Australia 6001
Phone: (09) 350-7700

Report Available

Education and the Challenge of Technology (March 1987), a report by Marcia C. Linn, documents discussions and recommendations emanating from a conference on technology and teacher education sponsored by the University of California at Berkeley and Apple Computer, Inc. Deans of schools of education, directors of teacher education, and those concerned with research and development in education and technology jointly developed the recommendations found in the report. This report invites those concerned about education and technology to work in concert to improve the enterprise.

The report features a chapter on "Technology and the School of the Future," an annotated software bibliography, recommendations for the future, and a keynote address by John Sculley (Apple's president and chief executive officer), "Perspectives on Technology and Teacher Education."

For a free copy of the report, please send your request to:

Marcia C. Linn, Adjunct Professor
Apple Technology and Teacher Education Conference
School of Education, EMST
Tolman Hall
University of California
Berkeley, CA 94720

Or send your request by electronic mail:

AppleLink address: X0319
BITNET: mclinn@violet. berkeley.edu

To the Membership...

Members of NARST,

The opportunity to meet and exchange ideas and perspectives with fellow science education researchers is the distinguising feature of the annual NARST conference. The 1988 meeting will continue past efforts to enable new and veteran members to become part of a researcher's network in their specific areas of study. Pat Blosser, program chairperson for 1988, has scheduled informal evening sessions for members to interact with fellow researchers who are currently taking the lead in studies of attitude formation and change, misconceptions in science, classroom instruction, and other topics of interest in our field. I know you will not want to miss the chance to personally take part in one or more of these discussion groups.

If you value keeping in touch with science education research, this year's Annual Meeting is one that you will want to attend! The program is packed with opportunities to hear about current activities and to exchange ideas. Over one hundred contributed papers reporting recently completed research in science education will be presented. Approximately fifteen poster sessions in which you can discuss on-going studies are planned. Two general sessions, one focusing on a National Science Foundation curriculum initiative and the other on the issue of using new technology in science education research, are scheduled. The three days of attention to research in science education will begin with two professional development sessions, one on using qualitative methodology in classroom research and the other on evaluating science programs. This program is our once-a-year opportunity to focus full attention on science education research and to interact with colleagues from institutions across the country and around the world.

The site for the 1988 meeting adds immeasurably to the formal and informal exchange of ideas. The Lodge of the Four Seasons in Lake Ozark, Missouri is a first class resort which provides a relaxed atmosphere in which to renew old acquaintances and to meet new friends. Past meetings in similar settings have taught us the value of such an atmosphere. The room rates are also a plus for the upcoming meeting. Rates at the Lodge will be $60.00 per room per day for single or double occupancy. Dianna Hunn has volunteered to assist members interested in sharing a room to reduce costs. If desired, a third party can share a room for even greater savings.

As always, my greatest concern when we meet outside a major city is the ease with which transportation can be arranged. Fortunately, we are working with London International Travel, LTD out of St. Louis. This agency is experienced in arranging transportation to the Lodge of the Four Seasons and by making our needs known to them in advance, problems should be kept to a minimum. **However, travel arrangements are something to which you will need to pay attention.** I urge you to carefully consider the materials I will be sending you as you make your plans.

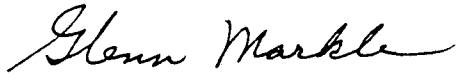
Through London International Travel, Trans World Airlines has offered NARST member special reduced fares from your home cities to St. Louis in conjunction with the April, 1988 meeting at the Lodge of the Four Seasons. These reduced rates reflect up to 45% savings off their non-restricted coach fares or five percent lower than the Super Savers. To take advantage of these special rates, contact TWA at 1-800-325-4933, or London International Travel at 1-800-325-4947. In Missouri: TWA, 1-800-392-1673; London International Travel, 314-567-6577.

Chartered Motorcoach service is available, round trip, from St. Louis to the Lodge of the Four Seasons. The round trip cost is $78.00 per person, ($45.00 One Way) and includes snacks and beverages onboard and baggage handling. To make your reservations, please contact London International Travel.

Dollar Rent a Car has offered NARST members special DOLLAR saving rates during meeting dates. Please contact London International Travel to make your reservations.

I will be sending you detailed conference registration materials in early December. Suggestions for easing travel either directly from your home city to the Lodge of the Four Seasons or from the NTSA meeting in St. Louis to the Lodge will be included in these materials. By working with London International Travel to make your travel arrangements, you will assure that the annual NARST meeting will be personally pleasant as well as professionally productive. If I can be of assistance as you make your plans, please do not hesitate to call me at (513) 475-2335.

Sincerely,



Glenn Markle
Executive Secretary, NARST

Nominations Requested

Distinguished Contributions to Science Education Research Award

The National Association for Research in Science Teaching seeks to improve Science Education through research. To this end the Association desires to recognize and reward individual(s) who have made significant contributions to Science Education through research. Contributions may be of several types, including but not limited to empirical, philosophical or historical research, evaluative studies, policy related research and studies reflecting new techniques to be applied in research. To be considered, an individual should have contributed over a period of many years (at least 15) and should be considered at the pinnacle of his/her career.

The award will be made to an individual who has over a period of many years (at least 15):

1. made a continuing contribution(s) to Science Education through research;
2. provided notable leadership in Science Education through research; and
3. had a substantial impact on Science Education through research.

This award is intended to be the highest recognition NARST can bestow for contributions to Science Education through research. The award will be bestowed only when a superior candidate has been identified by the awards committee.

To apply, a nominator or candidate should submit 10 copies of the following **by January 15, 1988:**

1. a cover letter, not to exceed 5 pages in length, describing the nature of the contributions of the individual, including specific documentation as to why these contributions are considered outstanding and substantive;
2. up to five letters of support, each not to exceed two pages in length, which provide evidence of extraordinary contributions of the individual; and
3. a curriculum vita including a complete list of publications and accomplishments.

Dr. Michael J. Padilla, Chairperson
NARST Awards Committee
Department of Science Education
University of Georgia
Athens, GA 30602

Institute for Chemical Education Science Workshop for College/ University Educators

During the summer of 1988, the Institute for Chemical Education (ICE) will hold a two-week workshop for those who are educating future science teachers. ICE will share the demonstrations and hands-on activities that have been researched and collated through ICE's continuing program of summer workshops for elementary, middle, and high school teachers. Guiding the development of ICE activities and materials is the principle that students and teachers need to interact in ways that will help them to understand how we know what we think we know and how we design experiments to further this knowledge.

During this intensive workshop, all participants will spend a good deal of time preparing, conducting, and observing demonstrations designed to involve a class safely and effectively with a wide range of chemical and physical phenomena. In addition to discussions with a variety of provocative guest presenters, there will be ample opportunity for guided discussion and critiques of the activities and the various ways they can be used productively in methods classes, science courses, and in elementary and secondary classrooms.

The workshop is open to college and university faculty from education and disciplinary science departments who are involved in methods and science education for prospective teachers. Subject to funding by the National Science Foundation, much of the cost of participation in this workshop will be underwritten. For more information and an application form, write or call:

Institute for Chemical Education
Department of Chemistry
University of Wisconsin-Madison
1101 University Avenue
Madison, WI 53706
(608) 262-3033

NARST
NATIONAL ASSOCIATION FOR RESEARCH IN SCIENCE TEACHING

Research Matters . . . To the Science Teacher

IMPROVING SCIENCE INSTRUCTION WITH MICROCOMPUTERS

By James D. Ellis

A Fantasy

Picture yourself in the science classroom of the 1990's. The curriculum and learning activities are aligned with the recommendations made during the 1980's, in the more than 40 reports responding to the national crisis in education. You, as the teacher, are charged with preparing students to participate in a society in which all citizens must cope daily with scientific and technologic problems and issues. Information technologies have revolutionized the economy and your daily living.

Microcomputers have revolutionized what you teach, how you teach, and how your students learn science. Until the microcomputer, never before have you had the potential to have all of your students:

- develop thinking skills in a variety of ways;
- work at their own pace while studying material tailored to their individual needs and interests (remediation and enrichment);
- understand scientific and technologic concepts in depth; and,
- do science in an intellectually honest way.

Never before have you had the potential for:

- diagnosing the level of student knowledge and skills;
- prescribing learning tasks appropriate to the needs of the student;
- evaluating, monitoring, and reporting student progress;
- adapting and developing learning materials for your tailor-made curriculum; and,
- spending most of your time assisting students directly with learning problems.

Will the microcomputer activate a higher level of educating than we have attained before, thus enabling us to approach the goal of a scientific and technologic literate citizenry? Or, is the picture presented above a fantasy?

The Reality

The status of educational computing in science is not consistent with the science instruction of the 1990's portrayed by leaders of the technologic revolution. Becker (1986), Lehman (1985), and Tinker (1984) point out that currently:

- thirty minutes of computer time per day for all students enrolled is available at only seven percent of high schools and roughly two percent of elementary and three percent of middle schools;
- the majority of computers are located in computer laboratories;
- only one-third of student time on computers involves instruction in content areas;
- only 15-20 percent of the time computers are being used for science instruction;
- only six percent of high school science teachers use microcomputers at least one hour per week per class;
- only one microcomputer is available for use in the majority of science classrooms;
- science teachers use the computer more to present information and less as a tool for learning;
- in 1984, on the average, software covered fewer than 15 topics per science course per grade level;
- two-thirds of the software in science is drill-and-practice and games; and,
- the majority of available software is trivial, unimaginative, and does not use microcomputers well.

Recent research has shed light on the effectiveness of microcomputers in teaching and learning. In a synthesis of 42 research studies, Bangert-Downs, Kulik, and Kulik (1985) found that in secondary schools instruction involving computers was only slightly more effective than "traditional instruction" without computers. Even in those studies where computers enhanced learning, little is known about how programs using microcomputers increased learning. Clark (1983) contests the significance of the research findings and suggests that computers "are mere vehicles that deliver instruction but do not influence student achievement anymore than the truck that delivers our groceries causes changes in our nutrition."

Researchers are determining how the computer can enhance science education. Zietsman and Hewson (1986) report that remediation of certain misconceptions in physics can be effected via a microcomputer simulation. In a study of "Rocky's Boots", a simulation and logic game for middle-aged students, Stein and Linn (1985) concluded that to achieve significant student performance with even high-quality software, instruction must emphasize the critical features of the program and provide activities and structure in addition to the interaction with the computer software. Wiser (1985) found that students using a unit on heat and temperature, including microcomputer-based laboratory hardware and software, performed better than students using traditional paper-and-pencil laboratory methods.

Bridging the Gap

Sufficient results from prolonged use of educational computing in science teaching do not exist to form conclusions as to its effectiveness; because, too few science teachers are using the computer as a significant part of their instruction. As Okey (1984) and Watson (1983) point out, few science teachers have participated in instruction using a computer, or learned how to use the computer for instructional purposes.

What are the knowledge and skills needed by a science teacher to use microcomputers to enhance learning and teaching? Ellis and Kuerbis (1985a) identified and validated 22 essential computer literacy competencies for science teachers. The competencies are described in the following categories:

- *computer awareness* — how to operate a microcomputer, how it affects education and other fields;
- *applications in science teaching* — how the microcomputer is used to enhance learning and teaching;
- *implementation of educational computing* — how to overcome barriers to integrating the microcomputer into science teaching;
- *evaluation of software* — how to identify, evaluate, and adopt materials for educational computing in science teaching;
- *resources* — how to identify, evaluate, and use a variety of sources of information regarding computer uses in science education; and,
- *attitudes* — the development of positive attitudes and values about the use of educational computing in science teaching.J

Note that computer programming was not a skill considered essential in using the microcomputer successfully in science teaching.

In a National Science Foundation project, Ellis and Kuerbis (1985b) have been developing and implementing a curriculum—*ENLIST Micros*—to prepare pre- and in-service science teachers grades K-12, to use the microcomputer to enhance learning and teaching. More than 500 science teachers around the nation have used the materials and recently, with support from NSF, a three-year project has been initiated to help 260 science teachers from 22 school districts in Colorado integrate educational computing into their instruction. The following discussion is based on my experience in these projects and on the research literature on educational computing.

Using computers in your science classroom can be approached in three stages—exploration, accommodation, and integration. The first stage is to *explore* exciting applications in a limited manner. During the exploration stage, you gain limited access to microcomputers that are usually located in a computer lab or preferably one microcomputer is checked out from the media center. You should try applications that seem to have merit and evaluate their effectiveness. Usually, teachers are attracted first to management software, such as "Printshop" that will produce banners and signs for bulletin boards or a gradebook program that facilitates record keeping. Additional management applications you should explore at this time are word processing of instructional and administrative materials and databases used for organizing information such as equipment and materials. During this stage, you should explore instructional applications such as simulations and microcomputer based laboratory materials. Try to find programs that are highly motivating or very practical. Usually, these programs are used to enrich existing instruction and improve normal instructional procedures and activities.

Next, begin to *accommodate* instruction to the requirements of microcomputer use. Teachers usually have access to one computer in their classroom. We encourage you to try a variety of approaches to using that computer such as demonstrating a concept to the whole class, assigning small groups in cooperative learning situations to complete a task at the computer while groups are working at other stations completing non-computer tasks, or using the computer to provide individualized learning opportunities for enrichment or remediation. During this accommodation stage, you can investigate how the computer can enrich teaching.

The final stage is to *integrate* educational computing into your ongoing instructional activities and by selecting computer activities that contribute to central goals of your program.

Often integration of educational computing into instruction can mean a redefinition of goals and approaches to teaching and learning. In the most complete implementation, the potentials described earlier may be achieved. However, most teachers will adjust incrementally to educational computing and focus on specific applications that they find effective and worthwhile.

References

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Ellis, James D. and Paul J. Kuerbis. *ENLIST Micros, experimental edition.* Colorado Springs, Colorado: BSCS, The Colorado College, 1985.

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Stein, Joanne S. and Marcia C. Linn. "Capitalizing on Computer-"Based Interactive Feedback." in *Children and Microcomputers: Research on the Newest Medium.* Chen, M. and W. Paisley (eds.). Beverly Hills, CA: Sage Publications, 1985, pp. 213-227.

Tinker, Robert F. *Science and Mathematics Software Opportunities and Needs (SAMSOM) Project, (Final Report).* Technical Education Research Centers, 1696 Massachusetts Avenue, Cambridge, MA. August, 1984.

Wiser, M. "Designing a Microcomputer Based Laboratory to Induce the Differentiation Between Heat and Temperature in Ninth Graders." Technical Report 85-17. Educational Technology Center, Harvard Graduate School of Education, Cambridge, MA. 1985.

Zietsman, Aletta I. and Peter W. Hewson. "Effect of Instruction Using Microcomputer Simulations and Conceptual Change Strategies on Science Learning." *Journal of Research in Science Teaching.* V23(1), pp. 27-39. 1986.

Dr. James D. Ellis is senior staff associate at the Biological Sciences Curriculum Study, The Colorado College, Colorado Springs, Colorado. He is a member of the National Association for Research in Science Teaching, an organization that seeks to improve science teaching through research.

The National Association For Research in Science Teaching is an organization that seeks to improve science teaching through research. For further information, contact the NARST Executive Secretary:

Dr. Glenn Markle
401 Teacher College
University of Cincinnati
Cincinnati, Ohio 45221

For more information about the ENLIST-Micros project contact: Dr. James D. Ellis, BSCS, 1115 N. Cascade Avenue, Colorado Springs, Colorado 80903.

Preparing Computer Literate Science Teachers

Join with the Biological Sciences Curriculum Study (BSCS) in preparing science teachers to implement educational technologies effectively. With support from the National Science Foundation, the BSCS has developed a curriculum, **ENLIST Micros,** for training teachers to use microcomputers to enhance learning and teaching in science and is developing and testing strategies to facilitate the implementation of educational computing in precollege science education.

BSCS staff will disseminate information about **ENLIST Micros** in a short course at the national convention of the National Science Teachers Association (NSTA). The all-day short course is designed for educators of preservice and inservice science teachers, including faculty at colleges and universities and state and local science supervisors and will be offered during the first day of the convention. Registration information is available from NSTA.

During the short course, project staff will share what they have learned from five years of developing and evaluating strategies for implementing educational technologies in science classrooms. Science educators completing the course will be provided materials and procedures for establishing implementation networks for educational technologies in their regions.

For more information about **ENLIST Micros,** contact: BSCS, Attn: EM2, 1115 North Cascade Avenue, Colorado Springs, CO 80903.

Nominees for NARST Offices

The slate of candidates for the Board of Directors and President of NARST presented by the Elections Committee at the Fall meeting of the Executive Board were approved. The nominees for President Elect are:

Marcia Linn, University of California at Berkeley;
and William Holliday, University of Maryland.

Candidates for Board Members-at-Large are:

Gerald Abegg, Boston University;
Lowell Bethel, The University of Texas at Austin;
Robert Sherwood, Peabody/Vanderbilt; and
J. Nathan Swift, SUNY-Oswego.

Ballots along with brief biographical information on each candidate will be mailed to all members in January.

Proceedings Now Available

The Proceedings of the Second International Seminar on Misconceptions and Educational Strategies in Science and Mathematics held this past summer are now available. Send orders and payments ($25.00 US funds per *each* volume — Department of Education, Cornell University) to:

Prof. Joseph D. Novak
Department of Education
400 Roberts Hall
Cornell University
Ithaca, NY 14853-5901

Volumn 1	Overview of the Seminar; Epistemology; Research Methodologies; Metacognitive Strategies; Use of Computers; Roster of Participants
Volumn 2	Overview of the Seminar; Teacher Education; Teaching Strategies; Biology; Elementary Science; Roster of Participants
Volumn 3	Overview of the Seminar; Physics; Mathematics; Chemistry; Roster of Participants

NARST

NARST News

NARST News is published and mailed to members on the first of the month of March, June, September, and December. Contributions need to be received one month before the publication date. Send contributions to the editor:

Dr. Thaddeus W. Fowler, Editor
NARST News
College of Education
University of Cincinnati
Cincinnati, OH 45221-0002

First priority will be given to regular *NARST News* features and other articles will be published as space permits. Please submit copy in printed form and, if possibly, also as a text file on a "five inch" floppy MS-DOS computer disc (WordPerfect preferred).

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