

NATIONAL ASSOCIATION FOR RESEARCH  
IN SCIENCE TEACHING

EXECUTIVE BOARD, SPRING MEETING

SAN FRANCISCO, CA

MARCH 30, 1989

NATIONAL ASSOCIATION FOR RESEARCH IN SCIENCE TEACHING

Spring Meeting, Executive Board  
San Francisco, CA

March 30, 1989

Proposed Agenda

	Page#
1. Welcome - Pat Blosser	
2. Approval of Minutes for November 4, 1988	1
3. Reports	
a) Financial Advisory Committee - Emmett Wright	12
b) Publications Advisory Committee - Ron Good	14
c) Program Committee - Bill Holliday	16
d) Research Committee - Rodger Bybee	17
e) Elections Committee - Linda DeTure	18
f) JRST Awards Committee - Lowell Bethel	19
g) NARST Awards Committee - Fred Finley	20
h) Distinguished Contributions Committee - Ann Howe	21
i) Policy Advisory Committee - Linda DeTure	23
j) Journal Editor - Russ Yeany	24
k) Executive Secretary - Glenn Markle	30
l) President-Elect - Bill Holliday	31
m) President - Pat Blosser	32
n) Archivist - Paul Joslin	33
o) ICASE - Dave Butts	34
p) AAAS - Dave Lockard	35
4. Other Old Business	
5. New Business	
a) Ad hoc Committee on Awards Committees - John Staver	37
b) Drafts of Issues Statements - Emmett Wright, Andy Anderson	38
c) Other	
6. Adjourn	

1988 Fall Meeting of the Executive Board  
National Association for Research in Science Teaching  
Little Rock, AR  
November 4, 1988

MINUTES

Board Members In Attendance

Dr. Charles Anderson  
Dr. Patricia Blosser  
Dr. Roger Bybee  
Dr. Linda DeTure  
Dr. Fred Finley  
Dr. Ronald Good

Dr. William Holliday  
Dr. Glenn Markle  
Dr. Robert Sherwood  
Dr. Russell Yeany  
Dr. Emmett Wright

Dr. Lowell J. Bethel and Mr. LoMoine Motz, members of the Board were not present for the meeting, although Mr. Motz and Dr. Hans Anderson, President Elect of NSTA, did attend the meeting for a short time during the afternoon to report on the "NSTA Initiatives."

A. Opening Remarks by the President

Dr. Blosser opened the meeting at 8:30 a.m. by welcoming members of the Board to the fall business meeting and asking if there were any changes needed in the proposed agenda. No changes were proposed.

B. Approval of Past Minutes

Motion: Moved that the minutes of the April 10, 1988 meeting of the Board be approved. (Holliday, DeTure)

Motion carried.

Motion: Moved that the minutes of the April 12, 1988 meeting of the Board be approved with corrections. (Holliday, Finley)

Motion carried.

C. Financial Advisory Committee

The report of the Financial Advisory Committee was presented by Dr. Wright. He recommended that the Board adopt the 1989 budget as proposed by the Executive Secretary.

Motion: Moved that the report of the Financial Advisory Committee be accepted. (Yeany, Sherwood)

Motion carried.

Motion: Moved that the Executive Secretary and the Financial Advisory Committee prepare a recommendation for investing the Associations contingency funds and submit it to the Board for consideration at the Spring meeting. (Good, Holliday)

Motion carried.

D. Publications Advisory Committee

The report of the Publications Advisory Committee was presented by Dr. Good. He reported on the on-going monograph publication activities. Dr. Barry Frazier is working on a monograph related to classroom environments and Drs. Anton Lawson, John Renner, and Michael Abraham are working on one related to the learning cycle. Both should be ready for distribution at the Spring meeting. Having seen a draft of the learning cycle material, Dr. Good reported his belief that it would be of interest to classroom teachers and suggested that we explore ways of disseminating monographs more widely. Publishers suggested by various members of the Board included NSTA, Wiley, Kindle, Hunt, and Kinko's. It was suggested that Dr. Good contact Bill Aldridge and/or Phyllis Marcucci at NSTA to explore possibilities of their publishing the monographs. The contact person at John Wiley is Jerry Robinson. As discussions are conducted, we need to have non-negotiable positions with regard to editing, royalties, and perhaps other items.

The discussion shifted to available funds to support the monograph project. Fifteen-hundred dollars was budgeted to support a monograph. Now that there are two monographs, what should we do? Should the monographs be free to members of NARST? Should it be free to those who register for the annual meeting? Should we try to recover the cost of producing the monograph? Is there a corporation willing to sponsor the monograph?

Dr. DeTure suggested that members should pay for a monograph if they want it, but that the cost should be little more than our cost of producing it. Holliday and Yeany agreed.

The consensus of the Board was that monographs should be shared beyond the NARST membership, but that this venture should not cost the Association money. We should market the monographs in such a way that our costs are recouped with perhaps a small profit.

Dr. Good suggested that 300 copies be prepared for the spring meeting and distributed at cost to members wanting to buy them. Dr. Yeany reminded the Board that the monograph venture is a "cumulative" venture and that subsequent issues should "look like" the first issue. Dr. Yeany expressed concerns about copy rights and suggested that NARST have all

other copy right rights but that the authors retain the right to use the materials for other purposes if they desire (articles, chapters, books, etc).

→ Motion: Moved that Ron Good and Glenn Markle explore publication and distribution possibilities for the monograph and report back to the Board during the Spring meeting. (Bybee, Holliday).

Motion carried.

→ Motion. Moved that 300 copies of each monograph be produced for distribution at the Spring, 1989 meeting. Copies would be sold at a price sufficient to recoup all production and distribution costs. (DeTure, Yeany)

Motion carried.

→ Motion: Moved that the chair of the Publications Committee have the authors of monographs sign a document giving NARST copy right except for the author's use of the material (author could use the material in latter articles, books, chapters, etc.) (Holliday, Finley)

Motion carried.

#### E. Policy Committee Report

The Policy Committee Report was presented by Dr. DeTure. She reported that the Policy and Procedures Handbook is being prepared. Issues related to the handbook will be discussed at tomorrow's issues meeting.

Motion: Moved that the Policy Committee report be accepted. (Bybee, Wright)

Motion carried.

F. Program Committee

The Program Committee report was presented by Dr. Holliday. The 1989 annual meeting will be held March 30 through April 1, 1989 at the Union Square Holliday Inn in San Francisco. Two-hundred-twenty-two proposals have been received and represent the work of approximately four-hundred different researchers. Twenty-seven of the proposals were rejected. Since the number of acceptable papers exceeded expectations, more use will be made of poster sessions so that more members will have the opportunity to present their work, including work in progress. The poster session will be expanded from 25 to 75 presentations. Holliday described the various types of proposals and how they will be used in the program.

Motion: Moved that maps and brochures of the City be purchased at a cost of \$.45 each to be inserted into the registration packet. (Wright, Sherwood)

Motion carried.

Motion: Moved that NARST honor Dr. Glenn Seeborg during a reception at the Exploratorium on the Wednesday evening before the beginning of the 1989 annual meeting. A token give will be given to Dr. Seeborg, but this is not to be confused with the regularly NARST awards program. (Bybee, Yeany)

Motion carried.

Motion: Moved that we not offer training sessions during the 1989 annual meeting. This is a one time only program modification and should not set a precedence for future meetings. (Holliday, Wright)

Motion carried.

Motion: Moved that the report of the Program Committee be accepted. (Finley, DeTure)

Motion carried.

G. Research Committee

Dr. Bybee reported on the activities of the Research Committee. The coordination of NARST-supported papers at regional meetings of the NSTA and the identification of authors for the current volume of Research Matters were described. The board discussed distribution of the Research Matters and decided to place it on the agenda for Saturday's issues sessions.

Motion: moved that the report of the Research Committee be accepted. (Holliday, Yeany)

Motion carried.

H. Elections Committee

Dr. DeTure reported on the activities of the Elections Committee. The following slate of candidates was presented for approval:

President:

Rodney Doran  
Jane Kahle

Research Coordinator:

Francis Lawrenz  
Joseph Riley

Board Members at Large:

Michael Abraham  
Dale Baker  
Donald McCurdy  
Kenneth Tobin

Motion: Moved that the nominations proposed by the Elections Committee be accepted. (Holliday, Finley)

Motion carried.

Motion: Moved that the Elections Committee Report be accepted. (Finley, Holliday)

Motion carried.

I. Awards Committee:

1. JRST Awards

The report was presented by Dr. Blosser.

Motion: Accept the report. (DeTure, Good)

Motion carried.

2. Outstanding Paper Award

The report on the Outstanding Paper Award was presented by Dr. Finley who described the difficulty in soliciting papers for practical application award. Several strategies for encouraging more applications were discussed. Two seemed to offer promise:

1. Insert a nomination form into the registration packet of each member attending the annual meeting and encourage them to complete the form and deposit it in the box provided at the registration desk.
2. Have each discussant rate the session she/he served, rate the quality of the discussion, and to check the appropriate box on the rating form if one of the papers should be candidate for the practical application award.

Dr. Finley recommended using only the winning practical application paper for an NSTA presentation.

Motion: Accept the report. (DeTure, Good)

Motion carried.

3. Distinguished Contributions Award

Dr. Blosser summarized the report by Ann Howe. The major recommendation is to not carry over the nominations from one year to the next. In other words, folders from current candidates would need to be reconstructed to be reconsidered for the award in subsequent years.

Motion: Moved that files of candidates for the Distinguished Contributions Award be active for three years. After three years, new credentials would need to be submitted for a candidate to be considered for

this award. (Bybee, Holliday)

Motion carried.

Motion: Accept the report. (Bybee, Sherwood)

Motion carried.

At this point in the meeting, President Blosser exercised her authority to modify the agenda in order to discuss actions related to naming a new Journal editor. This was done because Ron Good, a candidate for the position was presenting a paper at this time and by discussing the issue now, he would not need to excuse himself later on. Dr. Finley excused himself from the meeting because he is a candidate for associate editor.

J. New Journal Editor

The report of the search committee was distributed by President Blosser. The committee recommended that Dr. Ronald Good be named editor of the Journal.

Motion: Moved that Dr. Ronald Good be named editor of JRST effective January 1, 1991. Beginning January 1, 1989, he will serve as Associate Editor and his term will end December 31, 1994. The announcement of this decision will be held until agreement by Wiley has been secured. (Bybee, Wright)

Motion carried.

Dr. Anderson recommended that the next time we select an editor, that the report from the selection committee be delivered in person by the selection committee chairperson so that questions concerning the process, criteria, and rationale can be answered in person. Dr. Yeany suggested that the next chair could be selected from the members of the Board. No action was taken on either recommendation.

K. Report of the Journal Editor

Dr. Yeany reported on the statistics for the past year: manuscripts received, accepted, etc. and presented his recommendations for new members of the editorial board. They were Hanna Arzi, Frank Crawley, Jim Ellis, Gaalen Erickson, Steve Oliver, and Patricia Simmons.

Motion: Moved that the report and editorial board member recommendations be accepted. (Wright, Bybee)

Motion carried.

L. Executive Secretary Report

The report of the Executive Secretary was presented by Dr. Markle. Potential sites for the 1990 and 1991 annual meeting were described and the Atlanta Hilton and The Abbey in Chicago were recommended.

Motion: Moved that the Atlanta Hilton be the hotel site for the 1990 meeting and that the meeting be held from April 8 through April 11. (Holliday, DeTure)

Motion carried.

Motion: Moved that the Abbey be the site of the annual meeting from April 7-10, 1991. (Holliday, Finley)

Motion carried.

The proposed budget for 1990 was reviewed and discussed.

Motion: Moved that the Financial Advisory Committee review consider the current charges for renting the NARST mailing list and be prepared to make a recommendation to the Board during the spring meeting. (Holliday, Good)

Motion carried.

Motion: Moved that the 1989 proposed budget be adopted. (Wright, Finley)

Motion carried.

Motion: Moved that the Executive Secretary's report be accepted. (DeTure, Holliday)

Motion carried.

M. Ad Hoc Committee Reports

1. Investigations in Science Education.

Report presented by Dr. Blosser.

Motion: Accept the report. (DeTure, Good)

Motion carried.

2. International Issues.

Report presented by Dr. Blosser and discussed.

Motion: Accept the report. (DeTure, Sherwood)

Motion carried.

3. Teacher Liaison Committee.

Report presented by Dr. Blosser and discussed.

Motion: Accept the report. (Yeany, Finley)

Motion carried.

4. Triangle Coalition Report.

Report discussed. Materials for display at the upcoming meeting of the Coalition need to be sent to Bob Howe (materials include past newsletters, brochures, research matters, etc.)

Motion: Accept the report. (Holliday, Anderson)

Motion carried.

5. ICASE Report

Report discussed.

Motion: Accept the report. (Bybee, Good)

Motion carried.

N. President's Report

Dr. Blosser reported on the activities of the president during the past year.

Motion: Accept the report. (Good, Holliday)

Motion carried.

O. Past President's Report

Dr. DeTure reported on the activities of the past president during the year.

Motion: Accept the report. (Anderson, Wright)

Motion carried.

P. President Elect's Report

Nothing to report beyond the program planning activities reported earlier.

Q. New Business

1. Journal Editor.

Previously approved.

2. ERIC Partners.

Dr. Blosser described the request that NARST become an "ERIC Partner" and the Board discussed the meanings and implications of this move.

Motion: Moved that NARST become an ERIC Partner and that the Executive Secretary by the liaison with ERIC (Holliday, Wright)

Motion carried.

3. Science Education Initiatives.

Dr. Hans Anderson and LeMoine Motts of the NSTA presented a document titled, "Science Education Initiatives" and requested endorsement from NARST. The document was developed by NSTA members during the past year and is viewed as a valuable tool for influencing policy makers at various governmental levels.

The Board did not act on the request for endorsement. The document will be discussed at the Saturday issues meeting.

The Fall Board Meeting adjourned at 5:00 p.m.

Report of the NARST Financial  
Advisory Committee to the NARST  
Board of Directors

March 30, 1989

The Financial Advisory Committee (FAC) has not met since the winter board meeting because of the lack of specific business to transact. The functions of the committee that will need to be conducted over the next eight months include considerations of the proposed annual budget, approve program expenses, approval publication costs and new ventures, offer advice and recommendations to the Board regarding all financial affairs of the Association, and conduct an annual audit of the financial accounts of the Association.

Previous actions proposed by the FAC, subsequently approved by the Board of Directors during the past year include:

- A. Build into the budget \$1,000 per year in savings to support the transition to a new executive secretary. This will amount to \$3,000, \$1,000 per year for 1989, 1990, and 1991.
- B. Build into the budget \$1500 for publication of the first fastback series.
- C. Build into the budget set aside funds with the goal of developing a reserve fund of \$20,000.
- D. The Executive Secretary and the FAC prepare a recommendation for investing the Association's contingency funds and submit it to the Board for consideration at the spring meeting in San Francisco.

Various options exist for investing our set aside funds. These include: (1) regular saving accounts; (2) certificates of deposit; (3) mutual funds; and (4) money market investments. I have reviewed our options with Mr. Les Longburg, the investment officer/comptroller with the Kansas State University Foundations. He handles millions of dollars of investments for the Trust funds donated to the Foundation. After my explanation of the type and amount of funds NARST may have available for investment, he indicated that we need to decide between where we want to invest with no risk (bank savings account, 4-5% interest; certificates of deposit, 5-6% interest) and investments where there might be some risk associated with the investment (Mutual Funds, 9-10%, Money Market, 8-9%). He indicated that the amount of money we plan to invest and our desire for accessibility to the invested funds would dictate to some extent how we put together a portfolio for investments. Mr. Longburg also pointed out that we need to check our charter as a non-profit corporation because restrictions probably apply as to how we can invest our idle funds and how we may choose to spend the interest and/or dividends.

I indicated to him that we initially hope to accumulate about \$20,000 in investments and would need fairly quick access to the money. Based on my input he suggested that we think of our investment in three ways: (1) Savings account and/or certificates of deposit - 20% of our funds (up to \$4,000); (2) No load money market prime fund - 40%-80% of our funds (up to \$16,000); (3) Long-term no load investments - 40%-80%. These seem like reasonable recommendations that should be considered seriously by the Board.

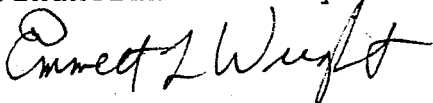
The Money Market Prime Fund is offered through the Vanguard Group of Mutual Funds, Valley Forge, Pennsylvania. A broad range of funds are available for investment. The current yield is between 8.5% and 9%. This is a no load fund. You deal directly with the company over the telephone so there is no broker or broker fees to deal with. You can easily put funds in, withdraw funds, or transfer them to another investment category without penalty. There is a small administrative fee charge, but these charges are low compared to business standards. The KSU Foundation has invested in this fund since 1981 and has been very pleased with the results.

The long-term investments (Fixed income securities fund), also offered through the Vanguard Group, fall into several categories. The higher the interest the more the risk. These funds pay monthly interest and the principal is transferable between various funds without penalty. The risk is associated with the value of the shares you buy-- they can go up and down quickly.

These are three types of income securities funds handled by the Vanguard group. The Government National Mortgage Association (GNMA) Fund, yielding around 9.5%, is money borrowed by the Federal Government to guarantee FHA mortgages. This is a very safe investment. The Investment Grade Fund, yielding 10-11%, is money borrowed by corporations and for government securities. This is a fairly safe fund. High Yield Fund (Junk Bonds), yielding 13.5-14.5%, is the highest risk fund category, even though the KSU Foundation has had no problems with these investments.

Mr. Longburg recommends highly the Vanguard Group, he suggests that we check out and compare other no load investment groups, such as the Federated Group of Funds. Brochures and other descriptive materials from the various companies will be distributed at the spring meeting for perusal by the Board members.

Respectfully submitted for the  
Financial Advisory Committee,



Emmett L. Wright, Chair  
March 30, 1989

---

EXECUTIVE SECRETARY

Dr. Glenn Markle  
NARST  
University of Cincinnati  
Cincinnati, OH 45221-0002  
(513) 475-2335

---

Organized to improve science teaching—through research

---

# NARST

NATIONAL ASSOCIATION FOR RESEARCH IN SCIENCE TEACHING

---

PRESIDENT

Dr. Patricia E. Blosser  
Science Education  
The Ohio State University  
Columbus, OH 43210-1172

M E M O

PRESIDENT-ELECT

Dr. William G. Holliday  
Science Teaching Center  
The University of Maryland  
College Park, MD 20742

Date: March 8, 1989

From: Ron Good, Chairman *RG*  
Publications Advisory Committee

IMMEDIATE PAST PRESIDENT

Dr. Linda DeTure  
Education and Human Development  
Rollins College  
Winter Park, FL 32789

To: Pat Blosser, 1988-'89 NARST President

Re: Report of the PAC activities during the 1989-'89 year

BOARD MEMBERS-AT-LARGE

Dr. Charles Anderson (1990)  
College of Education  
Michigan State University  
East Lansing, MI 48824

Dr. Lowell J. Bethel (1991)  
Science Education Center—EDB340  
The University of Texas at Austin  
Austin, TX 74712

Dr. Fred Finley (1990)  
Curriculum and Instruction  
University of Minnesota  
Minneapolis, MN 55455

Dr. Ronald Good (1989)  
223 E. Peabody  
Louisiana State University  
Baton Rouge, LA 70803

LeMoine Motz (1989)  
NSTA  
1742 Connecticut Avenue, N.W.  
Washington, D.C. 20009

Dr. Robert Sherwood  
College Box 45, Peabody  
Nashville, TN 37203

Dr. Emmett Wright (1989)  
Dept. of Curriculum and Instruction  
Kansas State University  
Manhattan, KS 66506

Nearly all of my efforts during this time as PAC Chairman have been devoted to the monographs project. Following the Spring 1988 NARST meeting, when this project was announced to the membership and supported by the NARST Board, I have communicated by phone and letter with Tony Lawson and his co-authors and with Barry Fraser on the development of their monographs. Especially with Lawson, et al. I have read and commented on various drafts of their monograph. To a lesser degree, I have done the same with Fraser's monograph. Because of time constraints, it was not feasible to involve the other members of the PAC during the development stages of the monographs.

The current situation is this: The Lawson, et al. monograph was completed in early February and sent to Glenn Markle for final preparation and printing. It should be ready for our San Francisco meeting. As I understand it, the monograph will be offered at cost to members who attend the meeting. Following the San Francisco meeting, a publisher/distributor such as NSTA will make the monograph more widely available. The specific arrangements of such an agreement will be determined by the NARST Board, hopefully at our San Francisco meeting. I have sent a copy of the Lawson, et al. monograph to Bill Kyle, who is working with NSTA representatives to decide on whether and how they might want to get involved in the distribution. Although the authors have not yet signed an agreement regarding rights, etc., it is my understanding that the authors will retain the right to use all material in the monograph in their future work. Specifics on this issue also should be worked out at our San Francisco NARST Board meeting.

JOURNAL EDITOR

Dr. Russell H. Yeany  
Science Education Research  
And Evaluation Lab  
Science Education Department  
University of Georgia  
Athens, GA 30602

RESEARCH COORDINATOR

Dr. Rodger Bybee (1989)  
B.S.C.S.  
Colorado College  
Colorado Springs, CO 80903

NARST-NEWS EDITOR

Dr. Thaddeus W. Fowler (1989)  
University of Cincinnati  
Cincinnati, OH 45221-0002

The Fraser monograph was completed somewhat later than the Lawson, et al. monograph. Later in February it was sent

to Glen Markel for preparation and printing similar to that described for the Lawson, et al. monograph. As of this date (March 6, 1989) I assume the Fraser monograph will also be ready for distribution to NARST members (at cost) at the San Francisco meeting.

I stayed in close touch by phone with Glen Markle throughout this process to be sure that our NARST budget would not be strained by the printing of both monographs. As you know, I also contacted you a couple of times to be sure that you thought it was okay to go ahead with the printing of both monographs. Most of the cost of printing the monographs should be recovered at our Spring meeting through their sale at cost to members. Approximately 300 copies of each monograph should be ready for distribution at the Spring meeting. I hope to hear from Bill Kyle about NSTA's interest in distributing one or both monographs in time to report something to the NARST Board.

In late February, Ken Tobin called me and expressed an interest in developing a monograph for next year's meeting. I told him I thought Andy Anderson would be the new chairman of the PAC and would work with him and his co-author (s) (Jim Gallagher?). I encouraged Ken to develop a brief prospectus.

If the NARST Board decides to go ahead with the development of monographs in the future, I recommend that we limit the number developed each year to one. Also, a better time schedule should be established to allow PAC members to participate more meaningfully in the process. I asked the authors to get a draft of the monograph to me in time for the November 4 Board meeting, which Lawson, et al. did. Even this did not allow time for me to distribute it to PAC members and get their input. I asked the authors to get a final copy to me by February 1, 1989, which Lawson, et al. did.

Once a prospectus for a monograph is completed and distributed to PAC members for their comments, it will be a challenge for the PAC chairman to keep them closely involved in the development of the monograph. The key to the process is getting good authors in the first place and having a prospectus that the PAC agrees is worth developing into a monograph. Having the experience of developing the first two monographs should make it a good deal easier for NARST to continue the process in the future. It is my opinion that the authors of the first two monographs have done an excellent job. NARST will be well represented by the products of their efforts.

# National Association for Research in Science Teaching

February 24, 1989

## Report of Program Committee, San Francisco Meeting

Gerald L. Abegg, Boston University  
Dale R. Baker, University of Utah  
Lynn Dierking, University of Maryland at College Park (ad hoc member)  
John H. Falk, Science Learning, Inc. (ad hoc member)  
William G. Holliday, University of Maryland at College Park  
Willis J. Horak, University of Arizona  
Peter Rubba, Pennsylvania State University  
J. Nathan Swift, SUNY-Oswego (ad hoc member)  
Richard Tolman, Brigham Young University  
Roger W. Bybee, Ex officio, Biological Sciences Curriculum Study  
Glen Markle, Ex officio, University of Cincinnati

Motion: Move that the President-Elect of 1989-1990 expand the program committee from its current members of six up to 12 members. The additional members are to be selected by the President-Elect and are to have an ad hoc status.

Motion: Move that three reviewers from the Program Committee evaluate each proposal for the upcoming meeting in Atlanta.

Motion: Move that foreign members submitting proposals for the NARST program not be required to include self-addressed stamped envelopes.

A record number of excellent papers is scheduled for presentation at the 1989 NARST annual meeting. More than 400 separate authors submitted a record number of proposals (230) covering a wide variety of research issues in science teaching. Because of the limited hotel meeting space available in San Francisco and NARST's continuing goal to encourage scholarships at high levels, the program committee materially raised its scholarly standards by maintaining the 1988 level of accepted contributed papers of 94 for the years 1988 and 1989, resulting in an increased number of poster sessions from 26 (1988) to 78 (1989) and increased rejection rate from 12 (1988) to 28 (1989). Similar adjustments were made for the 30 proposed group presentations (e.g., symposia, paper sets, panels), resulting in three rejected proposals, 14 special roundtable group presentations and 13 regular group presentations. Decisions regarding proposals were based on the requirements and criteria described in NARST's call for papers including the blind review process used in past years. Deviations between the number of accepted proposals and published entries in the program, are due to cancellations received by January 15, 1989. The program booklet is an appendix to this report.--Prepared by William G. Holliday, Program Chair

---

EXECUTIVE SECRETARY

Dr. Glenn Markle  
NARST  
University of Cincinnati  
Cincinnati, OH 45221-0002  
(513) 475-2335

---

Organized to improve science teaching—through research

---

# NARST

NATIONAL ASSOCIATION FOR RESEARCH IN SCIENCE TEACHING

---

---

PRESIDENT

Dr. Patricia E. Blosser  
Science & Mathematics Education  
The Ohio State University  
Columbus, OH 43210-1172

---

PRESIDENT-ELECT

Dr. William G. Holliday  
Science Teaching Center  
The University of Maryland  
College Park, MD 20742

---

IMMEDIATE PAST PRESIDENT

Dr. Linda DeTure  
Education and Human Development  
Rollins College  
Winter Park, FL 32789

---

BOARD MEMBERS-AT-LARGE

Dr. Charles Anderson (1990)  
College of Education  
Michigan State University  
East Lansing, MI 48824

Dr. Lowell J. Bethel (1991)  
Science Education Center—EDB340  
The University of Texas at Austin  
Austin, TX 74712

Dr. Fred Finley (1990)  
Curriculum and Instruction  
University of Minnesota  
Minneapolis, MN 55455

Dr. Ronald Good (1989)  
Science Education  
Florida State University  
Tallahassee, FL 32306

LeMoine Motz (1989)  
NSTA  
1742 Connecticut Avenue, N.W.  
Washington, D.C. 20009

Dr. Robert Sherwood  
College Box 45, Peabody  
Nashville, TN 37203

Dr. Emmett Wright (1989)  
Dept. of Curriculum and Instruction  
Kansas State University  
Manhattan, KS 66506

---

JOURNAL EDITOR

Dr. Russell H. Yeany  
Science Education Research  
And Evaluation Lab  
Science Education Department  
University of Georgia  
Athens, GA 30602

---

RESEARCH COORDINATOR

Dr. Rodger Bybee (1989)  
B.S.C.S.  
Colorado College  
Colorado Springs, CO 80903

---

NARST-NEWS EDITOR

Dr. Thaddeus W. Fowler (1989)  
University of Cincinnati  
Cincinnati, OH 45221-0002

To: Pat Blosser and the NARST Board

From: Linda R. DeTure

Date: March, 1989

Re: The Report of the Immediate Past President

As this is my final official board meeting as an officer of the organization, I simply wanted to thank you for your support and for the fine job you have done to keep the organization running and in good health. It has been my pleasure to work with and to get to know you better. As you can see in the Elections Committee's Report, the Board will be in good hands for the next few years with new upcoming and incoming Board Members.

I think as an organization we have made real strides under Pat's leadership this year and can continue to look forward to being a viable leader in the science education community. Once again thanks for everything and good-bye.

---

EXECUTIVE SECRETARY

Dr. Glenn Markle  
NARST  
University of Cincinnati  
Cincinnati, OH 45221-0002  
(513) 475-2335

---

# NARST

---

Organized to improve science teaching—through research

NATIONAL ASSOCIATION FOR RESEARCH IN SCIENCE TEACHING

---

---

PRESIDENT

Dr. Patricia E. Blosser  
Science & Mathematics Education  
The Ohio State University  
Columbus, OH 43210-1172

---

PRESIDENT-ELECT

Dr. William G. Holliday  
Science Teaching Center  
The University of Maryland  
College Park, MD 20742

---

IMMEDIATE PAST PRESIDENT

Dr. Linda DeTure  
Education and Human Development  
Rollins College  
Winter Park, FL 32789

---

BOARD MEMBERS-AT-LARGE

Dr. Charles Anderson (1990)  
College of Education  
Michigan State University  
East Lansing, MI 48824

Dr. Lowell J. Bethel (1991)  
Science Education Center—EDB340  
The University of Texas at Austin  
Austin, TX 74712

Dr. Fred Finley (1990)  
Curriculum and Instruction  
University of Minnesota  
Minneapolis, MN 55455

Dr. Ronald Good (1989)  
Science Education  
Florida State University  
Tallahassee, FL 32306

LeMoine Motz (1989)  
NSTA  
1742 Connecticut Avenue, N.W.  
Washington, D.C. 20009

Dr. Robert Sherwood  
College Box 45, Peabody  
Nashville, TN 37203

Dr. Emmett Wright (1989)  
Dept. of Curriculum and Instruction  
Kansas State University  
Manhattan, KS 66506

---

JOURNAL EDITOR

Dr. Russell H. Yeany  
Science Education Research  
And Evaluation Lab  
Science Education Department  
University of Georgia  
Athens, GA 30602

---

RESEARCH COORDINATOR

Dr. Rodger Bybee (1989)  
B.S.C.S  
Colorado College  
Colorado Springs, CO 80903

---

NARST-NEWS EDITOR

Dr. Thaddeus W. Fowler (1989)  
University of Cincinnati  
Cincinnati, OH 45221-0002

To: Patricia Blosser

From: Linda R. DeTure, Chair  
Mark Malone  
Jack Renner

Date: March, 1989

Re: The report of the NARST Elections Committee

The election of officers for 1989-1990 was conducted according to the policies and procedures of the by-laws. Three hundred ninety eight ballots were received and counted.

The election results were as follows:

President-elect: Jane Kahle

Research Coordinator: Frances Lawrenz

Board Members-at-large: Donald McCurdy  
Kenneth Tobin

Recommendation: Submitted to the NARST Board at the Spring Board Meeting, March 30, 1989 in San Francisco, CA. The Election's Committee recommends the Board vote for approval.



COLLEGE OF EDUCATION  
THE UNIVERSITY OF TEXAS AT AUSTIN

---

*Science Education Center • Austin, Texas • (512) 471-7354*

TO: Members of NARST Executive Board

FROM: Lowell J. Bethel *LJB*

DATE: March 16, 1989

Subject: JRST Awards

The assessments are in. They have been tabulated and the results are as follows. The JRST Award for the Outstanding Research Paper goes to Dr. Glen S. Aikenhead for his article entitled, "An Analysis of Four Ways of Assessing Student Beliefs about STS Topics." His paper was ranked significantly higher than all others in the nine issues of Volume 25.

I wish to thank the members who worked so hard and gave of themselves to do both the extensive and time consuming reading to make the article assessments. The committee responded well and their work made my job very easy. My sincere thanks to each and every one who participated. It is a pleasure to work with all of you.

I think the process is a good one and at this time I feel no problems exist. Perhaps after we meet some things may be raised, but I neither see nor recommend any changes at this time.

I would add that the committee might be enlarged so that each volume can be realistically assessed by at least three NARST members. This was not always the case. However, I do not feel that this was a weakness. It is simply a way to involve more members in this important work.

I look forward to discussing this at the upcoming NARST annual meeting.



UNIVERSITY OF MINNESOTA  
TWIN CITIES

Department of Curriculum and Instruction  
College of Education  
Peik Hall  
159 Pillsbury Drive S.E.  
Minneapolis, Minnesota 55455-0208

To: NARST Board  
From: Fred N. Finley  
Re: NARST Awards Committee Report  
Date: March 9, 1989

This year 12 entries for the Outstanding Paper Award and 4 entries for the Practical Applications Award were received sent to the committee members for review.

Armando Contreras and James Gallagher have won the Outstanding Paper Award for their paper titled A Discourse Analysis on Newton's Second Law as Taught By Three Experienced High School Physics Teachers.

James D. Ellis and Paul J. Kuerbis have won the Practical Applications Award for their paper titled A Model for Implementing Microcomputers in Science Teaching.

The Practical Applications Award will be submitted to NSTA for presentation at next years annual convention.

As I indicated at the Fall Board meeting we need to continue efforts to secure the entry of more papers into the competition, especially in the Practical Applications Award category. This year we will attempt to involve the discussants in soliciting nominations for the awards. Each discussant (and in the absence of a discussant, the session chair) will be asked to recommend a paper or papers (if any) that should be entered in one of the two awards categories. In addition, they should be asked to remind the audience that they can nominate papers as well by completing forms that will be left in the front of each meeting room. The author(s) of papers nominated in these ways then would be contacted and invited to submit their papers for review.

Finally, I wish to thank the Committee members for their efforts on behalf of NARST. The reviews were thoughtful and have contributed to the attempts of this organization to promote research in science teaching.



# North Carolina State University

Department of Mathematics and Science Education  
College of Education and Psychology

326 Poe Hall  
Box 7801  
Raleigh, NC 27695-7801  
(919) 737-2238

REPORT  
of  
DISTINGUISHED CONTRIBUTIONS TO SCIENCE EDUCATION RESEARCH COMMITTEE

The Announcement of the Award and request for nominations was published in the newsletter with a January 15th deadline. Two nominations were received.

Materials for each nominee and voting sheets were sent to all committee members with a February 23rd deadline.

The committee selected Willard Jacobson of Teacher's College, Columbia University, as the recipient of this Award for 1989. Willard has been notified, as has his nominator, Rod Doran.

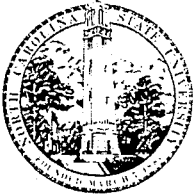
There are a number of issues surrounding this award that are causing rather widespread concern. Several of these are the following:

1. To what extent is this award intended to recognize research specifically?
2. What should the criteria be?
3. Why are so few nominations coming in?

When the Committee meets at the Annual Meeting in San Francisco I will ask the Committee to discuss these issues and make recommendations to the Board for action at the fall meeting.

Ann C. Howe  
Distinguished Contributions  
Awards Committee

ACH/jb  
3/89



# North Carolina State University

Department of Mathematics and Science Education  
College of Education and Psychology

326 Poe Hall  
Box 7801  
Raleigh, NC 27695-7801  
(919) 737-2238

March 8, 1989

Dr. Willard J. Jacobson  
Department of Mathematics and Science Education  
Teachers College  
525 West 120 Street  
Columbia University  
New York, NY 10027

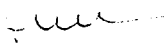
Dear Willard,

It is my great pleasure to tell you that you have been selected as the 1989 recipient of the Distinguished Contributions to Science Education Research Award of the National Association for Research in Science Teaching. This award is given to recognize your continuing contributions over many years, your notable leadership and the impact that your work has had on science education research.

The award will be presented at the Awards Luncheon of the Annual Meeting in San Francisco on Friday, March 31. We hope that you will be able to accept the award in person but if that will not be possible, I hope you will let me know in advance.

Please accept my personal congratulations and those of the Distinguished Contributions Awards Committee. We look forward to being able to congratulate you in person in San Francisco.

Sincerely,

  
Ann C. Howe, Chair  
Distinguished Contributions  
Awards Committee

---

EXECUTIVE SECRETARY

Dr. Glenn Markle  
NARST  
University of Cincinnati  
Cincinnati, OH 45221-0002  
(513) 475-2335

---

# NARST

---

Organized to improve science teaching—through research

NATIONAL ASSOCIATION FOR RESEARCH IN SCIENCE TEACHING

---

PRESIDENT

Dr. Patricia E. Blosser  
Science & Mathematics Education  
The Ohio State University  
Columbus, OH 43210-1172

PRESIDENT-ELECT

Dr. William G. Holliday  
Science Teaching Center  
The University of Maryland  
College Park, MD 20742

IMMEDIATE PAST PRESIDENT

Dr. Linda DeTure  
Education and Human Development  
Rollins College  
Winter Park, FL 32789

BOARD MEMBERS-AT-LARGE

Dr. Charles Anderson (1990)  
College of Education  
Michigan State University  
East Lansing, MI 48824

Dr. Lowell J. Bethel (1991)  
Science Education Center—EDB340  
The University of Texas at Austin  
Austin, TX 74712

Dr. Fred Finley (1990)  
Curriculum and Instruction  
University of Minnesota  
Minneapolis, MN 55455

Dr. Ronald Good (1989)  
Science Education  
Florida State University  
Tallahassee, FL 32306

LeMoine Motz (1989)  
NSTA  
1742 Connecticut Avenue, N.W.  
Washington, D.C. 20009

Dr. Robert Sherwood  
College Box 45, Peabody  
Nashville, TN 37203

Dr. Emmett Wright (1989)  
Dept. of Curriculum and Instruction  
Kansas State University  
Manhattan, KS 66506

To: Patricia Blosser

From: Linda R. DeTure, Chair  
Patricia Blosser  
Jim Shymansky  
John Staver  
Glen Markle, ex officio

Date: March, 1989

Re: Policy Committee Spring Report

The Policy committee reviewed the NARST Policies and Procedures Handbook for the Fall Board Meeting and made recommendations. Since then notes for changes have been made and Handbook will be passed along to the upcoming Policy Committees for continued review.

Recommendations: None at this time.

JOURNAL EDITOR

Dr. Russell H. Yeany  
Science Education Research  
And Evaluation Lab  
Science Education Department  
University of Georgia  
Athens, GA 30602

RESEARCH COORDINATOR

Dr. Rodger Bybee (1989)  
B.S.C.S  
Colorado College  
Colorado Springs, CO 80903

NARST-NEWS EDITOR

Dr. Thaddeus W. Fowler (1989)  
University of Cincinnati  
Cincinnati, OH 45221-0002

# JOURNAL OF RESEARCH IN SCIENCE TEACHING

---

RUSSELL H. YEANY, Jr., Editor

*Department of Science Education*

*The University of Georgia*

*Athens, Georgia 30602*

*Telephone No. (404) 542-1763*

TO: Patricia Blosser  
Executive Board, National Association for  
Research in Science Teaching

FROM: Russell H. Yeany, Editor  
Journal of Research in Science Teaching

RE: 1988 Editor's Report

DATE: March 13, 1989

Attached is the report for the Journal of Research in Science Teaching for the Board Book. Sorry for the delay but the secretary that does the Journal work only comes in one day per week.

Any questions on the report, please give me a call.

TABLE 1  
MANUSCRIPT RECORD VOLUME 25 (1988)

DESCRIPTION	1983	1984	1985	1986	1987	1988
Manuscripts Received	132	147	150	160	120	175
Manuscript Pages Rec'd.	2675	2840	3021	3200	3000	4375
Comments & Criticisms	11	4	6	4	6	6
Book Reviews	0	2	0	0	0	0
Manuscripts Accepted	81	56	59	60	55	75
Manuscript Pages Accepted	1915	1120	1169	1200	1375	1875
Manuscripts Rejected	75	47	44	50	50	60
Manuscripts Deactivated	8	0	0	0	0	0
Manuscripts in Revision*	29	24	51	30	50	71
Manuscripts in Review	9	11	56	20	30	45
Acceptance Rate (%)	49	56	58	38	45	42
Rejection Rate (%)	51	47	46	31	41	34

\* 32 Manuscripts are in for Major Revisions.

FIGURE 2

1989 JOURNAL EDITORIAL BOARD

	1st Term	2nd Term		1st Term	2nd Term
Hanna Arzi	90	92	William LaShier	89	91
Dale Baker		90	Joy Lindbeck	89	91
Donna Berlin	89	91	Victor Mayer		89
George Bodner		90	Steve Oliver	90	92
Ron Bonstetter	89	91	Bruce Perry	89	91
Ted Bredderman	89	91	Peter Rubba		89
Eugene Chiappetta		90	Robert Shrigley		90
Frank Crawley	90	92	Patricia Simmons	90	92
Linda Cronin	89	91	Mike Smith	89	91
Jim Ellis	90	92	Barbara Strawitz		89
Gaalen Erickson	90	92	David Treagust	89	91
Heidi Kass		90	Michael Waugh		90
Joseph Krajcik	89	91	Emmett Wright		89
Gerald Krockover	89	91	Dr. J. Nathan Swift	89	90

FIGURE 3

NAMES AND ADDRESSES OF NEW MEMBERS  
JOURNAL EDITORIAL BOARD  
BEGINNING 1989

Hanna Arzi  
(current)  
Center for Science Education  
P. O. Box 22685  
Tel Aviv 61226  
Israel

(1989)  
University of Arizona  
School of Education  
Tucson, AZ 85721

Frank Crawley  
Science Education Center  
University of Texas at Austin  
Austin, TX 78712

Jim Ellis  
BSCS  
1115 N. Cascade Avenue  
Colorado Springs, CO 80903

Galen Erickson  
Faculty of Education  
University of British Columbia  
Vancouver, BC V6T 1Z5  
Canada

Steve Oliver  
Curriculum and Instruction  
249 Bluemont Hall  
Kansas State University  
Manhattan, KS 66506

Patricia Simmons  
Science Education Department  
University of Georgia  
212 Aderhold  
Athens, GA 30602

J. Nathan Swift  
Education, Poucher Hall  
SUNY-Oswego  
Oswego, NY 13126

1989 JOURNAL EDITORIAL BOARD

Dr. Hanna Arzi  
(current)  
Center for Science Education  
P.O. Box 22685  
Tel Aviv 61226  
ISRAEL

Dr. Arzi (1989)  
University of Arizona  
School of Education  
Tucson, AZ 85721

Dr. Dale Baker  
133 MBH, University of Utah  
Salt Lake City, UT 83112

Dr. Donna Berlin  
1126 Plum Ridge  
Columbus, OH 43213

Dr. George Bodner  
Chemistry Department  
Purdue University  
West Lafayette, IN 47907

Dr. Ron Bonnstetter  
211 Henzlik Hall  
University of Nebraska  
Lincoln, NE 68588-0355

Dr. Ted Bredderman  
Ed 311  
SUNY at Albany  
Albany, New York 12222

Eugene Chiappetta  
Dept. of Curr. & Instruction  
University of Houston  
University Park  
Houston, TX 77004

Frank Crawley  
Science Education Center  
University of Texas at Austin  
Austin, TX 78712

Dr. Linda Cronin  
258 Norman Hall  
University of Florida  
Gainesville, FL 32611

Jim Ellis  
BSCS  
1115 N. Cascade Avenue  
Colorado Springs, CO 80903

Gaalen Erickson  
Faculty of Education  
University of British Columbia  
Vancouver, BC V6T 1Z

Heidi Kass  
Dept. of Secondary Education  
University of Alberta  
Edmonton, Alberta T6G

Dr. Joseph Krajcik  
0231 Science Teaching Ctr.  
University of Maryland  
College Park, MD 20742

Dr. Gerald Krockover  
2245 Indian Trail Dr.  
West Lafayette, IN 47906

Dr. William Lashier, Jr.  
School of Education  
Curriculum & Instruction Dept.  
University of Kansas  
Lawrence, KS 66044

Dr. Joy Lindbeck  
362 Keith Ave.  
Akron, OH 434313

Dr. Victor Mayer  
111 West Dominion Blvd.  
Columbus, OH 43214

Steve Oliver  
Curriculum and Instruction  
249 Bluemont Hall  
Kansas State University  
Manhattan, KS 66506

Dr. Bruce Perry  
811 Erin Drive  
Oxford, OH 45056

Dr. Peter A. Rubba  
The Pennsylvania State Univ.  
Chambers Building  
College of Education  
University Park, PA 16802

Robert Shrigley  
168 Chambers Building  
Pennsylvania State University  
University Park, PA 16802

Dr. Patricia Simmons  
Science Education Department  
University of Georgia  
212 Aderhold  
Athens, GA 30602

Dr. Mike U. Smith  
Mercer University  
1400 Coleman Ave.  
Macon, GA 31207

Dr. Barbara Strawitz  
Curriculum & Instruction  
Louisiana State University  
Baton Rouge, LA 70803

Dr. David Treagust  
Science & Math Ed. Center  
Curtin University of Technology  
GPO Box U1987  
Perth, W.A. 6000  
AUSTRALIA

Dr. Michael Waugh  
386 Education Building  
University of Illinois  
1310 S. 6th Street  
Champaign, IL 61820

Dr. Emmett L. Wright  
Blumont Hall  
Dept. of Curriculum & Instruction  
Kansas State University  
Manhattan, KS 66506

Dr. J. Nathan Swift  
Education, Poucher Hall  
SUNY-Oswego  
Oswego, NY 13126

REPORT FROM EXECUTIVE SECRETARY

Submitted by  
Glenn C. Markle, Executive Secretary  
March 30, 1989

1. Membership

The first mailing of membership materials for 1989 was done in November, 1988. The records of those whose addresses were incorrect and who could not be traced were purged from the directory in late January. The current directory contains the names, addresses, and phone numbers of approximately eleven-hundred science educators.

NARST's membership on March 15, 1989 was 528 regular members, 94 student members, 2 spouse members, and 48 emeritus member, a total of 672 members, of whom 623 receive the Journal. Membership is running about 10% ahead of last year at the same time. A second mailing to those in the directory who have not yet joined NARST for 1989 will be mailed in mid-April. My goal is to enroll 800 NARST members for 1989.

Any help or suggestions you have for encouraging potential NARST members to join our Association would be appreciated.

2. Minutes of the Fall Board meeting were mailed to members of the Board in February.

3. San Francisco in 1989

As of March 15, 1989, two-hundred-twenty-two had registered for the annual meeting. This was about 10% more than were registered prior to the meeting last year. The Association owes a special thanks to Bill Holliday for the work he did to prepare this meeting, to Diana Hunn for her contributions which enabled members to pair up and thus reduce room costs, to Kay O'Sullivan who helped out considerably as a member of the local arrangements committee, and to other members of the program committee and the local arrangements committee.

4. Atlanta in 1990

The 1990 meeting will follow the NSTA meeting in Atlanta. (April 8-11. Easter is April 15.) The Atlanta Hilton will serve as the meeting site in 1990. Room rates will be \$109.00 for singles or for doubles/twins. March 8, 1990 will be the cut off date for guaranteed room reservations.

5. Chicago in 1991

The 1991 meeting will be held from April 7 through April 10 at the Abbey on Lake Geneva located in Fontana, Wisconsin. Our meeting will follow the AERA meeting in Chicago. Easter will fall on March 31, 1991. Room rates at the Abbey will be \$68.00 for a single or double.

6. Boston in 1992

Information from several potential meeting sites in Boston has been collected. I will do on-site inspections this summer and present proposals from at least three sites to the Board at Fall meeting of the Board.

7. Financial Report

The records of receipts and expenditures during 1988 are attached to this report. Verification of these figures by the University of Cincinnati's College of Education Fiscal Officer will be sent to the Finance Committee as soon as the annual audit is completed (probably in late April). I will discuss the state of the budget with the Finance Committee at its meeting in San Francisco. In general, we were in better financial shape at the end of 1988 than we had been at the end of the previous two years.

As of February 28, 1989, the balance in the NARST budget was \$36,971.00. However, major convention expenses will need to be paid as well as the expenses associated with our members' subscriptions to JRST. Nevertheless, I am more optimistic about the budget now than I was two years ago.

8. Emeritus Members

The following members have requested emeritus status in NARST, and I am recommending that the Board act favorably on their requests.

Jack Easley,	University of Illinois
Willard Jacobson,	Columbia University
Joy Lindbeck,	University of Akron

9. New Executive Secretary

My term as Executive Secretary is due to expire on January 1, 1991, approximately one and one-half years from now. January is a terrible time of the year to change executive secretaries --- the majority of our dues are being collected, election ballots must be prepared and mailed, registration materials for the annual meeting must be distributed and received, and the nitty-gritty details of preparing for the annual meeting must be addressed (printing programs, dealing with the hotel on last minute problems, printing Research Matters, arranging for the NARST booth at NSTA, etc.). I propose that the transition to a new executive secretary take place in July rather than January. While I would not feel slighted if the next Executive Secretary assumed the position in July, 1990, I am willing to continue serving the Association until July 1, 1991 if the Board so desires. Regardless of when the transition takes place, the Association should begin the search for the next Executive Secretary immediately. It would be most helpful if the new executive secretary could be named in time to attend the fall meeting of the Board in 1990.

1988 NARST Financial Report  
Income and Expenditures

1988 NARST FINANCIAL RECORDS: MONTHLY SUMMARY

1988	Initial Balance	Receipts	Expenditures	Final Balance
January	8180.36	18397.80	2976.35	23601.81
February	23601.81	9272.63	964.95	31909.49
March	31909.49	15648.10	390.58	47167.01
April	47167.01	5397.23	8408.31	44155.93
May	44155.93	2408.00	1020.58	45543.35
June	45543.35	2912.05	12354.02	36101.38
July	36101.38	1312.00	1017.83	36395.55
August	36395.55	1176.28	17732.17	19839.66
September	19839.66	1418.00	1130.69	20126.97
October	20126.97	450.00	134.05	20442.92
November	20442.92	578.75	336.67	20685.00
December	20685.00	698.84	6517.22	14866.62
TOTAL	8180.36	59669.68	52983.42	14866.62
Summary	8180.36	59669.68	52983.42	14866.62

NARST BUDGET SUMMARY - 1988  
Through December 31, 1988

	Initial Balance	Encumbered Funds	Budget Balance
NARST General Funds	5307.74		5307.74
Delta Project Funds	2872.62		2872.62
<b>TOTAL FUNDS</b>	<b>8180.36</b>	<b>0.00</b>	<b>8180.36</b>

=====

INCOME SUMMARY

ITEM	BUDGETTED AMOUNT	ACTUAL RECEIPTS	BALANCE RELATIVE TO BUDGET FOR 1988
Membership Dues	34590.00	38053.80	3463.80
Annual Meeting Income	17600.00	17884.50	284.50
Other Income	52800.00	54231.38	1431.38
<b>TOTAL</b>	<b>104990.00</b>	<b>110169.68</b>	<b>5179.68</b>

-----

EXPENDITURE SUMMARY

ITEM	BUDGETTED AMOUNT	ACTUAL DISPERSEMENTS	BALANCE RELATIVE TO BUDGET FOR 1988
Member expenses inc. JRST	16152.00	17923.55	1771.55
Journal Postage & Supplies	1000.00	1564.81	564.81
Annual Meetings	18000.00	18667.68	667.68
Officer/Board Expenses	8100.00	8808.08	708.08
Exec Sec Expenses	3700.00	2429.60	-1270.40
Research Matters	250.00	198.00	-52.00
NARST News	4000.00	3291.70	-708.30
Delta Project	2872.00		-2872.00
Other (ICASE, etc.)	160.00	100.00	-60.00
U.Ga. & U.C. Expenses*	50500.00	50500.00	0.00
<b>TOTAL</b>	<b>104734.00</b>	<b>103483.42</b>	<b>-1250.58</b>

=====

\*NON-CAS EXPENDITURES. JOURNAL EDITOR AND EXECUTIVE SECRETARY SUPPORT

NARST GENERAL FUNDS  
RECEIPTS

	BUDGETTED INCOME	ACTUAL RECEIPTS	CATEGORY BUDGET BALANCE
<b>Membership Dues</b>			
1988 Dues	34590.00	36879.80	2289.80
1989 Dues		1174.00	1174.00
Other			0.00
<b>TOTAL</b>	<b>34590.00</b>	<b>38053.80</b>	<b>3463.80</b>
<b>Annual Meeting</b>			
Registrations	17000.00	17199.50	199.50
Train. Sess.	600.00	685.00	85.00
<b>TOTAL</b>	<b>17600.00</b>	<b>17884.50</b>	<b>284.50</b>
<b>Other Income</b>			
Mailing Lists	300.00	900.00	600.00
Royalities	2000.00	1997.28	-2.72
Donations		10.00	10.00
Misc. Income		824.10	824.10
*U.Ga.	26000.00	26000.00	0.00
*U.C.	24500.00	24500.00	0.00
<b>TOTAL</b>	<b>52800.00</b>	<b>54231.38</b>	<b>1431.38</b>

-----  
\*Contributions for JRST Editor and Executive Secretary

NARST GENERAL FUNDS  
EXPENDITURES

	DATE	BUDGET	EXPENDED	ENCUMB.
<b>MEMBERSHIP</b>				
Type set ballots	Jan 7		30.00	
Printing ballots and descriptions	Jan 22		170.53	
Candian check charge; Yore	Jan 31		19.97	
Foreign check charge	Mar 23		54.00	
Bad check: Gremlt	Mar 24		50.00	
Candian check charge: Yore	Mar 30		22.19	
Can. check chrg Farragher	Apr 27		25.86	
Foreign check, Adey (England)	May 13		15.00	
Foreign check, Adey, England	May 31		44.00	
Foreign chk	Aug 18		10.00	
Bad cck: Rodriquez	Jun 15		30.00	
Bad chk: Novak	Apr 29		70.00	
Conf. Reg. Refund: Shaw	May 1		70.00	
Conf. Reg. Refund: Laugen	Jul 15		80.00	
Wiley: final pmt for '87 subscriptions	May 9		192.00	
Wiley, '88 member subscriptions	Aug 25		17040.00	
	<b>MEMBER TOTAL</b>	<b>16152.00</b>	<b>17923.55</b>	

	DATE	BUDGET	EXPENDED	ENCUMB.
--	------	--------	----------	---------

ANNUAL MEETINGS

1988 Annual Meeting

Type set program (Bill from 1987)	Jan 7		977.00	
Type set program 1988	Apr 18		957.00	
Print '88 prog	Apr 18		1100.00	
Print abstracts	Jun 9		1000.00	
Travel: Barrow Local Committee	Feb 26		114.97	
Bitner, local com meal exp.	May 13		17.36	
NSTA Booth United Expo	Mar 31		75.00	
NSTA Booth Supplies	Apr 25		99.84	
Plaques, awards	Apr 4		132.75	
Plaques, awards	Jun 3		134.75	
Plaques, awards (error, refund coming)	Jun 7		134.75	
Arvey Paper	Apr 7		68.00	
Plaques, awards	May 24		111.80	
Print badge cards	Apr 7		126.60	
Badge holders	Apr 7		12.18	
More badg hlders	Apr 7		29.76	
Travel, Markle	Apr 27		761.47	
Travel, Yeany	Jul 14		287.40	
Joslin: UPS chrgs	May 12		33.28	
Tinker, travel. Speaker	Jun 8		251.85	
Lodge 4 Seasons	Jun 3		7859.32	
Lodge 4 Seasons	Jun 21		285.28	

Workshop Expenses

Lawrence honor.	Apr 12		200.00	
Lawrence, travel	May 13		345.14	
Gallagher honor.	Apr 12		200.00	
Gallagher travel	May 12		172.37	
Tobin, honor.	Apr 12		200.00	

	DATE	BUDGET	EXPENDED	ENCUMB.
<b>JOURNAL EXPENSES</b>				
	Yeany, Jrnl Edit	Apr 12	1000.00	
	Legal fees	Jan 7	564.81	
	(Negotiate contract)			
	<b>JOURNAL TOTAL</b>	<b>1000.00</b>	<b>1564.81</b>	
<b>OFFICERS/EXECUTIVE BOARD</b>				
	Typeset business cards	Apr 12	10.00	
<b>Fall Board Meeting 1987</b>				
	Travel: Anderson	Jan 14	496.97	
	Travel: DeTure	Feb 9	356.95	
	Weston Hotel	Feb 18	23.54	
<b>Officer Expenses</b>				
	Blosser, Pres.	Apr 12	1000.00	
	DeTure, Past Pres	Apr 12	700.00	
	Holliday, Pres El	Apr 12	700.00	
<b>Fall Board Meeting 1988</b>				
	Travel, Markle	Nov 8	188.00	
	Travel, Markle	Nov 16	86.74	
	Travel, Good	Dec 2	236.49	
	Travel, Wright	Dec 2	258.00	
	Travel, Holliday	Dec 2	263.00	
	Travel, Finley	Dec 2	555.90	
	Travel, Sherwood	Dec 2	155.06	
	Two Board Dinners	Dec 2	300.81	
	Paid by Markle			
	Printing, Markle	Dec 2	9.10	
	Computer Rental	Dec 2	70.00	
	Travel, Anderson	Dec 2	412.00	
	Excelsior Hotel	Dec 29	2985.52	
	Rooms & Meals			
	Travel, Bybee			434.00
	Travel, Yeany			421.00
	Travel, Blosser			
	<b>TOTAL OFFICER/BOARD</b>	<b>8100.00</b>	<b>8808.08</b>	<b>855.00</b>

	DATE	BUDGET	EXPENDED	ENCUMB.
<b>1989 Annual Meeting</b>				
Markle, travel Preplanning	Jun 29		866.75	
Holliday, travel Preplanning	Jun 30		468.66	
Local committe lunch	Jul 14		124.68	
Holiday Inn Room chrges Will be reimb.	Jul 27		376.00	
<b>1990 Annual Meeting</b>				
Travel, Markle Site Inspection	Sep 13		527.71	
<b>1991 Annual Meeting</b>				
Travel, Markle Site Inspection	Aug 30		616.01	
<b>TOTAL ANNUAL MEETINGS</b>		<b>18000.00</b>	<b>18667.68</b>	

**EXECUTIVE SECRETARY OFFICE**

Supplies	Jan 22		4.32	
Labels, 6 bxs	Jan 27		181.54	
Supplies	Feb 8		90.78	
Type set	Apr 14		192.00	
NARST stationary	Jun 29		98.30	
Correct stat.	Jul 26		12.85	
Stationary	Aug 5		61.00	
Printing	Aug 31		71.70	
Printing	Sep 12		85.00	
Printing	Dec 1		70.85	
Printing	Dec 15		153.48	
Printing	Dec 16		47.73	
Phone, Jan	Jan 31		14.51	
Phone, Feb	Feb 29		39.59	
Phone, Mar	Mar 31		34.83	
Phone, Apr	Apr 30		14.12	
Phone, May	May 31		15.43	
Phone, Jun	Jun 30		12.90	
Phone, Jul	Jul 30		28.84	
Phone, Aug	Aug 31		2.01	
Phone, Sep	Sep 19		4.96	
Phone, Adj.	Sep 30		3.57	
Phone, Oct	Oct 19		32.84	
Phone, Nov	Nov 16		32.84	
Phone, Dec	Dec 16		11.90	
Phone, Dec	Dec 30		7.60	

	DATE	BUDGET	EXPENDED	ENCUMB.
Postage, Feb	Feb 29		97.60	
Postage, Mar				
Postage, Apr				
Postage, May				
Postage, Jun	Jun 30		65.10	
Postage, Jul				
Postage, Aug	Aug 31		2.22	
Postage, Sep	Sep 30		19.78	
Postage, Oct	Oct 31		80.01	
Postage, Nov				
Postage, Dec				
Bulk Mail Permit	Sep 12		60.00	
Bulk Mail Acct.	Dec 5		200.00	
Adt'l Bulk Mail	Dec 5		200.00	
Copy chrgs, UC	Mar 31		3.56	
Copy chrgs, UC	Apr 30		21.38	
Copy chrgs, UC	May 31		4.20	
Copy chrgs, UC	Jun 30		1.66	
Copy chrgs, UC	Jul 31		9.76	
Copy chrgs, UC	Aug 31		0.93	
Copy Chrgs, UC	Sep 30		15.32	
Copy Chrgs, UC	Oct 31		21.20	
Copy Chrgs, UC	Nov 30		29.09	
Copy Chrgs, UC	Dec 31		30.78	
Pre-print env.	Feb 18		241.52	
<b>TOTAL EXECUTIVE SECRETARY</b>		<b>3700.00</b>	<b>2429.60</b>	

RESEARCH MATTERS

Printing R.M.	Apr 7		120.00	
Type set	Apr 14		78.00	
<b>TOTAL RESEARCH MATTERS</b>		<b>250.00</b>	<b>198.00</b>	

NARST NEWS

Print Dec '87	Jan 6		418.70	
Type set	Jan 20		98.00	
Type set Mar '88	Mar 4		118.00	
Labeling, UC Mail	Mar 4		33.00	
Print Mar '88	Apr 21		589.35	
Type set Jun '88	Jun 17		414.00	
Print June '88	Jun 20		729.00	
Type set Sept '88	Sep 7		111.00	
Print Sept '88	Sep 7		198.65	
Labeling, UC Mail	Sep 7		33.00	
Type set Dec '88	Dec 9		181.00	
Print Dec '88	Dec 29		335.00	
Labeling, UC Mail	Nov 30		33.00	
<b>TOTAL NARST NEWS</b>		<b>4000.00</b>	<b>3291.70</b>	

	DATE	BUDGET	EXPENDED	ENCUMB.
<b>OTHER ITEMS</b>				
ICASE dues Pd to NSTA	Jun 17		100.00	
<b>TOTAL OTHER EXPENSES</b>		160.00	100.00	

**DELTA MONOGRAPH PROJECT**

No Activity On The Delta Monograph Project This Year

**BOTTOM LINE SUMMARY**

	INITIAL BALANCE	INCOME	EXPENDITURES	BALANCE
NARST	5307.74	110169.68	103483.42	11994.00
DELTA PROJECT	2872.62	0.00	0.00	2872.62
<b>TOTAL</b>	<b>8180.36</b>	<b>110169.68</b>	<b>103483.42</b>	<b>14866.62</b>

=====

The following outstanding bills incurred in 1988 were not paid by December 31:

Yeany's travel to Little Rock:	\$ 421.00
Bybee's travel to Little Rock:	434.00
<b>TOTAL</b>	<b>\$ 855.00</b>

Also, during 1988 no funds were invested in CD's to assist the the new Journal Editor and Executive Secretary assume their duties. We should be thinking in terms of approximately 3% of \$60,000 or about \$1800.00 which will invested as soon as possible.

## REPORT OF NARST PRESIDENT

Thanks to all NARST Board members, and especially to those who have served as committee chairs, for all of the work they have done over the past year. Sincere appreciation is also extended to the members of the various standing and ad hoc committees whose donated time and energies help keep the organization functioning. A special word of appreciation is given to Linda DeTure for the information she has provided, both orally and in the form of notebooks describing what activities need to take place in order to carry out the duties that are part of being president-elect and president.

Since the annual meeting in Lake Ozark, MO last April, my activities have included the following:

- o attendance at NSTA orientation for new board members in Washington, DC, in May
- o participation in the NSTA summer board meeting in Reno, in July
- o keynote speaker, Physical Science Workshop for Elementary Teachers, Old Dominion University, in July
- o program co-chair, Columbus NSTA regional meeting, in October
- o attendance at AAAS Forum on School Science, Washington, DC in October
- o chaired NARST fall board meeting and issues session, Little Rock, AR, November
- o presented a NARST session, "Monitoring Your Questioning Behavior," at NSTA Little Rock regional meeting, November
- o attended NSTA regional meeting in Charleston, in December, and presented a session on using ERIC to identify curriculum materials in science
- o attended winter meeting of NSTA board of directors in Washington, DC, in January
- o attended annual conference of the National Association for Science, Technology, Society in Washington, in January (ERIC-SMEAC sponsored this trip)
- o attended a conference on Challenges in Science and Technology Education, sponsored by the American Medical Association, in Washington DC, in March
- o chaired NARST spring board meeting in San Francisco, in March
- o will participate in NSTA board meeting in Seattle, in April (NSTA board members' terms run until the summer board meeting, even if division affiliate presidents have moved into past-president roles)
- o have written (and will write) numerous letters to various NARST members, thanking them for committee work, answering questions, etc.
- o produced President's Column material for NARST Newsletter, as well as transmitting information from members relative to upcoming conferences, etc.



# DRAKE UNIVERSITY

Center For Teacher Education

**TO:** Patricia Blosser  
NARST President  
Science Education  
The Ohio State University  
Columbus, OH 43210-1172

**DATE:** March 9, 1989

**FROM:** Paul Joslin  
Archivist

**RE:** Spring, 1989 Report

We have made quite a bit of progress collecting, classifying and filing documents and records of historical value and interest. These are now in two filing cabinets.

We have begun a record to show where items are that should not necessarily be moved, for example the personal copies of life writings of Gerald Craig; these are in the Wisconsin State Historical Museum in Madison.

Where we thought photocopies should be in our local records we have made them. We still have collections at distant sites we have not yet been able to get to for examination.

All of this work has been amazingly slow and, severely disturbed by two most disappointing events. First, my partner, Karen Murphy, was disabled and unable to work for the better part of a year. Second, during a freak electrical storm in December, a lightning bolt sent an electrical surge through the steel desk in her basement office. The result was the destruction of all of the computer records and writings she had accumulated. We have since learned to prepare backup copies should such a disaster reoccur.

I was on leave in Australia last Fall and am now playing catch up. But we'll persist some how.

Thanks for your support.



# The University of Georgia

College of Education  
Science Education Department

March 8, 1989

Dr. Patricia E. Blosser  
President, NARST  
% ERIC Center  
1200 Chambers Road  
Columbus Ohio 43212

Dear Pat:

Thankyou for your recent call of March 6 and your inquiry concerning NARST related activities with ICASE. We have been in regular communication with the ICASE Executive Secretary. In addition to cooperating with them in completing a survey form on the role of Science/Technology in US science education courses, we have forwarded notices of ICASE sponsored international conferences and publications to the NARST President for further dissemination as she may consider desirable.

As an example of this communication, the attached letter from Dr. Andrew G. Bruce from the Victoria University of Wellington describes the ICOTS Conference in August 1990 to be held in New Zealand. This information may be of interest to our membership and could be forwarded to the Newsletter Editor.

There is one request for possible board action. The Third Interamerican Consortium of Researchers in Science and Mathematics Education will be held at the Universidad de Los Andes (Meridal-Venezuela) from February 14 to 17, 1990. In the past, NARST has served as a sponsoring organization of the previous two conferences. It would be helpful if we could continue this activity. If the Board approves, a letter of support should be sent to Dr. Armando Contreras, Conference Organizer, Nucleo Universitario Rafael Rangel, Trujillo Estado Trujillo, Venezuela, Condigo Postal 3102A.

At this time, our interaction has been positive and there are no other activities to report.

If I can be of further assistance, please do not hesitate to let me know.

Very sincerely,

  
David P. Butts  
Aderhold Distinguished

Professor

212 Aderhold Hall • Athens, Georgia 30602 • (404) 542-1763  
An Equal Opportunity/Affirmative Action Institution

Enclosure

34



# International Clearinghouse for the Advancement of Science Teaching

Benjamin Building

The University of Maryland at College Park

College Park, Maryland 20742 U.S.A.

(301) 454-2024 (301) 454-4028

LOCKARD@UMDD.UMD.EDU

TO: Pat Blosser, President of NARST

FROM: *Dave Lockard*  
Dave Lockard, NARST Representative to AAAS

SUBJ: Report of the AAAS Representative to the NARST Board

DATE: March 14, 1989

The interactions of this NARST Representative to the AAAS have been mainly through our membership in the AAAS Consortium of Affiliates for International Programs (CAIP). This group operates under the AAAS Office of International Science and has been in existence since 1976, and NARST has been active with them for about five years. The objectives of the CAIP are to:

- \* Facilitate communication among CAIP member societies about international concerns and programs of common interest.
- \* Provide a forum and a mechanism for raising the concerns of the scientific and engineering community, through its professional associations, regarding international science policies and priorities and to present these to policymakers
- \* Encourage cooperation and coordination among members on multidisciplinary projects with international aspects.
- \* Stimulate new and/or expanded international science activities by Consortium members.

Currently 70 AAAS affiliates belong to the Consortium as "regular members". Regular members designate a representative and staff liaison from their society to the Consortium. There are no dues; however, member societies do submit an annual letter report to the CAIP and the representative is expected to attend at least one Consortium meeting each year. Communication among CAIP members is facilitated by a newsletter, Consortium Notes, published quarterly. The newsletter contains articles on international activities of Consortium members, announcements and updates of ongoing Consortium projects, and a calendar of future international activities. In addition a Consortium Directory of CAIP members is compiled and distributed annually. The Directory contains the names, addresses and other data on the representatives and staff of each member society, descriptions of CAIP member organizations, and brief descriptions of their activities, particularly at the international level. Consortium Notes and the Directory are distributed free of charge to Consortium members. Barry Gold, of the AAAS staff, is the CAIP Coordinator and is always interested in society activities.

Since NARST is the only active CAIP member society dedicated to science education research, we have been asked to help stimulate such research in developing countries. To do this, our Board was asked, and did vote affirmatively, to supply six free copies of our Journal of Research in Science Teaching to corresponding educational organizations in developing countries of sub-saharan Africa. AAAS receives journal copies from us, and from a number of other cooperating professional societies, and arranges free distribution to the designated countries. Hopefully, when we get our journal distributed over there, we will have an opportunity for our

own members to establish and carry on regular correspondence with our counterpart science education researchers and develop joint research projects.

A more recent project that we have become involved with is the joint planning, at their request of a science education conference in Ghana. Their hope is that by active interactions specific activities in science teaching and science teaching research will be suggested, funding found, and projects undertaken in that developing country. One of our members, Audrey Champagne, has already made a visit to that country to help in their planning sessions and we look forward to some of our NARST members becoming actively involved in the conference and with the projects that may later result from the sessions.

There are a number of other CAIP activities that NARST might want to get involved with and these include a Caribbean Regional Seminar, U.S.-West German Seminars on Exchanges, Global Initiatives, and CAIP-sponsored symposia at AAAS Annual Meetings. Just recently we received a letter from Barry Gold noting that CAIP would like to increase the number of CAIP-sponsored symposia held at the 1990 AAAS Annual Meeting in New Orleans to be held from February 15-20, 1990. Barry would like to have any suggestions for symposia by the end of March, if possible for that meeting, but he is interested in your ideas and suggestions at any time.

Another recent development is the idea of inviting any counterpart foreign professional societies to become "corresponding members" of CAIP at no cost to them. To assist in this endeavor, William Sangster, who is Chairman of the CAIP Steering Committee, asks that we submit addresses and appropriate contacts in both developed and developing countries to Barry Gold, CAIP Coordinator, Office of International Science, AAAS, 1333 H Street, N.W. Washington, D.C. 20005. Again, a number of worthwhile research projects might develop that our members might contribute to or stimulate from their own studies.

Recommendations to NARST are that we continue, and possibly expand on, our journal distribution program, to submit ideas for symposia at the AAAS Annual Meetings, to suggest counterpart associations in both developed and developing countries that might become "corresponding members", and to keep an active role in CAIP and AAAS in general.

On a related, but more personal note, this representative has been invited by AAAS to do an analysis of the NSF Materials Development 1990 budget and present it at the Third Annual Seminar on Science Education in the Federal Budget meeting at AAAS, being held on Monday, April 3, 1989. Over 300 invitations have been sent out by AAAS for the Seminar at which analyses of the administration's proposed FY 1990 budgets for the National Science Foundation, the Department of Education, and the Department of Energy will be presented. The analyses will be followed by comments from representatives of the federal agencies and questions from the audience. Any help in this analysis that can be given quickly to this NARST Representative will be greatly appreciated.



## Center for Science Education

College of Education  
Bluemont Hall  
Manhattan, Kansas 66506  
913-532-6294

### MEMORANDUM

DATE: March 8, 1989

TO: Patricia E. Blosser, President, NARST

FROM: John R. Staver, Chair, ad hoc NARST committee

In accordance with your direction to form an ad hoc committee to: (1) inspect the responsibilities of the NARST Awards Committee, the JRST Awards Committee, and the Distinguished Contributions Award Committee; (2) develop a charge for these committees; and (3) submit a report to you for possible Board action in San Francisco, I submit the following report on behalf of the ad hoc committee members, Lloyd Barrow, Linda Crow, and myself:

We find no good reasons to change the responsibilities or the administrative structure of any of the aforementioned committees. Each is performing its function well under the direction of its chair. We see no reason to create an oversight or steering committee for the purpose of monitoring and coordinating the endeavors of the three committees. Each committee, however, does need a formal charge, and we have written these for the Board's examination, modification, and possible approval.

**NARST Awards Committee Charge:** To select the outstanding paper from those papers presented at the prior year's NARST annual meeting and submitted to the NARST Awards Committee for review. The author(s) of the paper judged as the best among those presented and submitted will receive the NARST Award. To select the outstanding paper focusing on practical applications of research from those papers presented at the prior year's NARST annual meeting and submitted to the NARST Awards Committee for review. The author(s) of the paper judged as best among those presented and submitted will receive the Practical Applications Award.

**JRST Awards Committee Charge:** To select the article published in the current volume of the Journal of Research in Science Teaching which is judged to be the most significant contribution to the volume. The author(s) of the article selected will receive the JRST Award.


**Distinguished Contribution Award Committee Charge:** To examine and judge from nominations the contributions of individuals to the field of science education through research over an extended period of time. If the merits of an individual's contribution warrant recognition, then the individual will receive the Distinguished Contribution Award.

Membership of the NARST Awards Committee, the JRST Awards Committee, and the Distinguished Contribution Award Committee will be composed of a sufficient number of NARST members to carry out the charge. These members will serve on three-year rotating terms. The Chair will be a member of the NARST Board of Directors. The Executive Secretary will be an ex officio member of each committee. The President will identify members with the advice of the appropriate Chair.



## Division of Teacher Education

College of Education  
Bluemont Hall  
Manhattan, Kansas 66506  
913-532-5550

TO: Dr. Pat Blosser  
FROM: Emmett L. Wright   
DATE: March 13, 1989  
RE: 2nd Draft - NARST Statement of Purpose

Based on input from Roger Bybee I am forwarding you the 2nd draft of the "Statement of Purpose for the National Association for Research in Science Teaching Setting Directions for the 1990's." Additional people have volunteered to review the document (Dr. Elizabeth Charron; Dr. William Kyle; Dr. Judith Kay). I will send each of them a copy and encourage their input prior to the Board meeting on March 30, 1989.

ELW/tjh

cc: Roger Bybee

Statement of Purpose for the  
National Association for Research in Science Teaching  
Setting Direction for the 1990's

The National Association for Research in Science Teaching (NARST) is a major international professional society promoting an articulation between research and its dissemination to the practitioner for the improvement of science teaching. The association, because of this leadership role, must take a proactive stance that both reflects the science education profession and enhances the general community of education professionals. NARST should provide recommendations that specifically influence the development of public educational policy at the international, national, state, and local levels, as it affects the promotion of quality science teaching. The future direction of NARST is prioritized on the following purposes:

- (1) Provide leadership in promoting the use of an established scientific basis to improve science teaching at the local, state, national and international levels.
- (2) Develop an agenda for basic and applied research in science education.
- (3) Translate, codify, synthesize and disseminate the findings of science education research in a manner that such findings have direct implications and are useful for both researchers and the classroom practitioner.

- (4) Develop and evaluate mechanisms for disseminating and implementing the applications of basic research to science teaching.
- (5) Enhance the quality of science teaching worldwide particularly as it relates to Global Issues.
- (6) Define the role of NARST in conjunction with and as distinct from other professional organizations concerned with science education.

#### Promoting Quality Science Teaching

The membership of NARST represents the scholarly leadership of the science teaching profession. In the past NARST depended on individual members and other organizations to serve as spokespersons for the profession. NARST must become more proactive and systematically represent an organizational view to various public and professional audiences on issues affecting the quality and quantity of science teaching. For example, specific research-based rationales need to be formulated to support defensible positions for:

- 1) the necessity for the laboratory;
- 2) the sequence and number of secondary science courses offered;
- 3) the provision of systematic and hands-on science instruction in the elementary schools;

- 4) the development of appropriate science education in middle school.
- 5) the applicability of technology oriented science programs.
- 6) the need for research-based college level science courses for general education and teacher preparation students;
- 7) the intent, contents and quality of science textbooks and references;
- 8) nationally recognized certification requirements;
- 9) the financing of preservice and inservice education of science teachers; and,
- 10) the support for basic research in science teaching.

The leadership of NARST, and when appropriate the membership, needs to be sensitized to share these positions in various forums such as (1) written testimony before a legislative committee, a school board, a commission; (2) an editorial or letter to the editor in print and non-print media.

#### Enhancing Basic and Applied Science Education Research

The scientific professions have developed codifications of knowledge claims and a clear definition of research goals and priorities. The National Institute of Health is an example of a federal agency that provides a well articulated national agenda for the funding of research in the medical sciences.

Professional societies and the medical profession have a major input into agenda. A corollary for NARST is the need to take leadership in codifying knowledge claims in science teaching and defining clearly a basic research agenda that will augment and enhance basic understandings about how science is learned and used by students of different ages and in various science disciplines.

In addition to maintaining a quality research journal there is a real need to support a continuous effort to develop for researchers and science teachers an annual synthesis of science education research. This could appear as a review published in JRST or as a separate publication. The review should be organized on the codified knowledge claims of the discipline.

#### Applying Research Findings to Science Teaching

The education enterprise is faced with the lack of strong, focused leadership from within the profession, resulting in general discontent from the public and political decision-makers. What, when and how science is taught are challenges facing professional science educators. Various studies have illustrated that the status quo in science teaching is unimaginative, out-of-date, and generally not addressing the needs of students for the 21st century. Findings from basic and applied science education research are not being translated and integrated into good

classroom practices. The science education research focused journals provide no relief for the already inundated science teacher. NARST needs to focus on cooperative efforts with federal and state agencies, and professional societies (including scientific and educational) to develop strategies to translate into a useable form research-tested information about teaching strategies, curriculum innovations, evaluation, and the use of contemporary instructional technologies (including various technologies such as interactive computer systems).

Dissemination of Basic and Applied Research

In addition to supporting a wide distribution of research findings through "Research Matters" and other publications, NARST needs to become proactive in supporting systematic staff development models. It is time to bury the one- or two-day workshops for teachers about new curriculum and workable ideas for science education. Such workshops have never had significant impact on adoption or implementation. Few teachers possess the undergirding understanding to implement innovations. They need support and continuing coaching, not only from the local administrators and supervisors, but also from the science education professionals. NARST must become a leader in assisting the science teaching profession to develop research-based strategies to provide systematic staff development for the teaching corps in the promising research findings and to provide

encouragement and support for science teachers to become active science education researchers. In addition, NARST needs to influence the development of public policy that insures continuous funding for inservice activities.

In most professions, the practicing professional, in the clinical sense, is also an active contributor to the knowledge base. Law and medicine are examples. Science education should follow this pattern, and NARST should become a leader in supporting and promoting the concept of "every teacher is a researcher."

#### Promoting Global Education

The world has, is, and will continue to experience stress. Various ecological, social and political disasters are having profound impacts on the quality of life. Education, the great equalizer, is one of the hopes for the future. NARST needs to become more active in promoting the development of quality science curriculum and the education of science teachers in the third world. This recommendation includes providing a forum for the discussion of issues related to the teaching of science in developing countries.

Draft Prepared by Emmett L. Wright

Review to date by: John Staver

Larry Sharmann

Steve Oliver

Roger Bybee

MICHIGAN STATE UNIVERSITY

---

COLLEGE OF EDUCATION • DEPARTMENT OF TEACHER EDUCATION

EAST LANSING • MICHIGAN • 48824-1034

March 7, 1989

MEMORANDUM

TO: NARST board members and other interested people

FR: Andy Anderson and Bill Holliday

RE: Draft position paper

Enclosed you will find a first draft of a possible NARST position statement. Andy Anderson will be revising it around March 17-20 so that we can discuss the revised version at the NARST board meeting. If you would like your comments and concerns to be considered in this round of revisions please get them to Andy, (preferably in writing), before that time.

Andy's Address:

2338 Hulett Road  
Okemos, MI 48864  
(517) 349-6797  
Bitnet: ANDYA@MSU

CWA/jmp  
enclosure

FIRST DRAFT OF NARST POSITION PAPER  
by Andy Anderson, February, 1989

The National Association for Research in Science Teaching is dedicated to the improvement of science teaching through research. We feel that it is necessary to begin with a frank admission: We can see little evidence that during the 61 years of its existence either NARST or any other organization has made much progress toward achieving that purpose.

Surveys and observations of science teaching practice, for example, show little evidence of changes in practice over the last 25 years and little evidence that most science teachers have been influenced by, or even know about, educational research. Science teaching has been and continues to be dominated by text-driven teaching that typically promotes the memorization of facts and algorithms.

The failure of research to influence policy would not be problematic if our present teaching practices were working. However, a large and growing body of evidence indicates that they are not. Large scale assessment efforts such as those of the National Assessment of Educational Progress and a multitude of smaller studies all point to the same conclusion: Most students do not understand what they are taught in science classes; they do not even succeed in memorizing and retaining the facts and algorithms that are the focus of most science instruction.

It is true that the research community has failed to develop research findings or conceptual tools that were useful and powerful enough to influence teaching practice. But like medical research in the nineteenth century, science education research today is developing theories and research results that have the power to serve as a professional knowledge base that can be used to make significant improvements in teaching practice. For example, the last decade has seen an explosion in our research-based knowledge of how children learn science, and numerous projects have shown that this new knowledge can be used to improve classroom science teaching.

We therefore believe that the time has come for us, as members of NARST to assert the importance to the developing professional knowledge base in science education and to fight for the adoption of policies that encourage its use and support its further development. Specific activities that could be undertaken by NARST members or by NARST as an organization in support of this goal include the following:

1. Working with professional science teachers' organizations. Work to help the leadership and the members of the National Science Teachers' Association and its local affiliates understand the essential role that research-based knowledge must play in the improvement of science teacher education and in the enhancement of science teachers' professional status. Encourage the adoption of policies that lead to more rigor and the inclusion of more research-based knowledge in practitioners' publications and teacher education efforts.

2. Working with the National Science Foundation. Encourage the re-evaluation of policies that tend to separate research, materials development, and teacher education, and the development of policies that help NSF-supported development and teacher education projects to draw upon, and contribute to, the professional knowledge base. For example, such policies could include giving preference in funding to development and teacher education projects that have to following characteristics: (a) explicit and extensive use of research-based knowledge in planning and execution, (b) the inclusion of research components that contribute to the development of the knowledge base, and (c) skeptical and thorough evaluation of project results by means that themselves make use of and contribute to research-based knowledge.

3. Improving teacher education. Encourage the development and use of methods and materials for including research-based knowledge in preservice and inservice teacher education programs. To do this in a meaningful way will probably require that teacher education programs be made longer and more rigorous, as recommended by such organizations as the Holmes Group, the Carnegie Task Force for the Improvement of Teaching, and others concerned with the reform of teacher education and the development of professionalism in teaching.

4. Improving teacher and student assessment. Support the development of systems for teacher and student assessment that make use of research-based knowledge about teaching and learning and that encourage science teachers to do the same.

5. Improving teaching materials. Educate the publishers of textbooks and other teaching materials about the extent to which their products currently fail to meet students' needs. Encourage them to make greater use of research-based knowledge to improve the effectiveness of their products. Such efforts require us to influence textbook selection committees and their constituents.

All of the above suggestions involve changes in the policies and practices of large and complex organizations, many of whose members have reason to be skeptical about the usefulness of science education research. Therefore these changes will not come quickly or easily. They can occur, however, if NARST members, who have many contacts with all of these organizations, argue forcefully for the importance of research-based knowledge and show that their arguments are correct. Perhaps the best way to start this long and complicated change process is with ourselves. We can, as members of NARST, consider ways in which we should use and contribute to research-based knowledge in the course of our own activities in teacher education, in service, and in policy making.

1989 Spring Meeting of the New Executive Board  
National Association for Research in Science Teaching  
San Francisco, CA  
Saturday, April 1, 1989

MINUTES

Board Members in Attendance

Dr. Charles Anderson	Dr. Frances Lawrenz
Dr. Lowell Bethel	Dr. Glenn Markle
Dr. Patricia Blosser	Dr. Donald McCurdy
Dr. Fred Finley	Dr. Robert Sherwood
Dr. Ronald Good	Dr. Kenneth Tobin
Dr. William Holliday	Dr. Russell Yeany
Dr. Jane Kahle	

A. Opening Remarks by the President

President Holliday welcomed members of the Board and officially began the Spring meeting of the new Board at 5:20 p.m.

B. Distribution of Minutes Describing the 1989 Spring Meeting (Old Board)

The minutes of the March 30, 1989 Board meeting were distributed. Members were requested to review them and to notify the Executive Secretary if there were needed corrections. The minutes will be approved at the Fall meeting of the Board.

C. Financial Advisory Committee

The Financial Advisory Committee report was presented by Dr. Sherwood.

Motion. Moved that the budget line for the Journal postage and supplies be increased from \$1000.00 to \$1500.00 for 1989 only. The \$1500.00 is to be equally divided between Dr. Yeany (the outgoing editor) and Dr. Good (the incoming editor). (Staver, Blosser)

Motion carried.

Motion. Moved that a budget line be added to the 1989 budget for the NARST Monograph Series in the amount of \$1500.00. Income generated from the 1988 sales are to be shown as a line item for income. (Staver, Finley)

Motion carried.

Motion. Moved that the annual meeting program continue to be mailed at the 3rd class rate rather than mailing it at the first class rate.

After discussion, the Board concurred with this recommendation but did not believe a motion was needed since the recommended practice was the same as past practice.

Motion. Moved that an interest bearing account be established outside of the University of Cincinnati accounts. For the 1989 Budget Year, the amount to be placed in this account shall be \$3000.00. Two thousand dollars of this amount to be considered a "reserve fund" and \$1000.00 for the "transition fund" for the Executive Secretary transition in 1991. (Stave, Bethel)

Motion Carried.

Motion. Moved that the budget lines for the expenses of the President and President-Elect be increased to \$2000.00 for the President (from \$1000.00) and to \$1000.00 for the President-Elect (from \$700.00). (Staver, Finley)

The discussion of this motion revealed that the expense accounts for the officers have not changed since 1983 and that we now expect our officers to represent the Association at other professional meetings whereas in the past this was not the case. The president was directed to consider attending meetings other than regional NSTA meetings if attendance at other meetings would be of more benefit to NARST. Examples cited were AAAS, NSF, and IRA.

Motion Carried.

D. Publication Advisory Committee

The Publication Advisory Committee report was presented by Dr. Kenneth Tobin.

Motion: Moved that the Chair of the Publications Committee, the President, the President-Elect, and the Executive Secretary negotiate with relevant persons from NSTA for publication and dissemination of the two monographs produced by NARST in the past year. It the Board's intention that NARST would retain the copyright to the monographs but provide NSTA with electronic copy of the two monographs. NSTA would publish and sell the two monographs and pay NARST a royalty rate based on a proportion of total sales.  
(Tobin, Lawrenz)

Motion carried.

Motion. Moved that one monograph be written each year to be available at the annual meeting and that the following procedure be adopted to select an author/s for the 1990 NARST monograph:

Members be invited to submit a proposal to write a monograph to the chair of the Publications Committee..

Proposals be distributed for review to a panel of members from the Publications Committee.

If the quality of the proposals is sufficiently high, the Panel will select a monograph to be written.

(Tobin, Bethel)

Motion carried.

Motion. Moved that the president of NARST and the Chair of the Publications Committee negotiate with NSTA to obtain a contract whereby:

NARST will provide NSTA with a carefully edited electronic copy of the NARST monograph.

NSTA will publish the monograph and undertake the necessary art work etc. to assure a quality product.

NSTA will determine the price at which the monograph will be sold.

NSTA will provide NARST, at cost price, copies of the monograph to be sold by NARST at the agreed price.

NSTA will pay royalties to NARST at an agreed rate, based on the money received from total sales.

The contract must be ratified by the NARST Board of Directors. (Tobin, Kahle)

Motion carried.

E. Policy Advisory Committee

The Policy Advisory Committee report was presented by Dr. Blosser. With regard to the Search Committee for the next Executive Secretary, the Committee suggested that the Board rethink the role of the Executive Secretary and possibly expand that role. They suggested the role of the Executive Secretary be changed to an "Executive Director" and that it be filled by a "high profile" person who would exert more influence in the policy arena. Dr. Good spoke against the idea of a "director" and characterized NARST as a "grass roots" organization in which decision making power resides in the membership. He was very reluctant to move in a direction that would change that character. In the absence of a specific motion, the President stopped discussion of this matter.

The discussion shifted to the Distinguished Contributions Committee and its role in selecting the recipient of the Distinguished Contributions Award.

Motion. Moved that the Board have faith in the judgement of the Committee and delegate all responsibility for the selection of the award recipient to the Committee.  
(Blosser, Tobin)

A discussion of the process followed. Prior to this year, the process was for members of the Distinguished Contributions Committee and the Board to review and rate the credentials of candidates for this award. All ratings were considered prior to the Committee "recommending" a recipient to the Board for approval. This year, the Board was not involved in the review process and, according to the Dr. Blosser's report, the Committee was somewhat miffed that members of the Board had to "approve" their recommendations while the credentials of candidates for the other NARST awards were not reviewed and approved by the Board. Members of the Board did not question the need to have faith in the Committee, but nevertheless indicated the desire to continue

a greater involvement in selecting this award winner than it has with other awards. After discussion, the above motion was defeated by a vote of 11 to 1.

Motion. Moved that the Distinguished Contributions Committee select the recipient of the Distinguished Contributions Award. The selection must be ratified by the Board. (Anderson, Staver)

Motion carried.

F. Elections Committee

The Elections Committee sought clarification about nominating international members to serve on the Board or as officers. Their concern focussed on the obligation of the Association to pay travel expenses for Board members to attend the Fall Board meeting. The sense of the Board was that international members should be able to serve as members of the board or as officers, but that more clearly defined rules relating to the Association's obligation to pay travel expenses to the Fall meeting needed to be developed. This question was referred to the Financial Advisory Committee for review, consideration, and recommendation.

NEW BUSINESS

International Committee.

The president posed questions about the charge to the International Committee. What is its charge? Who determines the charge? After discussion, the Board requested that the President recommend a charge for the International Committee at the Fall Board Meeting.

NARST Purposes: Position Papers.

After a brief discussion of procedures for resolving differences between the two NARST position papers reviewed at the previous Board meeting, the President was asked to form a task force to consider the two position papers and to report their recommendations at the Fall Board Meeting.

### Journal of Research in Science Teaching.

Dr. Good reported on the editorial board's discussion of the backlog of articles for the JRST. The time lapse from acceptance of an article to publication is approximately two years. This is viewed as unacceptable and there is concern that authors of high quality science education research will use other outlets if the time to publication is not reduced. The Editorial Board requests that the number of pages on the Journal be increased temporarily from 900 to 1500 and then reduced to 1200.

The Board directed the Executive Secretary to explore the cost implications of expanding the length of the Journal with Wiley and to report back at the Fall meeting. Specifically, the Board is interested in the cost of publishing up to 1500 pages on a sliding scale -- eg., the cost of 1100 pages, 1200 pages, etc.

### Fall Board Meeting.

Committee reports for the Fall Board Meeting are due in the President's hands by September 10, 1989.

The Executive Secretary was asked to identify a meeting site for the Fall Board Meeting on November 17 and 18, 1989. Since the meeting will begin early on the 17th and not end until mid-to-late afternoon on the 18th, the expectation is that members will arrive the evening of the 16th and may elect to stay over Saturday night and check out on Sunday the 19th. The Fall Board Meeting will not be held in conjunction with any of the NSTA regional meetings.

The Spring Meeting of the new NARST Executive Board was adjourned at 6:55 p.m.

1989 Spring Meeting of the Executive Board  
National Association for Research in Science Teaching  
San Francisco, CA  
March 30, 1989

MINUTES

Board Members in Attendance

Dr. Charles Anderson	Dr. William Holliday
Dr. Lowell Bethel	Dr. Glenn Markle
Dr. Patricia Blosser	Dr. LaMoine Motz
Dr. Roger Bybee	Dr. Robert Sherwood
Dr. Linda DeTure	Dr. Russell Yeany
Dr. Fred Finley	Dr. Emmett Wright
Dr. Ronald Good	

Others in Attendance:

Dr. Jane Kahle  
Dr. Donald McCurdy  
Dr. Kenneth Tobin

A. Opening Remarks by the President

President Blosser welcomed members of the Board and others in attendance to San Francisco. With approval of the Board, Dr. Blosser indicated that the written reports of the various committees presented in the Spring Meeting Board Book would be accepted and only those reports containing specific recommendations needing Board action would be discussed during the meeting. The Board concurred.

B. Approval of Minutes Describing the 1987 Fall Meeting

Dr. Blosser pointed out several minor corrections in the minutes of the previous meeting and a need to change the year in which Dr. Yeany leaves the editorship of the Journal from 1991 to 1990 (page 7 of the minutes). The needed changes were marked by the executive secretary.

**Motion:** Moved that the minutes of the November 4, 1988 meeting of the Board be approved with the changes described above. (Good, DeTure)

Motion approved.

C. Financial Advisory Committee

The Financial Advisory Committee report was presented by Emmett Wright. Three topics were identified to be discussed by the Financial Advisory Committee during its meeting: the development of an account to support the transition to a new executive secretary when the transition occurs; the development of a reserve fund in the event of unforeseen Association needs; and the development of an account to support the publishing of a monograph or fastback series. Based upon conversations with the principal investor from Kansas State, Dr. Wright proposed that NARST initiate investment accounts with the Van Gard group.

Dr. Blosser indicated that the new Financial Advisory Committee would be composed of Robert Sherwood (Chair), Stanley Helgeson, Donald McCurdy, Michael Piburn, Douglas Roberts, and Glenn Markle (ex officio). The new committee was charged to discuss the development of the above accounts as well as the recommendations for investing Association monies which Dr. Wright had proposed.

D. Publication Advisory Committee

The Publication Advisory Committee report was presented by Dr. Ronald Good. He briefly reviewed the history of the development of the monograph series, distributed copies of the first two NARST monographs to members of the Board, and complemented the authors on the fine jobs they had done.

The issue of who will own the copyright to the monographs was discussed and it was reaffirmed that NARST would hold the copyright but that the authors would maintain the right to use the material in other ways (articles, other books, etc.). Dr. Good agreed to draft a letter of agreement describing the copyright to be signed by monograph authors. Dr. Kahle suggested that the NSTA monograph agreement format might be a good one for us to use.

The discussion shifted to the selection of a publisher/distributor of the current and future monographs and Dr. Good introduced Dr. William Kyle of the NSTA Research Division who provided information on NSTA's publication policies. He described two options if we were to chose to have NSTA publish the NARST monographs:

Option 1. NSTA publishes the monograph. This means they design the cover and print the material which we provide them on a computer file text. NSTA would assess NARST \$2500.00, provide a copy of the monograph for each member, and market the monograph to its members.

Option 2. NARST publishes the monograph. NSTA purchases copies at 50% of NARST's list price, advertises the monograph, and distributes it. If NARST chose to sell other copies of the monograph, they would have to charge the NSTA list price for them.

Dr. Yeany asked about inventory: Who would maintain it? How many copies? etc. Dr. Blosser stated that she believed NSTA would bur some number of books and distribute them. No definitive information seemed to emerge from this discussion.

Other options for publishing the monographs were discussed. Dr. Kyle suggested considering Kendel-Hunt, SUNY Press, or some other private publishing outlet. Dr, Yeany suggested that one of the universities represented in our membership might be willing to assume the task of publishing/distributing the monograph, especially if they could make a profit while doing it. As the discussion developed, the issue was whether NARST should profits from the sale of the monographs. Dr. Bybee made a strong statement about the need for NARST to establish its own identity and to make a profit on this product.

The Publications Committee was charged to discuss issues related to publishing and distributing the monograph and to report back to the Board on the nature of the agreement we should seek, the distribution of profits from the sale of the monographs, the discount that NARST members should be given when they purchase the monograph, and other questions that emerge during their discussions.

During the discussion, questions about a previous agreement between NARST and NSTA to publish a "meta-analysis" book were posed. Several members of the Board expressed surprise that they had no knowledge of such an agreement. Dr. Blosser will check with Dr. Shymanski and others to determine if such an agreement exists and, if so, the nature of the agreement.

The new Publications Advisory Committee will continue discussion of these issues. The new Publications Advisory Committee consists of: Ken Tobin (chair), Herbert Brunkhorst, James Ellis, Ron Good (ex officio) and J. Preston Prather.

**Motion:** Moved that a letter of commendation be sent by the president to the authors of the current monographs and to others involved in producing it. (Bybee, Wright)

Motion Carried.

E. Program Committee

The Program Committee report was presented by William Holliday who commended the Program Committee for its efforts during the past year.

**Motion.** Moved that the President-Elect for 1989-90 be empowered to expand the program committee from its current six members to a number sufficient to accomplish the tasks which need to be done. All Program Committee members are to be selected from the active NARST membership. (Holliday, Yeany)

Motion carried.

Dr. Holliday's second proposed motion (page 16 of the Board Book) to increase the number of reviewers for program proposals was withdrawn after discussion.

**Motion.** Moved that foreign members submitting proposals for the NARST program not be required to include self addressed stamped envelopes. (Holliday, Good)

Motion carried.

F. JRST Awards Committee.

The JRST Awards Committee report was presented by Lowell Bethel who recommended increasing the number of active members who review JRST articles for this award be increased from 12 to 15. The sense of the Board was that the committee has enough members but that all members must be encouraged to be active in reviewing articles.

G. NARST Awards Committee

The report of the NARST Awards Committee was presented by Fred Finley who expressed concern about the small number of papers nominated for the "practical applications" award. Dr. Good suggested having members of the committee search out papers for the award -- to have nominations by members of the committee. Dr. Yeany suggested using the expanded abstracts as the basis for nominating papers, and Dr. DeTure suggested having the program reviewers check a box on the review form if a proposed paper appears to be a good candidate for the award. The questions of how to get more papers nominated for the award was referred to the Awards Committee for further discussion.

Dr. Markle reported that a form which Dr. Finley had developed to encourage nominations from this year's papers was available at the registration/information desk and that those operating the desk would encourage members to nominate papers.

H. Distinguished Contributions Award

Dr. Blosser led the discussion of three questions posed by Dr. Howe regarding this award. (See page 21 of the Board Book)

Dr. Yeany stated his belief that the Distinguished Contribution Award winner must be a researcher who has contributed significant science education research over a substantial period of time. There was general agreement that this was the intent when the award was initiated.

The discussion shifted to the role of the Board in reviewing and rating candidates for this award. Dr. Bybee stated that the Board should be involved in the process, and more importantly, that the rating forms previously used to assess candidates should be used in the future. The consensus of the Board was that members of the Board should be included in the voting process.

I. Editors Report

Russell Yeany presented the Editor's report. He distributed circulation data from Wiley and briefly reviewed the manuscript submission data from the Board Book.

Dr. Yeany reported that the transition to the new editor, Dr. Ronald Good, is moving along smoothly. He recommended that the support for the Journal expenses be increased from \$1000.00 to \$1500.00 for the current year and that the funds be equally split between his operation and Dr. Good's. The

recommendation was referred to the Financial Advisory Committee for discussion. The expectation is that the Financial Advisory Committee will report back on this recommendation on Saturday, April 1, 1989.

Dr. Good invited members of the Board to attend the Editorial Board Meeting during this conference.

J. Elections Committee Report

Dr. DeTure reported that the return rate of ballots this year, about 65%, was very good. Three-hundred-ninety-eight members voted in this year's elections. The newly elected officers are:

Dr. Jane Kayle	President
Dr. Frances Lawrenz	Research Coordinator
Dr. Donald McCurdy	Board Member
Dr. Kenneth Tobin	Board Member

K. Policy Advisory Committee

The report of the Policy Advisory Committee was presented by Dr. DeTure who pointed out the need to continue the process of developing the policies and procedures handbook. Dr. Markle will send a copy of the handbook to Dr. Blosser who will distribute copies to new members of the Board and officers.

Dr. DeTure distributed copies of the NARST Award Winning papers which had been published by ICASE for distribution to its members.

**Motion: Moved that the NARST Award Winning papers continue to be published by ICASE at no cost to NARST. (DeTure, Finley)**

Motion carried.

L. Executive Secretary's Report

Dr. Glenn Markle presented the Executive Secretary's report.

The following members were recommended for Emeritus Status:

Jack Easley,	University of Illinois
Willard Jacobson,	Columbia University
Joy Lindbeck,	University of Akron

**Motion:** Moved that the recommended candidates be approved for emeritus status. (Anderson, Wright).

Motion carried.

The 1988 financial report in the Board Book was reviewed and questions about specific line items answered. Members of the Board expressed appreciation for the detailed financial report.

The need to name the next Executive Secretary in the middle of the calendar year rather than in January was discussed. The Board agreed that the next executive secretary should begin July 1, 1991. The discussion shifted to the process for identifying candidates to serve as Executive Secretary at that time.

**Motion.** Moved that a search committee for a new Executive Secretary be formed and charged to produce a ranked list of candidates for the Board to consider. Dr. Holliday will serve as chair of the Committee which will present a slate of candidates in a timely fashion so that the new Executive Secretary can be selected at next years Spring Board Meeting. The new Executive Secretary should plan to assume the duties of the office on July 1, 1991 but should be invited to attend the Fall meeting of the Board in 1990. (Finley, Good)

Motion carried.

M. President Elect's Report

The President Elect report was presented by Dr. William Holliday. The proposed "leadership team" for 1989 was reviewed and the membership discussed by the Board.

**Motion: Moved that proposed leadership team be approved.  
(Anderson, Yeany)**

Motion carried.

The discussion shifted to the level of financial support for expenses provided to the officers. The matter was referred to the Financial Advisory Committee for a recommendation.

N. New Business

Dr. Blosser reported her desire to make the ad-hod Awards Committee a "standing committee." The task force she had formed to examine the matter recommended that the Boards take such action.

**Motion: Moved the membership of the NARST Awards Committee, the JRST Awards Committee, and the Distinguished Contribution Award Committee be composed of a sufficient number of NARST members to carry out the charges to these committees. Committee members will serve on three-year rotating terms and the Chair will be a member of the NARST Board of Directors. The Executive Secretary will be an ex officio member of each committee. The President will identify members with the advice of the appropriate chair. The committees will be standing committees. (DeTure, Wright)**

Motion carried.

Since this motion requires a change in the By-Laws, it must be voted upon by the membership at large. The vote will be taken during the next election of officers, in the spring of 1990.

During the last half-hour of the meeting, the Board discussed the papers which had been written by Dr. Wright and others and by Drs. Anderson and Holliday. These papers were an outgrowth of last fall's planning meeting. They addressed the question, "What is the purpose of NARST and in what directions should we move?"

Dr. Good stated that Anderson and Holliday's paper did not give sufficient recognition to the research findings of the past several years. He believed that Dr. Wright's statement was too wordy and that we should strive for a shorter paper,

one or two pages. No consensus emerged during the discussion; there were obvious differences of opinion among Board members and all agreed that we need to consider these important questions during the coming year. Due to time constraints, as well as the apparent lack of consensus, the discussion was terminated without closure on the issue or a procedure for determining the purposes of NARST.

The Spring Board meeting adjourned at 11:40 a.m.

# JOURNAL OF RESEARCH IN SCIENCE TEACHING

---

RUSSELL H. YEANY, Jr., Editor

Department of Science Education  
The University of Georgia  
Athens, Georgia 30602  
Telephone No. (404) 542-1763

February 27, 1989

Dr. Leslie W. Trowbridge  
Earth Science Department  
University of Northern Colorado  
Greeley, CO 80639

Dear Les:

I have forwarded your requests to use certain JRST articles in your forthcoming textbook to Dr. Glen Markle at the University of Cincinnati. Glen is Executive Secretary of NARST and as such is in charge of these matters.

I urge you to correspond with him directly as to the status of your requests.

Good luck with your textbook. We need some good materials for secondary science teachers.

Sincerely,



Russell H. Yeany  
Editor

RHY/js

cc: Dr. Glen Markle

4/12/89  
Dear Glen:  
I should appreciate having you  
look at these requests. Thank you  
in advance.  
Cordially, Les Trowbridge

REQUEST FOR PERMISSION

To: JRST

Date: 12/13/88

In my forthcoming textbook BECOMING A SECONDARY SCHOOL SCIENCE  
TEACHER  
scheduled for publication in 1990 by Charles E. Merrill Publishing Company, I would like to include the following from your publication.

Title: Evolution of the Lab. Role of the Role of CPE Copyright: 1988

Author(s): Rafael Nachman & Maria C. Lima

Journal, volume, date: JRST Vol 24 No 5 pp 491-506/1988

Pp. 492 to 506 : Paragraph par 5 " perhaps constitute --  
beginning with ending with

Pp. 492 to "Harder to parse" -- " ... " misinterpret the

Illustrations and other: \_\_\_\_\_

Rights Requested:

- Distribution in the English language in the U.S. and Canada.
- Distribution in the English language throughout the world.
- World rights in all languages.

This request includes all future revision and editions thereof. If you do not control the rights as requested, please let me know to whom I should write. Proper acknowledgment of title, author, and publisher will be given. Please use the release provided below, returning the original request to me. A copy is enclosed for your files. I would greatly appreciate your approval of this request.

Sincerely,  
Leslie W. Rowledge  
Earth Science Dept.  
Univ. of Northern Colorado  
Greeley, CO 80639

The permission to quote is granted on the terms stated in this letter.

Date \_\_\_\_\_

Name \_\_\_\_\_

Address \_\_\_\_\_

DATA

REQUEST FOR PERMISSION

To: JRST

Date: 12/13/81

In my forthcoming textbook Becoming a Secondary School Science Teacher scheduled for publication in 1991 by Charles E. Merrill Publishing Company, I would like to include the following from your publication.

Title: "The Effect of Real-World Graphing" Copyright: 1981

Author(s): Heather Brasell

Journal, volume, date: JRST Vol 24 No 4 pp 385-395 (1981)

Pp. Abstract p385 beginning with "single class period" ending with

Pp. to real time graphing paraphrased

Illustrations and other:

Rights Requested:

- Distribution in the English language in the U.S. and Canada.
- Distribution in the English language throughout the world.
- World rights in all languages.

This request includes all future revision and editions thereof. If you do not control the rights as requested, please let me know to whom I should write. Proper acknowledgment of title, author, and publisher will be given. Please use the release provided below, returning the original request to me. A copy is enclosed for your files. I would greatly appreciate your approval of this request.

Sincerely,

Leslie W. Nowbridge  
Earth Science Dept  
Univ. of Northern Colo  
Greeley, CO 80639

The permission to quote is granted on the terms stated in this letter.

Date \_\_\_\_\_

Name \_\_\_\_\_

Address \_\_\_\_\_

REQUEST FOR PERMISSION

To: JRST

Date: 12/13/88

In my forthcoming textbook Becoming a Sec. School Science Teacher scheduled for publication in 1994 by Charles E. Merrill Publishing Company, I would like to include the following from your publication.

Title: Computer Simulation to Stimulate Copyright:

Author(s): Robert Rivers & Edward Vockell

Journal, volume, date: JRST Vol 24 No 5 pp 403-413/1988

Pp. Abstract p 403 beginning with paraphrase ending with

Pp. \_\_\_\_\_ to \_\_\_\_\_ : " \_\_\_\_\_ " .... "

Illustrations and other: \_\_\_\_\_

- Rights Requested:
- Distribution in the English language in the U.S. and Canada.
  - Distribution in the English language throughout the world.
  - World rights in all languages.

This request includes all future revision and editions thereof. If you do not control the rights as requested, please let me know to whom I should write. Proper acknowledgment of title, author, and publisher will be given. Please use the release provided below, returning the original request to me. A copy is enclosed for your files. I would greatly appreciate your approval of this request.

Sincerely,  
Fiske W. Lowbridge  
Earth Science Dept  
Univ of Northern Colo  
Greeley, CO 80639

The permission to quote is granted on the terms stated in this letter.

Date \_\_\_\_\_

Name \_\_\_\_\_

Address \_\_\_\_\_

REQUEST FOR PERMISSION

To: JRST

Date: 12/13/88

In my forthcoming textbook Becoming a Sec. School Science Teacher scheduled for publication in 1990 by Charles E. Merrill Publishing Company, I would like to include the following from your publication.

Title: Improving Research Computers in Science Learning Copyright: 1988

Author(s): Krajcik, Finnigan, Funetta

Journal, volume, date: JRST Vol 23 No 5 pp 465-472/88

Pp. 468 to 472 : "We must find or create... traditional

Pp. (to Paragraph of 3 paragraphs) ... "beginning with ... ending with instruction

Illustrations and other: \_\_\_\_\_

Rights Requested:

- Distribution in the English language in the U.S. and Canada.
- Distribution in the English language throughout the world.
- World rights in all languages.

This request includes all future revision and editions thereof. If you do not control the rights as requested, please let me know to whom I should write. Proper acknowledgment of title, author, and publisher will be given. Please use the release provided below, returning the original request to me. A copy is enclosed for your files. I would greatly appreciate your approval of this request.

Sincerely,  
Leslie W. Snowbridge  
Dept of Earth Science  
Univ of N. Colorado  
Aspen, CO 80639

The permission to quote is granted on the terms stated in this letter.

Date \_\_\_\_\_

Name \_\_\_\_\_

Address \_\_\_\_\_



SECRETARY

Dr. Glenn Markle  
NARST  
University of Cincinnati  
Cincinnati, OH 45221-0002  
(513) 475-2335

Organized to improve science teaching—through research



NATIONAL ASSOCIATION FOR RESEARCH IN SCIENCE TEACHING

PRESIDENT

Dr. Patricia E. Blosser  
Science Education  
The Ohio State University  
Columbus, OH 43210-1172

PRESIDENT'S EXPENSES, 1988

Patricia E. Blosser  
(272-26-2877)

PRESIDENT-ELECT

Dr. William G. Holliday  
Science Teaching Center  
The University of Maryland  
College Park, MD 20742

Fall Board Meeting in Little Rock, Nov. 1988  
NSTA registration 35.00  
Plane ticket 238.00  
Parking at Pt. Columbus 26.50

289.50

IMMEDIATE PAST PRESIDENT

Dr. Linda DeTure  
Education and Human Development  
Rollins College  
Winter Park, FL 32789

AAAS Forum, Washington, October 1988  
Registration 137.00  
Hotel 70.00  
Meals 35.00  
Parking at Pt. Columbus 10.40  
Plane fare 218.00

470.40

BOARD MEMBERS-AT-LARGE

Dr. Charles Anderson (1990)  
College of Education  
Michigan State University  
East Lansing, MI 48824

Dr. Lowell J. Bethel (1991)  
Science Education Center—EDB340  
The University of Texas at Austin  
Austin, TX 74712

Dr. Fred Finley (1990)  
Curriculum and Instruction  
University of Minnesota  
Minneapolis, MN 55455

Dr. Ronald Good (1989)  
Dept. of Curriculum and Instruction  
Louisiana State University  
Baton Rouge, LA 70803

LeMoine Motz (1989)  
NSTA  
1742 Connecticut Avenue, N.W.  
Washington, D.C. 20009

Dr. Robert Sherwood  
College Box 45, Peabody  
Nashville, TN 37203

Dr. Emmett Wright (1989)  
Dept. of Curriculum and Instruction  
Kansas State University  
Manhattan, KS 66506

Charleston NSTA Regional, Dec. 1988  
Registration 35.00  
Plane fare 238.00  
Hotel and meals 259.55  
Taxis 15.00  
Parking at Pt. Columbus 10.40

557.95

President's Stipend \$1,000.00  
President's Expenses 1,317.85

- 317.85

JOURNAL EDITOR

Dr. Russell H. Yeany  
Science Education Research  
And Evaluation Lab  
Science Education Department  
University of Georgia  
Athens, GA 30602

RESEARCH COORDINATOR

Dr. Rodger Bybee (1989)  
B.S.C.S  
Colorado College  
Colorado Springs, CO 80903

NARST-NEWS EDITOR

Dr. Thaddeus W. Fowler (1989)  
University of Cincinnati  
Cincinnati, OH 45221-0002

**REPORT OF THE RESEARCH COMMITTEE**

Spring 1989

Submitted for the Committee

by

Rodger W. Bybee

Research Coordinator

## Introduction

The Research Committee had no specific directives after the fall 1988 NARST Board meeting. This report describes the coordination of NARST and NSTA presentations at the fall regional NSTA meetings, the authors/titles for this year's volume of Research Matters..., and recommends training sessions be included in the 1990 NARST meeting. In addition, a brief review of the Research Coordinator's role is provided.

## Coordination with NSTA

The Research Coordinator made arrangements for the following presentations at the 1988 regional NSTA meetings.

<u>NARST Member</u>	<u>Topic</u>	<u>Regional Meeting</u>
Bill Robertson	Conceptual Learning	Portland, ME
Jim Ellis	Microcomputers in the Science Classroom	Columbus, OH
Bill Kyle and Jim Shymansky	Teaching for Conceptual Change	Charleston, SC

These NARST sessions will be coordinated with NSTA sessions on "Every Teacher A Researcher." Bill Kyle, Research Coordinator for NSTA, has done an excellent job of arranging these sessions.

## "RESEARCH MATTERS...1989"

The authors and topics for this year's volume of Research Matters... are listed below. Some of the authors were listed in last year's report, but failed to meet the deadline. These authors delivered their manuscripts on time for the 1989 volume.

Using Research to Improve the Quality of Classroom Discussions

J. Nathan Swift  
C. Thomas Gooding  
Patricia R. Swift  
State University of  
New York--Oswego

## REPORT OF THE RESEARCH COMMITTEE - Springs 1989 - Page Two

Using Textbooks for Meaningful Science Learning	Sarah L. Ulerick Florida State University
Using Inquiry Laboratory Strategies in College Science Courses	William H. Leonard Clemson University
Computer-based Technology in College Science Laboratory Courses	William H. Leonard Clemson University
Changing and Measuring Attitudes in the Science Classroom	Thomas R. Koballa Jr. University of Texas at Austin
Enhancing Learning Through Conceptual Change Teaching	William C. Kyle, Jr. Purdue University James A. Shymansky University of Iowa

### Training Sessions at the Annual Meeting

At the recommendation of Bill Holliday, NARST did not have training sessions at the 1989 annual meeting. The program committee recommended this change due to budgetary considerations and the fact that there is an extra general session and a reception for Glenn Seeborg at the Science Exploratorium. The Research Coordinator supported the recommendation for the 1989 NARST meeting.

The Research Committee recommended that training sessions be included in the 1990 NARST meeting.

### Responsibilities of the Research Coordinator

The office of Research Coordinator has potential for a variety of projects since it has the longest term of any elected office (3 years) in NARST. However, this potential has not been fully realized in the past.

The position of Research Coordinator has not been clearly defined. In general, a person was elected and the retiring coordinator talked with the new coordinator at the annual meeting. On one hand, there is the perception that the coordinator has significant freedom. On the other hand, the actual work leaves one with the impression that that freedom is somewhat restricted due to ambiguities of the office, directions of other offices, committees, and organizational policies. All of this is to say that there is a need for some clarification of the position, particularly for future Research Coordinators.

Duties of the current Research Coordinator (1986-89) include arranging for authors to write "Research Matters...", arranging training sessions for the national meeting, and completing other projects such as coordinating presentations with the NSTA Director of Research.

If a person knew he or she had various opportunities when they ran for the office, it may strengthen the specific office of Research Coordinator and NARST as an organization. There are many things a Research Coordinator might do. These recommendations are for discussion only. Other recommendations may be made based on board discussion and suggestions.

The office of Research Coordinator could include any or all of the following responsibilities:

- Arrange for "Research Matters..." Specifically, an individual could set out a plan (and people) for three years of publications. This would allow for the development of topics and themes. If this were done with four out of the possible six issues a year, there would still be an opportunity for one or two new topics each year.
- Arrange one symposium for the NARST convention. The idea here is that the person knows he/she must do this, and that the topic is something that coordinates a line of research within NARST.
- Write a short column in the Newsletter. This opportunity currently exists. The recommendation is that this be a "requirement" of the office. The topic of the column could be "opportunities for research." With such a title, the column could include topics of needed research and it could describe funding priorities for agencies such as NSF, the Department of Education, and private foundations.
- Design research projects for NARST. A three-year term provides opportunities for some research by NARST. There are topics of interest to the organization and its members as well as the wider science education community, for example, changes in undergraduate and graduate science education, and trends in science education research.
- Liaison with other organizations. There is some need for involvement, as appropriate, with research in other organizations such as AERA, NSTA, AAAS, and SSMA.

These are the opportunities of the office. They are offered for discussion and clarification as the next Research Coordinator assumes office.

MEMORANDUM

MARCH 27, 1989

TO: Chris Shepherd  
FROM: Susan Dorato  
RE: JOURNAL OF RESEARCH IN SCIENCE TEACHING Circulation Status

Attached the status reports for the TEA Editorial board meeting:

- I. Three Year Circulation Comparison
- II. Institutional vs. Individual Report
- III. International Circulation Report

1.

JOURNAL OF RESEARCH IN SCIENCE TEACHING

THREE YEAR CIRCULATION COMPARISON

<u>February Comparison</u>	<u>Domestic</u>	<u>Foreign</u>	<u>Total</u>	<u>Variance</u>	<u>Member*</u>
February 1989	1169	410	1579	+ 0.7%	596
February 1988	1138	430	1568	+11.4%	556
February 1987	1014	394	1408		373
 <u>December Comparison</u>					
December 1988	1467	509	1976	+1.9%	714
December 1987	1409	530	1939	+4.3%	720
December 1986	1243	616	1859		605

\*Included in total.

3/24/89

## II.

## JOURNAL OF RESEARCH IN SCIENCE TEACHING

## INSTITUTIONAL vs. INDIVIDUAL REPORT

(Paid subscriptions as of 12/31/88)

<u>Classification</u>	<u># of Subscriptions</u>	<u>% of Total</u>
<u>Institutional</u>		
Institute	876	44.3%
Institute Library	134	6.8%
Industry	174	8.8%
	<hr/>	<hr/>
Sub-Total	1184	59.9%
 <u>Individual</u>		
Individual (at home)	719	36.4%
Individual (at institute)	21	1.1%
Individual (at industry)	52	2.6%
	<hr/>	<hr/>
Sub-Total	792	40.1%
TOTAL	1976	100.0%

3/24/89

3/24/89 sld

III. JOURNAL OF RESEARCH IN SCIENCE TEACHING

INTERNATIONAL CIRCULATION REPORT  
(1988 paid subscriptions through 12/31/88)

Country	# of Subs	Country	# of Subs
-----	-----	-----	-----
Argentina	1	Jordan	1
Australia	56	Korea	9
Austria	1	Malaysia	4
Barbados	1	Mexico	5
Belgium	7	Netherlands	10
Botswana	1	New Zealand	6
Brazil	7	Nigeria	2
Canada	59	Norway	1
China	6	Panama	1
Costa Rica	1	Poland	1
Denmark	5	Portugal	3
Egypt	1	Saudi Arabia	4
England	58	Scotland	3
Finland	9	Singapore	3
France	7	South Africa	19
West Germany	27	Spain	25
Greece	1	Sweden	3
Hong Kong	3	Switzerland	4
Hungary	1	Taiwan	11
India	16	Thailand	8
Ireland	3	Trinidad	1
Israel	9	Turkey	2
Italy	18	Venezuela	1
Jamaica	1	Wales	1
Japan	57	Other	25
TOTAL			509



John Wiley & Sons, Inc.  
605 Third Avenue  
New York, NY 10158-0012  
212-850-  
Telex 12-7063  
Cable JONWILE

3/22/89

To: Chris

From: Carol Ann *Carol Ann*

Re: J. of Research in Science Teaching Report

No. of mss not yet published: 54

We have enough mss for 6-7 issues (Sept.-Feb. or Mar.).

Page Budget:

CY89 Budget: 896

Actual through May 1989 issue: 480 (4 issues left at 416 pp.)

FY89 Budget: 896

Actual: 880

Publag:

Averages about 10 months, but can run as high as 11-12 months.

Production Editor: Kathy Astor

NATIONAL ASSOCIATION  
for Research in  
Science Teaching

Officers and Committee  
Members for 1989-1990

President

William G. Holliday  
Science Teaching Center  
University of Maryland  
College Park, MD 20742

Immediate Past President

Patricia E. Blosser  
ERIC  
1200 Chambers Road  
The Ohio State University  
Columbus, OH 43212

Board Members

Charles Anderson (1990)  
229 Erickson Hall  
Michigan State University  
East Lansing, MI 48824

Lowell J. Bethel (1991)  
Science Education Center - EDB 340  
The University of Texas at Austin  
Austin, TX 78712

Fred Finley (1990)  
370 Peik Hall  
University of Minnesota  
Minneapolis, MN 55455

Donald W. McCurdy (1992)  
211 Henzlik Hall  
University of Nebraska  
Lincoln, NE 68585

LaMoine Motz (1989)  
NSTA  
1742 Connecticut Ave., NW  
Washington, DC 20009

Robert Sherwood (1991)  
College Box ~~45~~ Peabody College  
Vanderbilt University  
Nashville, TN 37203

Kenneth G. Tobin (1992)  
Science Education  
Florida State University  
Tallahassee, FL 32306

Executive Secretary

Glenn Markle  
College of Education  
University of Cincinnati  
Cincinnati, OH 45221-0002

513 556-2332

Editor, Journal of Research  
in Science Teaching

Ronald G. Good  
Department of Curriculum  
and Instruction  
Louisiana State University  
Baton Rouge, LA 70803

Editor, NARST News

Thaddeus W. Fowler  
College of Education  
University of Cincinnati  
Cincinnati, OH 45221-0002

Research Coordinator

Frances Lawrenz (1992)  
370 Peik Hall  
University of Minnesota  
Minneapolis, MN 55455

**Financial Advisory  
Committee**

Chairman

Robert Sherwood (1991)  
College Box 45, Peabody College  
Nashville, TN 37203

## Members

Stanley L. Helgeson (1991)  
Educational Studies: Science Education  
The Ohio State University  
Columbus, OH 43210

Donald W. McCurdy (1992)  
211 Henzlik Hall  
University of Nebraska  
Lincoln, NE 68585

Michael D. Piburn (1990)  
1253 West Minister Ave.  
Westminister College  
Salt Lake City, UT 84691

Douglas A. Roberts (1991)  
EDCI, Ed. T 702  
University of Calgary  
Calgary, Alberta  
T2N 1N4 CANADA

Glenn Markle ex officio  
College of Education  
University of Cincinnati  
Cincinnati, OH 45221-0002

## **Publications Advisory Committee**

### Chairman

Kenneth G. Tobin (1990)  
Science Education  
Florida State University  
Tallahassee, Florida 32306

## Members

Herbert K. Brunkhorst (1992)  
School of Education  
California State University  
San Bernadino, CA 92407

James D. Ellis (1990)  
Biological Sciences Curriculum Study  
Colorado College  
1115 N. Cascade Ave.  
Colorado Springs, CO 80903

Ronald G. Good (ex officio)  
Department of Curriculum and Instruction  
Louisiana State University  
Baton Rouge, LA 70803

J. Preston Prather (1991)  
The University of Tennessee at Martin  
Rm. 205H, Gooch Hall  
Martin, TN 38238

## **Policy Advisory Committee**

### Chairman

Patricia E. Blosser (1989)  
Educ. Studies: Science Education  
The Ohio State University  
Columbus, OH 43210

## Members

William G. Holliday  
Science Teaching Center  
University of Maryland  
College Park, MD 20742

Dr. John J. Koran, Jr.  
Associate Dean  
Graduate School  
University of Florida  
Gainesville, FL 32601

John R. Staver (1990)  
School of Education  
University of Illinois at Chicago  
Chicago, IL 60655

Glenn Markle ex officio  
College of Education  
University of Cincinnati  
Cincinnati, OH 45221-0002

## **Election Committee**

### Chairman

Patricia E. Blosser  
ERIC  
1200 Chambers Road  
The Ohio State University  
Columbus, OH 43212

### Members

Marcia C. Linn  
Tolman Hall  
University of California  
Berkeley, CA 94720

James A. Shymansky  
450 Van Allen Bldg.  
University of Iowa  
Iowa City, Iowa 52242

## **Research Committee**

### Chairman

Frances Lawrenz (1992)  
370 Peik Hall  
University of Minnesota  
Minneapolis, MN 55455

## Members

Joseph S. Krajcik (1991)  
University of Maryland  
College Park, MD 20742

William C. Kyle, Jr. (1989)  
Purdue University  
West Lafayette, Ind 47907

Frances Lawrenz (1990)  
Dept. of Curriculum & Instruction  
159 Pillsbury Dr., SE  
University of Minnesota  
Minneapolis, MN 55455

William Leonard (1990)  
College of Education  
Clemson University  
Clemson, SC 29634

J. Steve Oliver (1990)  
College of Education  
Bluemont Hall  
Kansas State University  
Manhattan, KS 66506

Glenn Markle (ex officio)  
College of Education  
University of Cincinnati  
Cincinnati, OH 45221-0002

**Distinguished Contribution  
Award Committee**

Chairman

Ann C. Howe (1990)  
Math & Science Education  
Box 7801  
N. Carolina State University  
Raleigh, NC 27695-7801

Members

Michael R. Abraham (1991)  
University of Oklahoma  
Norman, OK 73019

Marianne B. Betkouski (1990)  
Education/Curriculum & Instruction  
University of North Florida  
Jacksonville, FA 32216

Jane Butler Kahle (1990)  
Purdue University  
West Lafayette, IN 47907

Anton E. Lawson (1990)  
Department of Zoology  
Arizona State University  
Tempe, AZ 85287

Kathleen A. O'Sullivan (1992)  
Department of Secondary Education  
San Francisco State University  
1600 Holloway Ave.  
San Francisco, CA 94132

Donald E. Riechard (1991)  
Educational Studies  
Emory University  
Atlanta, GA 30322

Glenn Markle (ex officio)  
College of Education  
University of Cincinnati  
Cincinnati, OH 45221-0002

**JRST Awards Committee**

Chairman

Lowell J. Bethel (1991)  
Science Ed Center - EDB 340  
The University of Texas at Austin  
Austin, TX 78712

Members

Ron Bonnstetter (1989)  
211 Henzlik Hall  
University of Nebraska  
Lincoln, NE 68588-0355

Angelo Collins (1991)  
CERAS 507  
Stanford University  
Stanford, CA 94305

Frank E. Crawley (1992)  
Science Education Center EDB 340  
The University of Texas at Austin  
Austin, TX 78712

James J. Gallagher (1990)  
327 Erickson Hall  
Michigan State University  
East Lansing, MI 48824

Frances Lawrenz (1990)  
Department of Curriculum & Instruction  
159 Pillsbury Dr., SE  
University of Minnesota  
Minneapolis, MN 55455

Alan J. McCormack  
5615 Meredith Ave.  
San Diego, CA 92120

Edmund A. Marek (1990)  
Room 323 Physical Science Bldg.  
University of Oklahoma  
Norman, OK 73019

John C. Park (1991)  
Mathematics and Science Education  
Campus Box 7801, NCU  
Raleigh, NC 27695

Joseph P. Riley (1990)  
212 Aderhold Hall  
University of Georgia  
Athens, GA 30602

Julie P. Sanford (1990)  
University of Texas  
Assoc. Dir. of Research Sponsored  
Projects Office  
El Paso, TX 79968-0566

Kenneth G. Tobin (1990)  
Science Education  
Florida State University  
Tallahassee, FA 32306

Kevin C. Wise (1990)  
Curriculum and Instruction  
Southern Illinois  
Carbondale, IL 62901

#### NARST Awards Committee

##### Chairman

Fred Finley (1990)  
159 Pillsbury Dr., SE  
University of Minnesota  
Minneapolis, MN 55455

## Members

Mary Atwater (1992)  
Department of Science Education  
University of Georgia  
Athens, GA 30602

Heather Brasell (1991)  
P.O. Box 6A  
Alapaha, GA 32162

Eugene L. Chiapetta (1990)  
Education  
University of Houston  
Houston, TX 77004

Linda L. Cronin (1990)  
Science Education  
Norman Hall  
University of Florida  
Gainesville, FA 32611

Michael A. Dryden (1990)  
Department of Physics  
Arizona State University  
Tempe, AZ 85287

Larry G. Enoch  
College of Education  
Kansas State University  
Manhattan, KA 66502

David Harmon (1991)  
RESA IV  
300 Main St.  
Summerville, WM 26651

David L. Haury (1990)  
Department of Education  
Tufts University  
Medford, MA 02155

Joseph S. Krajcik (1990)  
Science Teaching Center  
  
The University of Maryland  
College Park, MD 20742

Sandra Y. McGuire (1991)  
Alabama A & M  
6506 Green Meadow Rd  
Huntsville, AL 35810

Michael D. Piburn (1990)  
1253 West Minister Ave.  
Westminister College  
Salt Lake City, UT 84691

Larry Yore (1991)  
University of Victoria  
P.O. Box 1700  
Victoria, BC, V8N 2Y2  
CANADA

**Ad Hoc Committee on  
International Issues**

Chairman

Pamela Fraser-Abder (1989)  
Faculty of Education  
University of the West Indies  
St. Augustine, Trinidad, West Indies

Members

Glen Aikenhead (1989)  
Faculty of Education  
University of Saskatchewan  
Saskatoon, Saskatchewan, Canada  
S7N 0W0

Nancy Brickhouse  
College of Education  
University of Delaware  
Newark, Del 19711

Galen L. Erickson  
Faculty of Education  
University of British Columbia  
Vancouver, BC V6T1Z5  
Canada

Barry J. Fraser  
College of Education  
Curtin University  
Bentley, W.A. 6102  
Australia

Pamela Fraser-Abder  
Faculty of Education  
The University of the West Indies  
St. Augustine, Trinidad  
West Indies

James J. Gallagher  
327 Erickson Hall  
Michigan State University  
East Lansing, MI 48824

Geoff Giddins  
Curtin University  
Box 41987  
Perth 6001, West Australia

J. W. George Ivany  
Vice President, Academic Affairs  
Symon Fraser University  
Burnaby, B.C. V5A1S6  
Canada

Michael Jay  
Apple Computer, Inc.  
20525 Mariani Ave.  
Cupertino, CA 95014

Paul A. Kirschner  
Box 2960  
6401 LD Heerleen  
The Netherlands

Patricia Simmons  
Department of Science Education  
University of Georgia  
Athens, GA 30602

David Treagust  
Science and Mathematics Education  
Curtin University of Technology  
Bentley, W.A. 6102  
Australia

## Program Committee

### Chairman

Jane Butler Kahle  
Purdue University  
West Lafayette, IN 47907

### Members

Peter W. Hewson (1992)  
University of Wisconsin  
225 N. Mills St  
Madison, WI 53706

Willis J. Horak (1990)  
University of Arizona  
1765 West Niona Place  
Tucson, AZ 85704

Frances Lawrenz (ex officio)  
370 Peik Hall  
University of Minnesota  
Minneapolis, MN 55455

Peter A. Rubba (1990)  
CE-STS, 165 Chambers Bldg.  
Pennsylvania State University  
University Park, PA 16802

Richard Tolman (1990)  
Zoology Department  
Brigham Young University  
Provo, UT 84602

Victor L. Willson (1992)  
Educational Psychology  
Texas A&M University  
College Station, TX 77840

Glenn Markle ex officio  
College of Education  
University of Cincinnati  
Cincinnati, OH 45221-0002

**Representative to the  
International Council  
of Associations for  
Science Education  
(ICASE)**

David P. Butts  
Department of Science  
University of Georgia  
Athens, GA 30602

**Representative to the  
American Association  
for the Advancement  
of Science**

J. Nathan Swift  
Education, Poucher Hall  
SUNY-Oswego  
Oswego, NY 13126

**NARST Archivist**

Paul Joslin  
Drake University  
Des Moines, Iowa 50311

**Representative to the  
Triangle Coalition**

Chairman

Stanley L. Helgeson  
The Ohio State University  
Columbus, OH 43210-1172

Members

David R. Stronck  
Dept. of Teacher Education  
California State University  
Hayward, CA 94542

Sarah L. Ulerick  
Science Education  
414 Education Building  
Tallahassee, FL 32306

## NARST, Setting the Direction for the 1990's

This past November, the fall meeting of the NARST executive board was followed by a day of discussion of issues that NARST should be dealing with if it is to fulfill its purpose of improving science teaching through research. As a result of this discussion, two papers were prepared for review and examination at the spring board meeting on Thursday, March 30. My purpose today, in this talk, is to provide the general membership with an advance organizer ~~of~~ <sup>for</sup> these papers. I will try to present the highlights of each paper, as modified by Board discussion. Then I'd like to raise a few questions and, perhaps, issue a challenge.

One paper was written to emphasize actions NARST should take in dealing with policy makers at national, state, and local levels. Because NARST is an international organization in terms of membership, that level has also been included. ~~In this paper, it is proposed that NARST:~~

- ~~o develop an agenda for basic and applied research in science education~~
- ~~o "translate, codify, synthesize and disseminate" science research findings so these findings have direct, useful implications for researchers and teachers~~
- ~~o develop and evaluate mechanisms for disseminating and implementing applications of basic research in science teaching~~
- ~~o enhance the quality of science teaching worldwide, particularly as it relates to Global Issues~~
- ~~o define its role, both in conjunction with - and as distance from - other science education professional organizations.~~

Let me talk in a little ~~more~~ detail about each of the five proposals for action ~~that have been~~ <sup>in this paper</sup> identified. First, it calls for NARST to present an organizational view on issues affecting the quality and quantity of science teaching. In my opinion, this is a new role for NARST. There is much diversity of membership within NARST and this is also reflected in the research interests of NARST members as papers are presented at the national meeting or published in the Journal. If this proposal for action were followed, there would be a "NARST position" that would be reflected

when NARST members testified to legislative committees, worked with school boards or curriculum committees, or were quoted in print and non-print media.

Second, NARST is called upon to codify knowledge claims in science teaching and to clearly define a basic research agenda involving how science is learned and used by students of different ages and in various science disciplines. If one examines this proposal for action, it involves the development of the codification scheme which may prove to be a complex task. Related to this proposal is the call for the production of an annual synthesis of research in science education, to be published in JRST or as a separate publication. At present we have an annual review of research - which is more a descriptive than a synthetic product. However, to produce a synthesis involves reading and analyzing the research. Should NARST substitute the synthesis for the annual review? Who will be willing to undertake the task?

Third, NARST is called on to focus on cooperative efforts with federal and state agencies and professional societies (scientific and educational) to develop strategies that translate into useable form research-tested information about teaching strategies, curriculum innovations, evaluation, and the use of contemporary instructional technologies.

Fourth, NARST is urged to become a leader in assisting the science teaching profession to develop research-based strategies to provide systematic staff development for teachers, and to influence the development of public policy to insure continuous funding for inservice activities. In addition, NARST is urged to continue providing leadership in supporting and promoting the concept of "every teacher a researcher."

Fifth, NARST should become more active in promoting the development of quality science curriculum and science teacher education in the Third World. This includes providing a forum for discussion of issues related to the teaching of science in developing countries.

The second paper begins with the gloomy premise that, after 61 years of NARST activity, there is little, if any, evidence that science teaching has been improved through research. However, science education research today is developing theories and research results with the power to serve as a professional knowledge base that can be used to make significant improvements in teaching practice. Therefore, NARST members or NARST as an organization should undertake such activities as the following five:

One, work with professional science teachers' organizations to understand the essential role that research-based knowledge must play in the ~~XXXX~~ improvement of science teacher education and in the enhancement of science teachers' professional status.

Two, work with the National Science Foundation to bring about the re-evaluation of policies that tend to separate research, materials development, and teacher education. In addition, NARST should assist NSF in developing policies that help NSF-supported development and teacher education projects to draw upon, as well as contribute to, the professional knowledge base.

Three, improve teacher education by encouraging the development and use of methods and materials for including research-based knowledge in preservice and inservice teacher education programs.

Four, improve teacher and student assessment by supporting the development of systems that make use of research-based knowledge about teaching and learning and that encourage science teachers to do the same.

Five, improve teaching materials by educating textbook publishers and publishers of other teaching materials about the extent to which their current products fail to meet students' needs. Again, publishers should be encouraged to make greater use of research-based knowledge to improve their effectiveness of their products. This emphasis also involves NARST members working to influence textbook selection committees.

The time remaining for the Presidential Address at the Awards Luncheon is always short, perhaps mercifully so, but I would like to raise some questions. If it is true that, after 61 years, there is scant evidence that research has improved science teaching - why is this the case? In 1984, the Association for Supervision and Curriculum Development published a book entitled Using What We Know about Teaching. Several chapters in this book touch on the question "Why don't teachers use research?" One explanation is that, when teachers have a problem, they turn for help to other teachers who have to deal daily with the reality they face, not the researcher whose time is spent in another environment. Also, teachers tend to consider that research has been oversold. There is a pervasive mistrust of research. Much research on teaching has been of recent development, as the second NARST action paper points out. Many research reports are jargon-laden, pretentious, and unclear. Teachers perceive of much research as being of the "hit and run" variety. Teachers have little to say about the purposes, timing, methods and tests involved in the study. The use of research is discouraging to teachers because of lack of attention to context and overemphasis on the means instead of emphases on the ends.

Information from science education research needs to be converted into a form which enables teachers to consider alternatives, to make informed professional judgments, and to refine common sense knowledge and implicit theories which guide their actions, to quote from an article by Colin Power published in an issue of Science Education in 1984. What have NARST members neglected to do? Why is this a goal that is not well achieved?

In 1961, Teachers College's Bureau of Publications produced a 19 page document, written by Goodwin Watson, entitled "What Psychology Can We Trust?" In his introductory statements, Watson ~~describes~~ <sup>says</sup> that the publication came about when he sat down to list some propositions important to education with which he thought few knowledgeable psychologists would disagree. He ended up with 50 such propositions, grouped under 9 major headings.

At the NARST meeting in Washington, DC, at a session on classroom research, I heard one presenter say, during the general discussion, that his experiences in this activity had convinced him that evaluating a student teacher, or any teacher, on the basis of only three or four observations over the course of a semester or quarter was a practice that could not be supported by what he had learned during his investigation. Surely, many NARST members have had similar experiences - they have posed a problem, designed a study, collected and analyzed the data that resulted, and reported their findings. And, in addition to the findings directly related to the research question, they have acquired <sup>other</sup> ~~XXXX~~ knowledge that can, and should, govern practice.

~~We have begun a number of networking groups, many of which~~

Last year we formed a number of networking groups - most of which are still functioning. My challenge is that these networking groups develop their own series of propositions important to science education that have relevance for classroom practice, and that we pool these findings from the networking groups in a publication that could be shared with science teachers. One of the shortcomings of Watson's book is that none of his 50 propositions has any research citation(s) to support its validity. We certainly could improve upon that - we could identify the findings and briefly elaborate on each, and we could cite relevant research to support our statements.

#### REFERENCES

- Hosford, P.D., ed. Using What We Know About Teaching. Alexandria, VA: Association for Supervision and Curriculum Development, 1984.
- Power, Colin. "Tinker, Tailor, Soldier, Spy - Implications of Science Education Research for Teachers." Science Education 68(2): 179-193, 1984.
- Watson, Goodwin. What Psychology Can We Trust? New York: Bureau of Publications, Teachers College, Columbia University, 1961.

*Art copy reactions?*  
*PB*

Statement of Purpose for the  
National Association for Research in Science Teaching  
Setting Direction for the 1990's

The National Association for Research in Science Teaching (NARST) is the major professional society in the world promoting an articulation between research and its dissemination to the practitioner for the improvement of science teaching. The association, because of this leadership role, must take a proactive stance that both reflects the science education profession and enhances the general community of education professionals. NARST should provide recommendations that specifically influence the development of public educational policy at the international, national, state, and local levels, as it affects the promotion of quality science teaching. The future direction of NARST is prioritized around the following purposes:

- (1) Provide leadership in promoting the use of an established scientific basis for science education to improve science teaching profession at the local, state, national and international levels.
- (2) Develop an agenda for basic and applied research in science education.
- (3) Translate, codify, synthesize and disseminate the findings of science education research in a manner that such findings have direct implications and are useful for both researchers and the classroom practitioner.

*There is no overt statement related to technology and science education nor to science in relation to these subject matter (Sci/math, STS, ...). Seems appropriate*

*15  
19  
17  
16*

- (4) Develop and evaluate mechanisms for disseminating and implementing widely the applications of basic research to science teaching in the classroom.
- (5) Enhance the quality of science teaching worldwide particularly as it relates to Global Issues.
- (6) Define the role of NARST in conjunction with and as distinct from other professional organizations concerned with science education.

#### Promoting Quality Science Teaching

The membership of NARST represents the scholarly leadership of the science teaching profession. In the past NARST depended on individual members and other organizations to serve as spokespersons for the profession. NARST must become more proactive and systematically represent members' views to various public and professional audiences on issues affecting the quality and quantity of science teaching. For example, specific research-based rationales need to be formulated to support defensible positions for:

- 1) the necessity for the laboratory;
- 2) the sequence and number of secondary science courses offered;
- 3) the provision of systematic and hands-on science instruction in the elementary schools;
- 4) the need for research-based conceived and organized

college level science courses for general education and  
teacher preparation students;

- 5) the intent, contents and quality of science textbooks and references;
- 6) nationally recognized certification requirements;
- 7) the financing of preservice and inservice education of science teachers; and,
- 8) the support for basic research in science teaching.

The membership needs to be sensitized to share these positions in various forums such as (1) written testimony before a legislative committee, a school board, a commission; (2) an editorial or letter to the editor in print and non-print media.

#### Enhancing Basic and Applied Science Education Research

The scientific professions have developed codifications of knowledge claims and a clear definition of research goals and priorities. The National Institute of Health is an example of a federal agency that provides a well articulated national agenda for the funding of research in the medical sciences.

Professional societies and the medical profession have a major input into agenda. A corollary for NARST is the need to take leadership in codifying knowledge claims in science teaching and defining clearly a basic research agenda that will augment and enhance basic understandings about how science is learned and used by students of different ages and in various science disciplines.

Use of Technology  
+ software in an  
integrated fashion

In addition to maintaining a quality research journal there is a real need to support a continuous effort to develop for researchers an annual synthesis of science education research. This could appear as a review published in JRST or as a separate publication. The review should be organized around the codified knowledge claims of the discipline.

#### Applying Research Findings to Science Teaching

The education enterprise is faced with the lack of strong, focused leadership from within the profession, resulting in general discontent from the public and political decision-makers. What, when and how science is taught are challenges facing professional science educators. Various studies have illustrated that the status quo in science teaching is unimaginative, out-of-date, and generally not addressing the needs of students for the 21st century. Findings from basic and applied science education research are not being translated and integrated into good classroom practices. The science education research focused journals provide no relief for the already inundated science teacher. NARST needs to focus on cooperative efforts with federal and state agencies, and professional societies (including scientific and educational) to develop strategies to translate into a useable form, research tested information about teaching strategies, curriculum innovations, evaluation, and the use of contemporary instructional technologies (including interactive computer systems).

Dissemination of Basic and Applied Research

In addition to supporting a wide distribution of research findings through "Research Matters" and other publications, NARST needs to become proactive in supporting systematic staff development models. It is time to bury the one- or two-day workshops for teachers about new curriculum and workable ideas for science education. Such workshops have never had significant impact on adoption or implementation. Few teachers possess the undergirding philosophic understanding to implement innovations on their own. They need support and on going coaching, not only from the local administrators and supervisors, but also from the science education professionals. NARST must become a leader in assisting the science teaching profession to develop research-based strategies to systematically inservice the teaching corps in the promising research findings and to provide encouragement and support for science teachers to become active science education researchers themselves. In addition, NARST needs to influence the development of public policy that insures continuous funding for inservice activities.

In most professions, the practicing professional, in the clinical sense, is also an active contributor to the knowledge base. Law and medicine are traditional examples. Science education should follow this pattern, and NARST should become a leader in supporting and promoting the concept of "every teacher is a researcher."

5 action research in  
collaboration with  
other researchers.

Promoting Global Education

The world has, is, and will continue to experience much stress. Various ecological, social and political disasters are having profound impact on the quality of life. Education, the great equalizer, is one of the hopes for the future. NARST needs to become more active in promoting the development of quality science curriculum and the training of science teachers in the third world. This includes providing a forum for the discussion of issues related to the teaching of science in developing countries.

Draft Prepared by Emmett L. Wright

Review to date by: John Staver

Larry Sharmann

Steve Oliver

ELW/tjh

What is this for?

ELW 3/6/89



ERIC® Clearinghouse for Science,  
Mathematics and Environmental  
Education

Room 310  
1200 Chambers Road  
Columbus, OH 43212-1792  
Phone 614-292-6717

February 9, 1990

Dr. Glenn Markle  
Executive Secretary, NARST  
Department of Curriculum & Instruction  
University of Cincinnati  
Cincinnati, OH 45221

Dear Glenn:

I hope you are well under way to being healthy again. It takes a long time to get over pneumonia, as I recall. I had it in both lungs the first year I taught in Shaker Heights and was out for at least a month and ~~felt~~ out of energy for several weeks after I went back to deal with ninth graders.

I am writing to remind you that somehow one chore got neglected when you sent out the mailing for the board of NARST. It was my understanding that we were also going to include the various by-law changes that need to be voted upon. As you will recall, I appointed an ad hoc committee, chaired by John Staver, to discuss changing the various awards committees from ad hoc committees to standing committees. It seemed appropriate to make these three committees standing committees because they have been functioning in that manner for years. (Technically, an ad hoc committee is appointed to carry out a specific function that is of short duration, as I understand the definition.)

John's committee presented a report to the board last spring which was accepted and passed. The information is found on page 37 of the board book and I am enclosing a copy of that page so that you need not hunt for it.

As I said earlier, I was under the impression that the by-law changes were going to be mailed out with the elections materials to save postage and to meet the timeline imposed in the by-laws. I would presume it is no longer possible to get this mailing done and call for return ballots in time for the action, if approved by the membership, to take place for the coming year.

Where this lack of follow-through will have an impact is in the appointments Jane makes to the incoming board. By past board action, all standing committees must be chaired by a current board member. I suppose there is no reason why Jane could not ask current board members (or incoming board members) who will be serving during her term to chair these committees, even if this is not an official by-law change. The only committee this really impacts is the Distinguished Award committee in that the JRST and NARST award committees are, or have been,

College of Education  
Department of Educational Theory and Practice  
Science and Mathematics

Markle, p.2

chaired by people who are currently on the board. Having the Distinguished Award committee chaired by a board member would certainly help to eliminate some of the complaints and grumbling that I have heard in past years when some board member objects to the recipient of the award. The committee chair would be there to explain the committee's actions and answer questions. It may be, too, that - as new people join the board - the politics will change, but I have not found that to happen a great deal during my past eight years on the board.

Anyway, I guess the bottom line is that I do not want the action of the ad hoc committee ignored and killed by not being acted upon. I am going off the board this April and will not be around to act as a combination watchdog-gadfly, so I want to register my request for action now.

Sincerely,



Patricia E. Blosser  
Past-president, NARST

Enc.

cc: Holliday, Kahle, Staver, Lawson, Yeany

## Center for Science Education

College of Education  
Bluemont Hall  
Manhattan, Kansas 66506  
913-532-6294

### MEMORANDUM

DATE: March 8, 1989  
TO: Patricia E. Blosser, President, NARST  
FROM: John R. Staver, Chair, ad hoc NARST committee

In accordance with your direction to form an ad hoc committee to: (1) inspect the responsibilities of the NARST Awards Committee, the JRST Awards Committee, and the Distinguished Contributions Award Committee; (2) develop a charge for these committees; and (3) submit a report to you for possible Board action in San Francisco, I submit the following report on behalf of the ad hoc committee members, Lloyd Barrow, Linda Crow, and myself:

We find no good reasons to change the responsibilities or the administrative structure of any of the aforementioned committees. Each is performing its function well under the direction of its chair. We see no reason to create an oversight or steering committee for the purpose of monitoring and coordinating the endeavors of the three committees. Each committee, however, does need a formal charge, and we have written these for the Board's examination, modification, and possible approval.

**NARST Awards Committee Charge:** To select the outstanding paper from those papers presented at the prior year's NARST annual meeting and submitted to the NARST Awards Committee for review. The author(s) of the paper judged as the best among those presented and submitted will receive the NARST Award. To select the outstanding paper focusing on practical applications of research from those papers presented at the prior year's NARST annual meeting and submitted to the NARST Awards Committee for review. The author(s) of the paper judged as best among those presented and submitted will receive the Practical Applications Award.

**JRST Awards Committee Charge:** To select the article published in the current volume of the Journal of Research in Science Teaching which is judged to be the most significant contribution to the volume. The author(s) of the article selected will receive the JRST Award.

**Distinguished Contribution Award Committee Charge:** To examine and judge from nominations the contributions of individuals to the field of science education through research over an extended period of time. If the merits of an individual's contribution warrant recognition, then the individual will receive the Distinguished Contribution Award.

Membership of the NARST Awards Committee, the JRST Awards Committee, and the Distinguished Contribution Award Committee will be composed of a sufficient number of NARST members to carry out the charge. These members will serve on three-year rotating terms. The Chair will be a member of the NARST Board of Directors. The Executive Secretary will be an ex officio member of each committee. The President will identify members with the advice of the appropriate Chair.

## Research Matters...To the Science Teacher

### USING TEXTBOOKS FOR MEANINGFUL LEARNING IN SCIENCE

By Sarah L. Ulerick

Much of science teaching is guided by and based upon the contents of science textbooks. Gatherings of science educators frequently condemn this practice, as they recommend more and better hands-on science activities in the K-12 curriculum. If we look carefully at classroom practice and textbooks, however, we might ask, "Is it the books themselves that are the problem or is it the manner in which students and teachers use them?" This article presents a rationale and strategies for teachers to facilitate meaningful learning from science textbooks.

#### Constructing Meaning

Over the past 20 to 30 years, views of how learners acquire knowledge has shifted from behaviorist theories of the 1950s and 60s to a "constructivist" view (e.g., von Glaserfeld, 1981). The constructivist view of knowledge acquisition holds that learning is a process of connecting new knowledge to existing knowledge, involving active engagement of the learner's mind. What we learn from any experience, including the experience of reading, depends upon what we already know and how we choose to "connect" our knowledge with the sensory input we perceive. Said differently, we use what we *already know* to make sense of what we don't.

Reading researchers have acknowledged for some time that reading is a process of active construction of meaning; and, the ideas supporting constructivism are well-documented by research on comprehension of written text (Bransford, 1979; Spiro, 1980). A number of studies have shown how a reader's knowledge interacts with text to influence comprehension, recall, and usefulness of what is read. For example, in a study described in Bransford (1979), readers were given the passage below to read and comprehend. Read the passage and see if you think it is easy to understand.

The procedure is actually quite simple. First you arrange items into different groups. Of course one pile may be sufficient depending on how much there is to do. If you have to go somewhere else due to lack of facilities that is the next step; otherwise, you are pretty well set. It is important not to overdo things. That is, it is better to do too few things at once than too many. In the short run this may not seem important but complications can easily arise. A mistake can be expensive as well. At first, the whole procedure will seem complicated. Soon, however, it will become just another facet of life. It is difficult to foresee any end to the necessity for this task in the immediate future, but then, one can never tell. After the procedure is completed one arranges the materials into different groups again. Then they can be put into their appropriate places. Eventually they will be used once more and the whole cycle will then have to be repeated. However, that is a part of life. (Bransford, 1979; p. 134-135; original study by Bransford & Johnson, 1972)

Most readers find this description of a procedure difficult to understand when read without a title. When the title was provided, readers had no difficulty following the paragraph. The title was "Doing the Laundry!"

Why is this non-technical description of a familiar procedure so difficult to make sense of without its title? Most of us have prior

knowledge to understand the paragraph, but are unable to use it without the "cue" or "context" which the title provides. If we are reasonably good readers, we probably tried to make sense of the sequence of sentences as we read along; we might have had one or two tentative hypotheses about the topic of the paragraph as we struggled to construct some coherent meaning for ourselves. If we are less persistent and resourceful readers, we might have given up half-way through the paragraph in frustration, concluding that it simply "made no sense."

Now read the following paragraph from a popular high school biology textbook:

Water enters the mouth, where it passes over the gills on either side of the head. The water is then forced out through separate pairs of gill slits. The gills are respiratory organs of the fish. The shark has large, well-developed eyes on either side of the head above the mouth. Paired nostrils on the ventral side of the head lead to olfactory sacs. These olfactory sacs sense odors in the water. As already mentioned, shark skeletons are made up of cartilage rather than bone.

Unless you have recently taught a unit on "Class Chondrichthyes," you might not have recognized this passage as a description of the respiratory system of the shark. Even when presented in the context of the printed textbook page, this passage is difficult to visualize in any concrete manner. Now, imagine you are a science-indifferent or science-phobic tenth grader with poor-to-average reading skills. How will you make sense of this passage? Even if you want to try, will you have the skills to do so? And why should you struggle to understand the passage to begin with?

#### Difficulties in Learning from Science Textbooks

The effort a reader puts into comprehending or making sense from text depends on several factors. The reader's purpose in reading is foremost among these. We tend to put more effort into figuring out things we really want to know. Our purpose also prescribes the context for the connections we will make between the information we are reading and what we already know. For example, readers who are told to compare and contrast ideas in a passage tend to read more slowly and to recall ideas in a compare/contrast structure. In many science classes, the traditional approach to using a textbook is to have students read a chapter and answer questions typically found at the end of the chapter. The questions tend to be low in cognitive level, inviting a search-and-find learning strategy (Stake & Easley, 1978; Tobin & Gallagher, 1987). Since answering these questions is their only purpose, students tend to engage at a very low cognitive level. Therefore, we should hardly be surprised that many students fail in the difficult task of making meaning from science prose.

The shallow purpose students are given for reading presents the first of several difficulties students have in learning from science textbooks. The low cognitive demands of such assignments discourage students from actively making meaningful connections to their existing knowledge and from actively monitoring their comprehension. When difficult passages are encountered, many students simply skip them, rather than undertake the effort to sort out a meaning for themselves.

Second, most science textbooks (particularly middle and secondary level books) are written in an impersonal, seemingly objective tone, which ignores the readers' needs. The style seldom offers invitations to the reader to access or "check-in with" his or her prior knowledge about a topic. Textbook authors write as if the reader has as much prior knowledge as they do; and, they assume that readers are familiar with the style and structure of expository writing.

A third problem in learning from science textbooks is that many

---

**EXECUTIVE SECRETARY**

Dr. Glenn Markle  
NARST  
University of Cincinnati  
Cincinnati, OH 45221-0002  
(513) 556-3600

---

Organized to improve science teaching—through research

---

# NARST

NATIONAL ASSOCIATION FOR RESEARCH IN SCIENCE TEACHING

---

**PRESIDENT**

Dr. William G. Holliday  
Curriculum and Instruction  
Benjamin Building  
University of Maryland  
College Park, MD 20742

---

**PRESIDENT-ELECT**

Dr. Jane Butler Kahle  
Department of Biological Sciences  
Purdue University  
West Lafayette, IN 47907

---

**IMMEDIATE PAST PRESIDENT**

Dr. Patricia E. Blosser  
ERIC  
1200 Chambers Road, Rm. 310  
The Ohio State University  
Columbus, OH 43212

---

**BOARD MEMBERS-AT-LARGE**

Dr. Charles Anderson (1990)  
229 Erickson Hall  
Michigan State University  
East Lansing, MI 48824

Dr. Hans Anderson (1996)  
NSTA  
1742 Connecticut Ave., NW  
Washington, DC 20009

Dr. Lowell J. Bethel (1991)  
Science Education Center—EDB 340  
The University of Texas at Austin  
Austin, TX 78712

Dr. Fred Finley (1990)  
370 Peik Hall  
University of Minnesota  
Minneapolis, MN 55455

Dr. Donald W. McCurdy (1992)  
211 Henzlik Hall  
University of Nebraska  
Lincoln, NE 68585

Dr. Robert Sherwood (1991)  
College Box 4, Peabody College  
Vanderbilt University  
Nashville, TN 37203

Dr. Kenneth G. Tobin (1992)  
Science Education  
Florida State University  
Tallahassee, FL 32306

---

**JOURNAL EDITOR**

Dr. Ronald G. Good  
Department of Curriculum  
and Instruction  
Louisiana State University  
Baton Rouge, LA 70803

---

**RESEARCH COORDINATOR**

Dr. Frances Lawrenz (1992)  
370 Peik Hall  
University of Minnesota  
Minneapolis, MN 55455

---

**NARST-NEWS EDITOR**

Dr. Thaddeus W. Fowler (1989)  
College of Education  
University of Cincinnati  
Cincinnati, OH 45221-0002

December 8, 1989

Professor Hans O. Andersen  
204 Wright Education Building  
Indiana University  
Bloomington, IN 47405

Dear Hans:

The NARST board of directors recognizes your personal commitment to improving science teaching, intensely expressed in your letter of December 2, 1989. NARST looks forward to contributing to NSTA's comprehensive initiatives by providing, at NSTA's pleasure, research-based suggestions.

The NARST board sees a value in NSTA ultimately creating a comprehensive document of the exemplary quality produced over the past five years by the National Council of Teachers of Mathematics (NCTM) NCTM's 272-page masterpiece, The Curriculum and Evaluation Standards for School Mathematics published this year, was created through the exhaustive cooperation of classroom teachers, researchers and other concerned people and associations.

Incidentally, NARST, a narrowly focused association committed to research-based efforts, continues to appreciate the broadly focused, exemplary service work of your association—NSTA, as illustrated by our very high proportion of overlap in common membership and our financial commitments to joint NARST-NSTA projects.

Sincerely,



William G. Holliday

copies to NSTA and NARST Boards of Directors ✓

---

EXECUTIVE SECRETARY

Dr. Glenn Markle  
NARST  
University of Cincinnati  
Cincinnati, OH 45221-0002  
(513) 475-2335

---

Organized to improve science teaching—through research

---

# NARST

NATIONAL ASSOCIATION FOR RESEARCH IN SCIENCE TEACHING

---

---

PRESIDENT

Dr. Patricia E. Blosser  
Science & Mathematics Education  
The Ohio State University  
Columbus, OH 43210-1172

---

PRESIDENT-ELECT

Dr. William G. Holliday  
Science Teaching Center  
The University of Maryland  
College Park, MD 20742

---

IMMEDIATE PAST PRESIDENT

Dr. Linda DeTure  
Education and Human Development  
Rollins College  
Winter Park, FL 32789

---

BOARD MEMBERS-AT-LARGE

Dr. Charles Anderson (1990)  
College of Education  
Michigan State University  
East Lansing, MI 48824

Dr. Lowell J. Bethel (1991)  
Science Education Center—EDB340  
The University of Texas at Austin  
Austin, TX 74712

Dr. Fred Finley (1990)  
Curriculum and Instruction  
University of Minnesota  
Minneapolis, MN 55455

Dr. Ronald Good (1989)  
Science Education  
Florida State University  
Tallahassee, FL 32306

LeMoine Motz (1989)  
NSTA  
1742 Connecticut Avenue, N.W.  
Washington, D.C. 20009

Dr. Robert Sherwood  
College Box 45, Peabody  
Nashville, TN 37203

Dr. Emmett Wright (1989)  
Dept. of Curriculum and Instruction  
Kansas State University  
Manhattan, KS 66506

---

JOURNAL EDITOR

Dr. Russell H. Yeany  
Science Education Research  
And Evaluation Lab  
Science Education Department  
University of Georgia  
Athens, GA 30602

---

RESEARCH COORDINATOR

Dr. Rodger Bybee (1989)  
B.S.C.S  
Colorado College  
Colorado Springs, CO 80903

---

NARST-NEWS EDITOR

Dr. Thaddeus W. Fowler (1989)  
University of Cincinnati  
Cincinnati, OH 45221-0002

To: Pat Blosser and the NARST Board

From: Linda R. DeTure

Date: March, 1989

Re: The Report of the Immediate Past President

As this is my final official board meeting as an officer of the organization, I simply wanted to thank you for your support and for the fine job you have done to keep the organization running and in good health. It has been my pleasure to work with and to get to know you better. As you can see in the Elections Committee's Report, the Board will be in good hands for the next few years with new upcoming and incoming Board Members.

I think as an organization we have made real strides under Pat's leadership this year and can continue to look forward to being a viable leader in the science education community. Once again thanks for everything and good-bye.

---

EXECUTIVE SECRETARY

Dr. Glenn Markle  
NARST  
University of Cincinnati  
Cincinnati, OH 45221-0002  
(513) 475-2335

---

---

# NARST

---

Organized to improve science teaching—through research

---

NATIONAL ASSOCIATION FOR RESEARCH IN SCIENCE TEACHING

---

PRESIDENT

Dr. Patricia E. Blosser  
Science & Mathematics Education  
The Ohio State University  
Columbus, OH 43210-1172

---

PRESIDENT-ELECT

Dr. William G. Holliday  
Science Teaching Center  
The University of Maryland  
College Park, MD 20742

---

IMMEDIATE PAST PRESIDENT

Dr. Linda DeTure  
Education and Human Development  
Rollins College  
Winter Park, FL 32789

---

BOARD MEMBERS-AT-LARGE

Dr. Charles Anderson (1990)  
College of Education  
Michigan State University  
East Lansing, MI 48824

Dr. Lowell J. Bethel (1991)  
Science Education Center—EDB340  
The University of Texas at Austin  
Austin, TX 74712

Dr. Fred Finley (1990)  
Curriculum and Instruction  
University of Minnesota  
Minneapolis, MN 55455

Dr. Ronald Good (1989)  
Science Education  
Florida State University  
Tallahassee, FL 32306

LeMoine Motz (1989)  
NSTA  
1742 Connecticut Avenue, N.W.  
Washington, D.C. 20009

Dr. Robert Sherwood  
College Box 45, Peabody  
Nashville, TN 37203

Dr. Emmett Wright (1989)  
Dept. of Curriculum and Instruction  
Kansas State University  
Manhattan, KS 66506

---

JOURNAL EDITOR

Dr. Russell H. Yeany  
Science Education Research  
And Evaluation Lab  
Science Education Department  
University of Georgia  
Athens, GA 30602

---

RESEARCH COORDINATOR

Dr. Rodger Bybee (1989)  
B.S.C.S.  
Colorado College  
Colorado Springs, CO 80903

---

NARST-NEWS EDITOR

Dr. Thaddeus W. Fowler (1989)  
University of Cincinnati  
Cincinnati, OH 45221-0002

To: Patricia Blosser

From: Linda R. DeTure, Chair  
Mark Malone  
Jack Renner

Date: March, 1989

Re: The report of the NARST Elections Committee

The election of officers for 1989-1990 was conducted according to the policies and procedures of the by-laws. Three hundred ninety eight ballots were received and counted.

The election results were as follows:

President-elect: Jane Kahle

Research Coordinator: Frances Lawrenz

Board Members-at-large: Donald McCurdy  
Kenneth Tobin

Recommendation: Submitted to the NARST Board at the Spring Board Meeting, March 30, 1989 in San Francisco, CA. The Election's Committee recommends the Board vote for approval.

---

EXECUTIVE SECRETARY

Dr. Glenn Markle  
NARST  
University of Cincinnati  
Cincinnati, OH 45221-0002  
(513) 475-2335

---

---

**NARST**

---

Organized to improve science teaching—through research

---

NATIONAL ASSOCIATION FOR RESEARCH IN SCIENCE TEACHING

---

PRESIDENT

Dr. Patricia E. Blosser  
Science & Mathematics Education  
The Ohio State University  
Columbus, OH 43210-1172

---

PRESIDENT-ELECT

Dr. William G. Holliday  
Science Teaching Center  
The University of Maryland  
College Park, MD 20742

---

IMMEDIATE PAST PRESIDENT

Dr. Linda DeTure  
Education and Human Development  
Rollins College  
Winter Park, FL 32789

---

BOARD MEMBERS-AT-LARGE

Dr. Charles Anderson (1990)  
College of Education  
Michigan State University  
East Lansing, MI 48824

Dr. Lowell J. Bethel (1991)  
Science Education Center—EDB340  
The University of Texas at Austin  
Austin, TX 74712

Dr. Fred Finley (1990)  
Curriculum and Instruction  
University of Minnesota  
Minneapolis, MN 55455

Dr. Ronald Good (1989)  
Science Education  
Florida State University  
Tallahassee, FL 32306

LeMoine Motz (1989)  
NSTA  
1742 Connecticut Avenue, N.W.  
Washington, D.C. 20009

Dr. Robert Sherwood  
College Box 45, Peabody  
Nashville, TN 37203

Dr. Emmett Wright (1989)  
Dept. of Curriculum and Instruction  
Kansas State University  
Manhattan, KS 66506

---

JOURNAL EDITOR

Dr. Russell H. Yeany  
Science Education Research  
And Evaluation Lab  
Science Education Department  
University of Georgia  
Athens, GA 30602

---

RESEARCH COORDINATOR

Dr. Rodger Bybee (1989)  
B.S.C.S.  
Colorado College  
Colorado Springs, CO 80903

---

NARST-NEWS EDITOR

Dr. Thaddeus W. Fowler (1989)  
University of Cincinnati  
Cincinnati, OH 45221-0002

To: Patricia Blosser

From: Linda R. DeTure, Chair  
Patricia Blosser  
Jim Shymansky  
John Staver  
Glen Markle, ex officio

Date: March, 1989

Re: Policy Committee Spring Report

The Policy committee reviewed the NARST Policies and Procedures Handbook for the Fall Board Meeting and made recommendations. Since then notes for changes have been made and Handbook will be passed along to the upcoming Policy Committees for continued review.

Recommendations: None at this time.

## NARST, Setting the Direction for the 1990's

This past November, the fall meeting of the NARST executive board was followed by a day of discussion of issues that NARST should be dealing with if it is to fulfill its purpose of improving science teaching through research. As a result of this discussion, two papers were prepared for review and examination at the spring board meeting on Thursday, March 30. My purpose today, in this talk, is to provide the general membership with an advance organizer ~~of~~ <sup>for</sup> these papers. I will try to present the highlights of each paper, as modified by Board discussion. Then I'd like to raise a few questions and, perhaps, issue a challenge.

One paper was written to emphasize actions NARST should take in dealing with policy makers at national, state, and local levels. Because NARST is an international organization in terms of membership, that level has also been included. ~~In this paper, it is proposed that NARST:~~

- ~~o develop an agenda for basic and applied research in science education~~
- ~~o "translate, codify, synthesize and disseminate" science research findings so these findings have direct, useful implications for researchers and teachers~~
- ~~o develop and evaluate mechanisms for disseminating and implementing applications of basic research in science teaching~~
- ~~o enhance the quality of science teaching worldwide, particularly as it relates to Global Issues~~
- ~~o define its role, both in conjunction with - and as distinct from - other science education professional organizations.~~

Let me talk in a little ~~more~~ detail about each of the five proposals for action ~~that have been~~ <sup>in this paper</sup> identified. First, it calls for NARST to present an organizational view on issues affecting the quality and quantity of science teaching. In my opinion, this is a new role for NARST. There is much diversity of membership within NARST and this is also reflected in the research interests of NARST members as papers are presented at the national meeting or published in the Journal. If this proposal for action were followed, there would be a "NARST position" that would be reflected

when NARST members testified to legislative committees, worked with school boards or curriculum committees, or were quoted in print and non-print media.

Second, NARST is called upon to codify knowledge claims in science teaching and to clearly define a basic research agenda involving how science is learned and used by students of different ages and in various science disciplines. If one examines this proposal for action, it involves the development of the codification scheme which may prove to be a complex task. Related to this proposal is the call for the production of an annual synthesis of research in science education, to be published in JRST or as a separate publication. At present we have an annual review of research - which is more a descriptive than a synthetic product. However, to produce a synthesis involves reading and analyzing the research. Should NARST substitute the synthesis for the annual review? Who will be willing to undertake the task?

Third, NARST is called on to focus on cooperative efforts with federal and state agencies and professional societies (scientific and educational) to develop strategies that translate into useable form research-tested information about teaching strategies, curriculum innovations, evaluation, and the use of contemporary instructional technologies.

Fourth, NARST is urged to become a leader in assisting the science teaching profession to develop research-based strategies to provide systematic staff development for teachers, and to influence the development of public policy to insure continuous funding for inservice activities. In addition, NARST is urged to continue providing leadership in supporting and promoting the concept of "every teacher a researcher."

Fifth, NARST should become more active in promoting the development of quality science curriculum and science teacher education in the Third World. This includes providing a forum for discussion of issues related to the teaching of science in developing countries.

The second paper begins with the gloomy premise that, after 61 years of NARST activity, there is little, if any, evidence that science teaching has been improved through research. However, science education research today is developing theories and research results with the power to serve as a professional knowledge base that can be used to make significant improvements in teaching practice. Therefore, NARST members or NARST as an organization should undertake such activities as the following five:

One, work with professional science teachers' organizations to understand the essential role that research-based knowledge must play in the ~~xxxx~~ improvement of science teacher education and in the enhancement of science teachers' professional status.

Two, work with the National Science Foundation to bring about the re-evaluation of policies that tend to separate research, materials development, and teacher education. In addition, NARST should assist NSF in developing policies that help NSF-supported development and teacher education projects to draw upon, as well as contribute to, the professional knowledge base.

Three, improve teacher education by encouraging the development and use of methods and materials for including research-based knowledge in preservice and inservice teacher education programs.

Four, improve teacher and student assessment by supporting the development of systems that make use of research-based knowledge about teaching and learning and that encourage science teachers to do the same.

Five, improve teaching materials by educating textbook publishers and publishers of other teaching materials about the extent to which their current products fail to meet students' needs. Again, publishers should be encouraged to make greater use of research-based knowledge to improve their effectiveness of their products. This emphasis also involves NARST members working to influence textbook selection committees.

The time remaining for the Presidential Address at the Awards Luncheon is always short, perhaps mercifully so, but I would like to raise some questions. If it is true that, after 61 years, there is scant evidence that research has improved science teaching - why is this the case? In 1984, the Association for Supervision and Curriculum Development published a book entitled Using What We Know about Teaching. Several chapters in this book touch on the question "Why don't teachers use research?" One explanation is that, when teachers have a problem, they turn for help to other teachers who have to deal daily with the reality they face, not the researcher whose time is spent in another environment. Also, teachers tend to consider that research has been oversold. There is a pervasive mistrust of research. Much research on teaching has been of recent development, as the second NARST action paper points out. Many research reports are jargon-laden, pretentious, and unclear. Teachers perceive of much research as being of the "hit and run" variety. Teachers have little to say about the purposes, timing, methods and tests involved in the study. The use of research is discouraging to teachers because of lack of attention to context and overemphasis on the means instead of emphases on the ends.

Information from science education research needs to be converted into a form which enables teachers to consider alternatives, to make informed professional judgments, and to refine common sense knowledge and implicit theories which guide their actions, to quote from an article by Colin Power published in an issue of Science Education in 1984. What have NARST members neglected to do? Why is this a goal that is not well achieved?

In 1961, Teachers College's Bureau of Publications produced a 19 page document, written by Goodwin Watson, entitled "What Psychology Can We Trust?" In his introductory statements, Watson <sup>says</sup> ~~describes~~ that the publication came about when he sat down to list some propositions important to education with which he thought few knowledgeable psychologists would disagree. He ended up with 50 such propositions, grouped under 9 major headings.

At the NARST meeting in Washington, DC, at a session on classroom research, I heard one presenter say, during the general discussion, that his experiences in this activity had convinced him that evaluating a student teacher, or any teacher, on the basis of only three or four observations over the course of a semester or quarter was a practice that could not be supported by what he had learned during his investigation. Surely, many NARST members have had similar experiences - they have posed a problem, designed a study, collected and analyzed the data that resulted, and reported their findings. And, in addition to the findings directly related to the research question, they have acquired <sup>other</sup> ~~XXXX~~ knowledge that can, and should, govern practice.

~~We have begun a number of networking groups - many of which~~

Last year we formed a number of networking groups - most of which are still functioning. My challenge is that these networking groups develop their own series of propositions important to science education that have relevance for classroom practice, and that we pool these findings from the networking groups in a publication that could be shared with science teachers. One of the shortcomings of Watson's book is that none of his 50 propositions has any research citation(s) to support its validity. We certainly could improve upon that - we could identify the findings and briefly elaborate on each, and we could cite relevant research to support our statements.

#### REFERENCES

- Hosford, P.D., ed. Using What We Know About Teaching. Alexandria, VA: Association for Supervision and Curriculum Development, 1984.
- Power, Colin. "Tinker, Tailor, Soldier, Spy - Implications of Science Education Research for Teachers." Science Education 68(2): 179-193, 1984.
- Watson, Goodwin. What Psychology Can We Trust? New York: Bureau of Publications, Teachers College, Columbia University, 1961.

## NARST, Setting the Direction for the 1990's

This past November, the fall meeting of the NARST executive board was followed by a day of discussion of issues that NARST should be dealing with if it is to fulfill its purpose of improving science teaching through research. As a result of this discussion, two papers were prepared for review and examination at the spring board meeting on Thursday, March 30. My purpose today, in this talk, is to provide the general membership with an advance organizer <sup>for</sup> ~~of~~ these papers. I will try to present the highlights of each paper, as modified by Board discussion. Then I'd like to raise a few questions and, perhaps, issue a challenge.

One paper was written to emphasize actions NARST should take in dealing with policy makers at national, state, and local levels. Because NARST is an international organization in terms of membership, that level has also been included. ~~In this paper, it is proposed that NARST:~~

- ~~o develop an agenda for basic and applied research in science education~~
- ~~o "translate, codify, synthesize and disseminate" science research findings so these findings have direct, useful implications for researchers and teachers~~
- ~~o develop and evaluate mechanisms for disseminating and implementing applications of basic research in science teaching~~
- ~~o enhance the quality of science teaching worldwide, particularly as it relates to Global Issues~~
- ~~o define its role, both in conjunction with - and as distinct from - other science/education professional organizations.~~

Let me talk in a little ~~more~~ detail about each of the five proposals for action ~~that have been~~ <sup>in this paper.</sup> identified. First, it calls for NARST to present an organizational view on issues affecting the quality and quantity of science teaching. In my opinion, this is a new role for NARST. There is much diversity of membership within NARST and this is also reflected in the research interests of NARST members as papers are presented at the national meeting or published in the Journal. If this proposal for action were followed, there would be a "NARST position" that would be reflected

when NARST members testified to legislative committees, worked with school boards or curriculum committees, or were quoted in print and non-print media.

Second, NARST is called upon to codify knowledge claims in science teaching and to clearly define a basic research agenda involving how science is learned and used by students of different ages and in various science disciplines. If one examines this proposal for action, it involves the development of the codification scheme which may prove to be a complex task. Related to this proposal is the call for the production of an annual synthesis of research in science education, to be published in JRST or as a separate publication. At present we have an annual review of research - which is more a descriptive than a synthetic product. However, to produce a synthesis involves reading and analyzing the research. Should NARST substitute the synthesis for the annual review? Who will be willing to undertake the task?

Third, NARST is called on to focus on cooperative efforts with federal and state agencies and professional societies (scientific and educational) to develop strategies that translate into useable form research-tested information about teaching strategies, curriculum innovations, evaluation, and the use of contemporary instructional technologies.

Fourth, NARST is urged to become a leader in assisting the science teaching profession to develop research-based strategies to provide systematic staff development for teachers, and to influence the development of public policy to insure continuous funding for inservice activities. In addition, NARST is urged to continue providing leadership in supporting and promoting the concept of "every teacher a researcher."

Fifth, NARST should become more active in promoting the development of quality science curriculum and science teacher education in the Third World. This includes providing a forum for discussion of issues related to the teaching of science in developing countries.

The second paper begins with the gloomy premise that, after 61 years of NARST activity, there is little, if any, evidence that science teaching has been improved through research. However, science education research today is developing theories and research results with the power to serve as a professional knowledge base that can be used to make significant improvements in teaching practice. Therefore, NARST members or NARST as an organization should undertake such activities as the following five:

One, work with professional science teachers' organizations to understand the essential role that research-based knowledge must play in the ~~xxxx~~ improvement of science teacher education and in the enhancement of science teachers' professional status.

Two, work with the National Science Foundation to bring about the re-evaluation of policies that tend to separate research, materials development, and teacher education. In addition, NARST should assist NSF in developing policies that help NSF-supported development and teacher education projects to draw upon, as well as contribute to, the professional knowledge base.

Three, improve teacher education by encouraging the development and use of methods and materials for including research-based knowledge in preservice and inservice teacher education programs.

Four, improve teacher and student assessment by supporting the development of systems that make use of research-based knowledge about teaching and learning and that encourage science teachers to do the same.

Five, improve teaching materials by educating textbook publishers and publishers of other teaching materials about the extent to which their current products fail to meet students' needs. Again, publishers should be encouraged to make greater use of research-based knowledge to improve their effectiveness of their products. This emphasis also involves NARST members working to influence textbook selection committees.

The time remaining for the Presidential Address at the Awards Luncheon is always short, perhaps mercifully so, but I would like to raise some questions. If it is true that, after 61 years, there is scant evidence that research has improved science teaching - why is this the case? In 1984, the Association for Supervision and Curriculum Development published a book entitled Using What We Know about Teaching. Several chapters in this book touch on the question "Why don't teachers use research?" One explanation is that, when teachers have a problem, they turn for help to other teachers who have to deal daily with the reality they face, not the researcher whose time is spent in another environment. Also, teachers tend to consider that research has been oversold. There is a pervasive mistrust of research. Much research on teaching has been of recent development, as the second NARST action paper points out. Many research reports are jargon-laden, pretentious, and unclear. Teachers perceive of much research as being of the "hit and run" variety. Teachers have little to say about the purposes, timing, methods and tests involved in the study. The use of research is discouraging to teachers because of lack of attention to context and overemphasis on the means instead of emphases on the ends.

Information from science education research needs to be converted into a form which enables teachers to consider alternatives, to make informed professional judgments, and to refine common sense knowledge and implicit theories which guide their actions, to quote from an article by Colin Power published in an issue of Science Education in 1984. What have NARST members neglected to do? Why is this a goal that is not well achieved?

In 1961, Teachers College's Bureau of Publications produced a 19 page document, written by Goodwin Watson, entitled "What Psychology Can We Trust?" In his introductory statements, Watson ~~describes~~ <sup>says</sup> that the publication came about when he sat down to list some propositions important to education with which he thought few knowledgeable psychologists would disagree. He ended up with 50 such propositions, grouped under 9 major headings.



MEMORANDUM

MARCH 27, 1989

TO: Chris Shepherd  
FROM: Susan Dorato  
RE: JOURNAL OF RESEARCH IN SCIENCE TEACHING Circulation Status

Attached the status reports for the TEA Editorial board meeting:

- I. Three Year Circulation Comparison
- II. Institutional vs. Individual Report
- III. International Circulation Report

I.

JOURNAL OF RESEARCH IN SCIENCE TEACHING

THREE YEAR CIRCULATION COMPARISON

<u>February Comparison</u>	<u>Domestic</u>	<u>Foreign</u>	<u>Total</u>	<u>Variance</u>	<u>Member*</u>
February 1989	1169	410	1579	+ 0.7%	596
February 1988	1138	430	1568	+11.4%	556
February 1987	1014	394	1408		373
 <u>December Comparison</u>					
December 1988	1467	509	1976	+1.9%	714
December 1987	1409	530	1939	+4.3%	720
December 1986	1243	616	1859		605

\*Included in total.

3/24/89

II.

JOURNAL OF RESEARCH IN SCIENCE TEACHING

INSTITUTIONAL vs. INDIVIDUAL REPORT

(Paid subscriptions as of 12/31/88)

<u>Classification</u>	<u># of Subscriptions</u>	<u>% of Total</u>
<u>Institutional</u>		
Institute	876	44.3%
Institute Library	134	6.8%
Industry	174	8.8%
	<hr/>	<hr/>
Sub-Total	1184	59.9%
<u>Individual</u>		
Individual (at home)	719	36.4%
Individual (at institute)	21	1.1%
Individual (at industry)	52	2.6%
	<hr/>	<hr/>
Sub-Total	792	40.1%
TOTAL	1976	100.0%

3/24/89

INTERNATIONAL CIRCULATION REPORT  
 (1988 paid subscriptions through 12/31/88)

Country	# of Subs	Country	# of Subs
-----	-----	-----	-----
Argentina	1	Jordan	1
Australia	56	Korea	9
Austria	1	Malaysia	4
Barbados	1	Mexico	5
Belgium	7	Netherlands	10
Botswana	1	New Zealand	6
Brazil	7	Nigeria	2
Canada	59	Norway	1
China	6	Panama	1
Costa Rica	1	Poland	1
Denmark	5	Portugal	3
Egypt	1	Saudi Arabia	4
England	58	Scotland	3
Finland	9	Singapore	3
France	7	South Africa	19
West Germany	27	Spain	25
Greece	1	Sweden	3
Hong Kong	3	Switzerland	4
Hungary	1	Taiwan	11
India	16	Thailand	8
Ireland	3	Trinidad	1
Israel	9	Turkey	2
Italy	18	Venezuela	1
Jamaica	1	Wales	1
Japan	57	Other	25
TOTAL			509



John Wiley & Sons, Inc.  
605 Third Avenue  
New York, NY 10158-0012  
212-850-  
Telex 12-7063  
Cable JONWILE

3/22/89

To: Chris

From: Carol Ann *Carol Ann*

Re: J. of Research in Science Teaching Report

No. of mss not yet published: 54

We have enough mss for 6-7 issues (Sept.-Feb. or Mar.).

Page Budget:

CY89 Budget: 896

Actual through May 1989 issue: 480 (4 issues left at 416 pp.)

FY89 Budget: 896

Actual: 880

Publag:

Averages about 10 months, but can run as high as 11-12 months.

Production Editor: Kathy Astor

**REPORT OF THE RESEARCH COMMITTEE**

Spring 1989

Submitted for the Committee

by

Rodger W. Bybee

Research Coordinator

## Introduction

The Research Committee had no specific directives after the fall 1988 NARST Board meeting. This report describes the coordination of NARST and NSTA presentations at the fall regional NSTA meetings, the authors/titles for this year's volume of Research Matters..., and recommends training sessions be included in the 1990 NARST meeting. In addition, a brief review of the Research Coordinator's role is provided.

## Coordination with NSTA

The Research Coordinator made arrangements for the following presentations at the 1988 regional NSTA meetings.

<u>NARST Member</u>	<u>Topic</u>	<u>Regional Meeting</u>
Bill Robertson	Conceptual Learning	Portland, ME
Jim Ellis	Microcomputers in the Science Classroom	Columbus, OH
Bill Kyle and Jim Shymansky	Teaching for Conceptual Change	Charleston, SC

These NARST sessions will be coordinated with NSTA sessions on "Every Teacher A Researcher." Bill Kyle, Research Coordinator for NSTA, has done an excellent job of arranging these sessions.

## "RESEARCH MATTERS...1989"

The authors and topics for this year's volume of Research Matters... are listed below. Some of the authors were listed in last year's report, but failed to meet the deadline. These authors delivered their manuscripts on time for the 1989 volume.

Using Research to Improve the Quality of Classroom Discussions

J. Nathan Swift  
C. Thomas Gooding  
Patricia R. Swift  
State University of  
New York--Oswego

## Research Matters... To the Science Teacher

# CHANGING AND MEASURING ATTITUDES IN THE SCIENCE CLASSROOM

By Thomas R. Koballa, Jr.

Teachers realize the importance of how students feel about science subjects and courses; nevertheless, they place little emphasis on affective objectives. The affective domain is often neglected because teachers have difficulty designing strategies to develop positive attitudes among students and documenting their development. The seemingly arbitrary use of terms associated with the affective domain has further contributed to this neglect. Recent research provides suitable guidelines to focus attention on this important domain.

The literature indicates that the affective domain related to science education is primarily concerned with attitudes related to science. The development of positive attitudes toward science has long been viewed as a legitimate goal of science education. Science curriculum developers have for some time sought to improve students' attitudes toward science and scientists. Concern for student attitudes toward science has also risen with regard to the possibility of increasing enrollment in elective science courses by improving attitudes toward science among adolescents.

### Attitude and Related Concepts

The term attitude encompasses a wide range of affective behaviors (e.g., prefer, accept, appreciate, and commit) and is used too loosely and without basis by some writers. It is also applied in a number of contexts and with a variety of meanings, which has led to considerable confusion. Nevertheless, a distinct, yet complex definition of attitude is emerging within the literature.

The most prominent quality is evaluative directionality, our favorable or unfavorable feelings toward something. Some experts contend that evaluation is the only element of attitude; the element that our attitude instruments seem to measure. Attitudes are learned either actively or vicariously, thus they can be taught. Because attitudes are learned they are susceptible to change, but stable enough to be enduring. Each attitude has an object and the changeable nature of an attitude is tied to the specificity of the object. It is harder to change one's attitude towards science, for example, than an attitude toward dissecting a frog in biology class on Monday. Attitude is also a correlate of behavior with personal, social, and cognitive variables thought to influence their level of consistency.

Other terms such as value, belief, interest, and opinion are often

confused with attitude. Values are rules that direct moral or ethical decisions that are considered either right or wrong. They are broader in scope than attitudes and unlike attitudes that range from positive to negative, values seem to be always positive in nature. Truth, beauty, goodness, liberty, equality, and justice are six values basic to Western civilization cited by Mortimer Adler (1982). Recognized by Shrigley, Koballa, and Simpson (1988) as values held by science teachers are academic achievement, a pollution free environment, and symmetry in nature. Values are considered more complex than attitudes and are less easily changed.

Beliefs are the cognitive basis for attitudes. They provide information for attitudes by linking objects and attributes. For example, "Cotton is fluffy," is a belief with "cotton" serving as an object and "fluffy" serving as an attribute. Information provided by beliefs may be factual (e.g., copper is malleable) or nonfactual (e.g., the atomic bomb is the most important scientific breakthrough of the 20th century). Nonfactual or evaluative beliefs differ little from attitudes. A person has many more beliefs than attitudes and far fewer values than either attitudes or beliefs.

An interest is a learned response of liking or preferring. It involves the selection and ranking of responses along a like-dislike continuum. Interests are directed toward activities and objects and they are usually expressed by action verbs, such as *reading* a book or *playing* football. Some writers have attempted to make a distinction between interest and attitude by pairing interest with preferences for activities and attitude with preferences for groups, institutions, or objects. However, this distinction seems artificial. In usage, the terms are essentially synonymous.

Usually manifested in the form of verbal expression, opinions are more cognitive than attitudes. Opinions over the years have competed for the position now firmly held by attitudes and have been used to represent cognition, evaluation, and behavior. The terms opinion and interest seem to serve no useful purpose as constructs for science education research and communication with the evaluation of rather distinct definitions for attitude, value, and belief. (A more comprehensive analysis of attitude and other related concepts can be found in the work of Shrigley, Koballa, and Simpson, 1988).

In addition to the terms just mentioned, science educators toil with scientific attitudes, a concept that further adds to the confusion. A cognitive concept, scientific attitudes are normally associated with the mental processes of scientists, (e.g., curiosity, rationality, and willingness to suspend judgment). Scientific attitudes possess attributes thought to be either true or false and do not express an evaluative quality. To lessen the semantic confusion, scientific attitudes may be better labeled as "scientific attributes".

### Persuasion

For the most part, efforts to improve attitudes by science educators have taken the form of learning science content or comparing innovative forms of teaching with more traditional ones. These efforts are similar to ones abandoned by attitude researchers nearly fifty years ago. Recently, theoretical models derived from social psychology have been employed in science education. Although no options for improving science attitudes should be overlooked, basing the study of attitudes on theoretical models derived from social psychology seems to be a fruitful option. Suggesting that we look

to the social psychological literature for theoretical rationales for attitude change are the key elements found in the definition of attitude and a wealth of theoretical development.

Recognized by social psychologists are seven major approaches to attitude change, with each approach subsuming numerous related theoretical models (Petty and Cacioppo, 1986). Conditioning and modeling, message-learning, judgmental, motivational, attributional, combinatory, and self-persuasion are the seven approaches. Petty and Cacioppo contend that the vehicle responsible for attitude change in all of the approaches is persuasion, even though the approaches differ in the outcomes that they specialize in explaining.

Persuasion refers to "any change in attitudes that results from exposure to a communication" (Petty and Cacioppo, 1986, p. 5) and embodies many aspects of teaching. Particularly when operationalized by means of Hovland's (Hovland, Janis, and Kelley, 1953) theoretical model, persuasion resembles classroom instruction. Persuasion and instruction both involve communication which includes giving arguments and evidence for the purpose of getting someone to believe something or to do something. Nevertheless, the use of persuasion as a vehicle for attitude change is suspected to have prompted much trepidation among educators. Bloom, Hastings, and Madaus (1971) contend that neglect of the affective domain is in part due to the fear of indoctrinating or brainwashing students when teaching to achieve affective outcomes.

Persuasion is easily distinguished from indoctrination and brainwashing. Persuasion depicts a situation which is marked by the conscious intent of the source to persuade and in which both the source and receiver function as active agents in the persuasion process. The aim of persuasion, like that of instruction, is to establish certain beliefs (and attitudes) so that they are held in conjunction with their foundation in argument and evidence. The recipient of a persuasive appeal is always free to accept or reject it; the same is not true for indoctrination and brainwashing. Like persuasion, indoctrination is concerned with the change and formation of beliefs; they differ, however, in that in persuasion the emphasis is placed on the reasons for the belief as opposed to the content of the belief. Much of what young children learn in school, public or private, is implanted by indoctrination.

Brainwashing, as coined by journalist Edward Hunter in the 1950s, refers to the coercive techniques applied by the North Korean military to obtain the cooperation and compliance of Allied Prisoners of War. Unlike persuasion, brainwashing involves physical brutality, psychological pressure, and intensive interrogation. Nevertheless, brainwashing was found to be quite ineffective as a means of ideological conversion. Of the several thousand Americans captured during the Korean war and "brainwashed", fewer than 50 collaborated with the enemy and fewer than 25 refused repatriation (Striker, 1984). Most of the men who originally refused repatriation later returned home.

Numerous studies based on the persuasion paradigm have been conducted over the last ten years primarily by a group of science educators led by Robert L. Shrigley (see Shrigley and Koballa, 1987). Their studies were organized around the question, "Who says what to whom how with what effect?" Using this question, they investigated how attitude change (the effect, or the dependent variable) is influenced by four stimuli (1) the source of the message (who), (2) the message (what), (3) the channel through which the message is delivered (how), and (4) the audience (whom). The persistence (retention) of changed attitudes was also a part of many of the studies. These research efforts led to the following conclusions.

- Carefully designed belief-laden messages built on Hovland's model can be used to change attitudes.
- Over the short-term, highly credible (expert and trustworthy) sources enhance the effectiveness of persuasive messages.
- Longer treatment periods are not better. In fact, messages of less than 30 minutes in length can change attitudes.
- Changes in attitudes are unrelated to gains in factual information.
- Messages that present both sides of an issue are more persuasive than those that present only one side.
- Anecdotal messages (containing vivid, concrete sensory information)

appear to be superior to data-summary messages (containing aggregated, statistical data) in changing attitudes.

- The channel by which a message is presented does not seem to affect its persuasiveness. Videotape, audiotape, and printed messages have been tried, without a clear advantage for one over the others.
- The attitudes of males are more positive than those of females.
- The effectiveness of persuasive message is not affected by the recipient's self-esteem, intelligence, or level of cognitive complexity.
- Attitude change and the persistence of attitude change are related to the recipient's self-generated thoughts to a persuasive message, but not to his ability to recall message arguments.

### Attitude Measurement

Inadequacies in the design of closed item questionnaires are often blamed for the lack of consistent research findings regarding science-related attitude. Since attitude is a construct that must be measured indirectly, usually through self-report, it is imperative that instruments used to assess attitudes be both reliable (i.e., produce consistent results) and valid (i.e., measure what you want to measure). Mathematical computations to determine instrument reliability are routine but the absence of a systematic plan for establishing validity is a flaw common to most attitude instruments. Establishing validity is a process that involves human judgment in addition to statistical procedures according to Abdel-Gaid, Trueblood, and Shrigley (1986). Heeding this warning, a number of closed item attitude scales were developed. Likert scales and semantic differential scales made up the majority of the instruments.

*Likert scales.* A Likert scale consists of a series of attitude statements that are clearly either positive or negative. A wide range of scores is achieved by having respondents report the intensity of an attitude. This is accomplished by having them indicate their agreement with each statement on a 5-point scale.

The development and testing of Likert scales evolved alongside the adaptation of Hovland's approach to the needs unique to science education. The goal was to see how well scales with only 20 to 25 items could withstand the rigor of both quantitative and qualitative analysis. Over the years a number of scales were developed as part of research endeavors in this area. Unfortunately few of the scales are appropriate for use by teachers with their classes, since the subjects of the research were primarily preservice and inservice teachers.

Measuring the attitude objects on each of the scales developed are positive and negative items similar to the one presented below that appears on the Revised Science Attitude Scale (Thompson and Shrigley, 1986):

I enjoy manipulating science equipment. (positive statement)

(a) strongly disagree    (b) agree    (c) undecided    (d) disagree    (e) strongly disagree

2                    1                    0                    -1                    -2

*Semantic differential scales.* A scale of this type consists of a series of bipolar adjective pairs (e.g., good-bad, beneficial-harmful) listed on opposite sides of a page with seven spaces in between. The attitude object is identified at the top of the scale and may be a word, statement, or picture. The respondent is instructed to evaluate the attitude object by placing a mark in one of the seven spaces between each adjective pair.

Development of semantic differential scales stems from the use of Fishbein and Ajzen's theory of reasoned action to investigate science-related attitudes. The theory is Fishbein and Ajzen's attempt to deal with the weak link often observed between attitudes and behaviors. Studies conducted within the framework of this theory have had a substantial impact on the field of attitude research since the mid-1970s.

In their theory, Fishbein and Ajzen suggest that attitude measures should focus on a person's attitude toward a behavior rather than on the person's attitude toward particular objects. That is, instead of asking about students' attitudes toward science, or computers, teachers should assess their attitudes toward learning science or writing Logo computer programs. The role of specificity in the

model is operationalized by the deliberate inclusion of four elements:

- action — reading
- target — my biology textbook,
- context — during study hall, and
- time — for 15 minutes every day throughout the school year.

Fishbein and Ajzen argue that the correlation between attitude and behavior is determined in part by the degree of correspondence between the elements comprising the attitudinal and behavioral variables.

Fishbein and Ajzen also identify another variable, operationalized in a similar manner, which should be measured along with attitude toward the behavior to facilitate behavioral prediction. The variable is called subjective norm. It reflects the person's perception that significant others think the behavior should or should not be performed. Derived from a combination of the attitude and subjective norm scores is a behavioral intention score, considered the best predictor of actual behavior.

Measuring intention, attitude, and subjective norm with respect to the behavior would require the use of semantic differential items similar to the one modeled below:

I intend to read my biology textbook during study hall for 15 minutes every day throughout the school year.

Likely \_\_\_\_\_: \_\_\_\_\_: \_\_\_\_\_: \_\_\_\_\_: \_\_\_\_\_: \_\_\_\_\_: \_\_\_\_\_: unlikely  
extremely quite slightly neither slightly quite extremely  
3 2 1 0 -1 -2 -3

Few semantic differential scales have been developed that measure the antecedents of science-related behaviors. Nevertheless, scales based on the theory of reasoned action offer several advantages over Likert scales. Their development and use is based on a systematic theory of human behavior, the goal of which is to predict and understand behavior. Clear distinctions are made between belief, attitude, intention and behavior. Attitude is assumed to be a function of all salient beliefs about the attitude object. As a result, the refinement of measures by means of item analysis or to assure unidimensionality by means of confirmatory factor analysis are not required according to Ajzen and Fishbein (1980). Furthermore, scales based on the theory of reasoned action are closely linked to the development of belief-based, persuasive messages. Efforts to develop and test Likert and semantic differential attitude scales led to the following conclusions.

- Attitude instruments provide us with a convenient means of assessing behavior. The only true reason for studying attitude is its relationship to behavior.
- Without reliable and valid measures of attitude, assessing attitude change is impossible.
- The phrase "monitor and modify" should be synonymous with the use of any attitude scale. Instrument reliability and valid data are not static, but change from sample to sample and from one administration to the next.
- Attitudes toward science cannot adequately predict nor provide a satisfactory explanation of science-related behaviors. (Yet investigators persist in measuring students' feelings about field trips, working with science equipment, and six-week units on electricity or ecology using scales that measure attitude toward science!)
- The prediction of behavioral intention, and hence behavior, is improved when the elements of the attitudinal and behavioral intention variables are calibrated at the same level of specificity as the behavioral criterion.
- The use of semantic differential scales based on the theory of reasoned action are preferred over Likert scales to predict and understand behavior and to assess the effects of persuasion.

### Teaching for Attitude Change

Affective objectives should be clearly identified and strategies designed to achieve these objectives must be employed.

Changing attitudes using Hovland's model does not require treatments lasting weeks or months; attitudes can be changed in as short a time as one class period, provided that attention is paid to the variables harbored within the question: Who says what to

whom how with what effect?

*Who: the communicator.* Cues discharged by the communicator provide the message recipient with information beyond the arguments and evidence presented in a message. A teacher can enhance his credibility by the way he introduces himself to his students. At the outset of an attempt to persuade students to handle non-venomous snakes, for example, a teacher should describe past activities in which he has handled non-venomous snakes (to appear more qualified). In addition, he may wish to tell the students that their failure to handle the snakes will not affect their class grades or chances to participate in future class activities.

Because most persuasive communication situations are unlikely to occur under conditions in which the speaker is suddenly made known to his audience, people make judgments about the source before they begin to process the message. As Bettinghaus (1968) points out, "it is not the momentary exposure to the source at the time of message transmission which is important, but the total set of impressions from the time the receiver first becomes aware of the source" (p. 118). The teacher who wishes to become persuasive must act accordingly during his daily activities, not merely at the time the message is delivered. Indeed, a communicator can impede attitude change when his perceived credibility is low and help to facilitate attitude change when credibility is high.

*What: the message.* An appropriate message variable would be a brief, belief-laden communication describing for adolescents reasons for not taking drugs. Teaching strategies identified as innovative (e.g., museum tours, process skills, self-paced and computer assisted instruction) when compared with traditional teaching lack the necessary precision and would not qualify as message variables in Hovland's model.

Achieving desired affective outcomes can be accomplished without being indoctrinary by constructing messages that emphasize the reasons for belief as opposed to the content of belief. If the goal of persuasion is to have the message recipient modify his beliefs (and attitudes) for reasons that are good and sufficient, messages that present both sides of a debatable issue (e.g., evolution, abortion, aluminum recycling) are essential.

Most people, scientists included, are more easily persuaded by anecdotal, case histories than by aggregated, statistical data (like that found in *Consumer Reports*). Explanations for the finding range from the greater potency of concrete, vivid information over abstract, pallid evidence to a lack of understanding of the fundamentals of statistical inference. Teachers can take advantage of the power of anecdotes by using personal testimonies to aid in the learning of science principles. Also, teachers can use their understanding of the power of anecdotes to curb reckless thinking such as when students insist on generalizing in tubful proportions from a thimbleful of facts.

*How: the channel.* Common sense might suggest that the order of channel persuasiveness would be: live, videotape, audiotape, and printed. But this does not always seem to hold true. The effectiveness of the channel seems to be affected by the complexity of the message (Chaiken and Eagly, 1976). An easily comprehended message should engender the most attitude change when it is live or videotaped and the least attitude change when it is printed. However, printed media is likely to be the most effective when the message is complex, because the reader can process it at his own pace. Over all, printed messages are preferred because they are easy to construct and can be reproduced with little chance of being unintentionally altered.

*Whom: the recipient.* Unlike the "hypodermic needle" approach to attitude change that guided research and seemed to mold public opinion in the 1950s, current persuasion theory suggests that humans are not passive and defenseless message recipients who can be injected with a persuasive message that will change their attitudes. As currently conceived, attitude change and persistence are linked to the active participation of the recipient as he elaborates upon the message's arguments and evidence. From this constructivist framework, teachers should not expect unwavering acceptance of the position advocated by a message because students will respond to persuasion in terms of their preexisting perspectives regarding the topic of the message.

*With what effect: measurement.* Because affective objectives are important, they should be the focus of formal evaluation. Formal evaluation may be carried out most easily with the aid of closed item questionnaires, either obtained or constructed. Using instruments developed by others can save much time and can provide the user with the benefits of the developers' experience. In choosing to use an existing scale, one should check to see if it has been tried and if the audience for which it has been designed matches the intended audience. An existing instrument should also carry some reliability and validity data. Depending on what data are available, pilot testing and modifying the scale may be necessary before it can be used.

If an existing scale cannot be found to meet a particular need then one must be built. Abdel-Gaid and her colleagues (1986) provide a fairly comprehensive report of the step-by-step Likert scale building process. Explicit directions for building scales based upon the theory of reasoned action are presented in Ajzen and Fishbein's (1980) book, *Understanding Attitudes and Predicting Social Behavior*. The development of an attitude scale is no easy task; time and computer access are a must. However, the final product, a reliable and valid attitude scale, will be well worth the time and effort invested.

---

*Thomas R. Koballa, Jr. is an associate professor at the Science Education Center, The University of Texas at Austin. He is a member of the National Association for Research in Science Teaching, an organization devoted to improving science teaching through research.*

#### ACKNOWLEDGEMENT

*Members of the research group whose findings and conclusions are summarized in this report include: Lawrence Calhoun, Susan Demers, Barbara Grabowski, Abdel Hassan, Thomas Koballa, Suzanne Miller, Robert Shrigley, and Dennis Showers.*

#### REFERENCES

- Abdel-Gaid, S., Trueblood, C.R., and Shrigley, R.L. (1986). A systematic procedure for constructing a valid microcomputer attitude scale. *Journal of Research in Science Teaching*, 23(9), 823-839.
- Adler, M.J. (1981). *Six great ideas*. New York: Macmillan.
- Ajzen, I., and Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. Englewood Cliffs, NJ: Prentice-Hall.
- Bettinghaus, E.P. (1968). *Persuasive communication*. New York: Holt, Rinehart, and Winston.
- Bloom, B.S., Hastings, J.T., and Madaus, G.F. (Eds.). (1971). *Handbook of formative and summative evaluation of student learning*. New York: McGraw Hill.
- Chaiken, S., and Eagly, A.H. (1976). Communication modality as a determinant of message persuasiveness and message comprehensibility. *Journal of Personality and Social Psychology*, 34, 605-614.
- Hovland, C.I., Janis, I.L., and Kelley, H.H. (1953). *Communication and persuasion*. New Haven, CT: Yale University Press.
- Petty, R.E., and Cacioppo, J.T. (1986). *Communication and persuasion*. New York: Springer-Verlag.
- Shrigley, R.L., and Koballa, T.R., Jr. (1987). *Applying a theoretical framework: A decade of attitude research in science education*. University Park: The Pennsylvania State University, Department of Curriculum and Instruction.
- Shrigley, R.L., Koballa, T.R., Jr. and Simpson, R.D. (1988). Defining attitude for science educators. *Journal of Research in Science Teaching*, 25(8), 659-678.
- Striker, L.D. (1984). *Mind-bending*. Garden City, NY: Doubleday and Company.
- Thompson, C.L., and Shrigley, R.L. (1986). What research says: Revising the Science Attitude Scale. *School Science and Mathematics*, 86(4), 331-334.

---

*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 further information on this topic, contact Dr. Joseph D. Novak, Department of Science and Mathematics Education, Cornell University, 404 Roberts Hall, Ithaca, New York 14853-5901.*

## Research Matters . . . To the Science Teacher

### USING RESEARCH TO IMPROVE THE QUALITY OF CLASSROOM DISCUSSIONS

By J. Nathan Swift, C. Thomas Gooding, and Patricia R. Swift

Studies conducted by the staff of the Classroom Interaction Research Laboratory at the State University of New York College at Oswego reveal that teachers find it difficult to engage in guided discussions with their students. In many cases, discussions change into drill or lectures, as teachers strive to cover the material. We believe that interactive discussions should occur more often than usual. This idea led us to study ways in which teachers can become more successful discussion leaders and questioners.

At our Laboratory, we listened to hundreds of audio tape recordings of middle school and high school science discussions. We prepared transcripts of these discussions. Careful analyses followed. We classified questions and other teacher-student interactions. Pauses in dialogue were measured. We counted the students' words and, whenever possible, we noted the sex of the students. Many other factors were evaluated in an effort to describe typical interaction patterns and to facilitate the development of increased effectiveness of teacher-led questioning and discussion.

Our first major study was a research project funded by the National Science Foundation, and entitled "Wait Time and Questioning Skills of Middle School Science Teachers" (Swift and Gooding, *Journal of Research in Science Teaching*, 1983, 20, 721-730). The study was designed to determine the effects of allowing longer pauses in the classroom for teachers and students to think and interact. We found that without special training wait time in teacher-student dialogue is short. Pauses average only 1.25 seconds between teachers' questions and replies by students (wait time 1) and only .55 seconds between the students' replies and subsequent comments by teachers (wait time 2).

In the middle school study of thinking time, we asked 40 teachers to tape record a discussion in one of their classes each week for 15 weeks. Most of the interactions were fast-paced drill, review for tests, with emphasis on low-level memory questions, or lectures punctuated by brief questions designed to keep the students alert. Few teacher-student interactions could be classified as discussion or inquiry lessons intended to develop the intellectual processes of students. We found that students typically do not ask questions in classroom discussions, nor are they encouraged to do so. This it seems that, while research has revealed that memory-level drill and lecture are not the best tools for learning, teachers persistently follow these strategies.

We were able to help teachers slow the rapid pace of instruction

with the introduction of a wait time feedback device (Wait Timer [TM]) in each of their classrooms. The device consists of voice-activated switches and a variable timer that triggers an amber light. The light is activated when a person is speaking. The light remains on as a signal to allow thinking time to occur. When three seconds elapse, the light goes out, indicating that it is appropriate for another participant to enter the discussion. Introduction of the Wait Timer resulted in changing interactive behavior to include more extensive use of evaluative questions, longer student responses, and improved level of student participation in discussion.

Increasing thinking time to at least three seconds following a high cognitive level question and a quality reply is crucial. That pause helps students extend and enrich their answers. This time also facilitates more effective follow-up questions by the teacher and other students.

A second project was supported by the National Science Foundation. This study entitled "Increasing the Effectiveness of Biology and Chemistry Instruction through Research Applications" enhances the ability of high school biology and chemistry teachers to use effective skills for questioning and discussion. The results of the first phase of this study revealed that even though high school students are developmentally more advanced than middle school students and the content more complex, high school teachers have some of the same difficulties in guiding discussions effectively. Teachers of biology experience greater difficulty in moving beyond the memory level of questioning than chemistry teachers. More of the discussion in the biology courses was at the lowest level of Bloom's taxonomy as redefined for science by Blosser (*Handbook of Effective Questioning Techniques*, 1973, Worthington, OH: Education Associates), whereas the chemistry courses were found to involve a greater proportion of evaluative questions and analytical thinking. Of special interest in regard to this finding is that the high school biology course contains a large technical vocabulary of more than 1,100 terms to be memorized. Chemistry, by contrast, has an analytical focus with lower emphasis on definitions. Teachers of biology may be focusing on memory level learning, at the expense of the analytical and ethical issues that are inherent to the field of biology. In an effort to achieve mastery at the memory level, some of the most exciting and important biology may be omitted.

To help teachers address concerns of a mutual interest to them and to the research laboratory staff, we are developing a Teachers as Researchers Project in selected high schools in central New York. Our goal is to move from the linear model of research and development, with its "top down" approach, to a collaborative model that incorporates classroom teachers in all phases of research from problem definition to evaluation.

Our focus is on the quality of questioning and discussion in the classroom. We have invited teacher researchers to join with us on mutually designed studies on wait time, questioning skills, student and teacher attitudes, and a variety of related topics influencing effective teaching and learning. The science teachers involved in the Teachers as Researchers Project report that the opportunity to participate in the project reduces their sense of isolation and leave them exhilarated and motivated to teach science. Working on shared professional concerns is perceived as vital to their continuing growth as teachers.

The most direct implication for this project, as a facet in the improvement of teaching, is that teachers want and need professional development opportunities. They make sacrifices of time and energy in order to access programs where they are offered partnerships in research on classroom teaching. This approach, wherein the teacher researcher is creatively involved in the selection, design, implementation, analysis, and outcome assessment of research programs, is worthy of further study. We see this as a practical way to move research findings into professional practice.

---

*Dr. J.N. Swift is Professor of Education, Dr. C.T. Gooding is Associate Dean of Graduate Studies, and Patricia R. Swift is a Research Associate at the State University of New York at Oswego, NY. They are members of the National Association for Research in Science Teaching, an organization dedicated to improving 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 further information on this topic, contact Dr. Joseph D. Novak, Department of Science and Mathematics Education, Cornell University, 404 Roberts Hall, Ithaca, New York 14853-5901.*

## Research Matters...To the Science Teacher

# COMPUTER-BASED TECHNOLOGY IN COLLEGE SCIENCE LABORATORY COURSES

By William H. Leonard

The microcomputer introduces several applications of computer-based technology to laboratory instruction in college science courses. Almost as soon as the microcomputer was used for science instruction, faculty, especially those in the physical sciences, began the development of computer-based applications. Furthermore, there are some interesting reports in the literature that describe the use of this technology and/or report the effects of computer-based instruction on student learning. This article reviews the recent literature on the use of microcomputer applications in college science laboratory courses with a focus on student educational outcomes.

Currently there are two major uses of computer-based technology in college laboratory courses: (1) direct instruction of laboratory concepts by simulation using traditional computer-assisted instruction (CAI) or by a more advanced version of CAI using an interactive videodisc system (IVI) and (2) using the microcomputer for data analysis and/or input of data with laboratory instrumentation interfaced to the microcomputer. The following discussion is divided into these two areas.

There are numerous studies using (CAI) in college science instruction, but only a few reports of use in conjunction with laboratory instruction specifically. In one study, students in an introductory chemistry laboratory course who used computer simulated experiments for four different laboratory investigations (kinetics, absorbance spectroscopy, emission spectroscopy, and equilibrium) did as well or significantly better than students performing the traditional laboratory investigation on the same topic. The CAI group also spent significantly less time learning the material (Calvin and Lasgowski, 1978). Curtis (1986) used a software system designed to teach students how to fit simple response functions to experimental data. Using modern data analysis techniques was found to help students with low and low-average mathematical skills more than it helped students with high skills. Miller (1986) found no differences in achievement or attitudes due to student use of CAI materials in a community college biology laboratory course.

Microcomputers interfaced laser videodisc players provide a combination of the advantages of the microcomputer and traditional television or videodisc images. The result of interfacing these two technologies permits a high level of interactivity between the computer and student, and high resolution, life-like video images of

natural phenomena (Leonard, 1987a). In comparison of interactive videodisc versus the traditional laboratory to teach physical principles of standing waves and strings, no difference was found on pretest/posttest gains between the two groups of students, but that students in the two groups used different strategies to separate and control for variables based on the physical nature of the instructional materials available (Stevens, 1985). Waugh (1987) randomly assigned two groups of chemistry students studying equilibrium to either a traditional laboratory activity or simulation with an interactive videodisc system. The latter group scored significantly better on both laboratory quizzes and on their laboratory reports. Similarly, a large group of non-major biology students were assigned to either traditional laboratory exercises or simulations on an interactive videodisc system to learn about cellular respiration and about biogeography. Results showed no statistically significant differences between the groups on laboratory quizzes, laboratory reports, or laboratory final exam. Opinion data on a questionnaire indicated that students felt the videodisc instruction gave them more experimental and procedural options and more efficient use of instructional time than did conventional laboratory instruction. Students indicated interactive videodisc was equivalent for general interest, understanding of basic principles, help on examinations, and attitudes toward science. The conclusion was that interactive videodisc can, in some cases, provide comparable instruction to the wet laboratory (Leonard, 1987b & 1988a).

One of the most exciting developments in laboratory instruction is the interfacing of laboratory measurement devices to a microcomputer. Nicklin (1985) found that many physiological experiments could be improved and made more accurate by interfacing common physiological instruments to a microcomputer. He also found that the microcomputer could act as a "lab partner" for students working individually on an experiment and that interfacing was not expensive. Old kymograph transducers interfaced with microcomputer-based workstations for undergraduate physiology laboratories were found to be very functional and successful (Rhodes, 1986). Morgan, Markell, and Feller (1987) have given a complete description of interfacing muscle physiology measuring devices to a microcomputer. One of these is a pistol grip transducer that is used to study contraction of the human trigger finger muscles. An excellent and illustrative guide for inexpensively constructing interfaces for twelve common laboratory instruments such as a thermometer, motion time, pH meter and humidity meter has been prepared by Vernier (1987). A simple and inexpensive interfacing kit, called *Science Toolkit*, is available from Carolina Biological Supply and other science supply companies. The basic module for the Apple II sells for \$70 and contains experiments in biology, chemistry, and physics. Additional modules for speed and motion, earthquakes, and human physiology are available for \$40, each with additional experiments. A variety of other commercial interfacing kits are available as well. For example, IBM is developing a Personal Science Laboratory (PSL) that can be used in college science laboratories.

There are educational benefits of using instruments interfaced to a microcomputer in the laboratory. These benefits include, reducing cost, improving effectiveness, saving student time (and thus preventing boredom), learning to use state-of-the-art scientific instrumentation, simplifying data analysis, making experimental

results more meaningful by allowing students to perceive relationships between independent and dependent variables as the experiment is completed, allowing students to more effectively comprehend abstract concepts, and providing opportunity for developing problem solving skills (Leonard, 1988b).

Ideas for classroom interfacing come from scientific research. Among those ideas being developed in research that may have interesting applications for the classroom are trackers for eye, head and hand gestures, tracers of eye direction and focus tracking, and voice recognition and synthesis (Foley, 1987). IBM currently has an interactive system capable of recognizing 20,000 words (98% of the typical English-speaking vocabulary). The development of much more powerful microcomputers, CD-ROM, and image capturing by microcomputers will soon be available for classroom use. Future possibilities for laboratory interfacing are almost unlimited.

The recent development and research on applications of computer technology for laboratory instruction in college science courses does suggest that applications of computer technology in the laboratory classroom is here to stay and that science faculty will continue to develop new applications for instruction. The temptation to tinker with this new technology is almost irresistible. The demonstrated educational benefits of computer applications for student learning also appears to be equivalent to or better than conventional laboratory instruction.

#### Recommendations to the Science Teacher

The first recommendation is that you try computer-based technologies in your laboratory courses. The interfacing instrumentation, for example, is not expensive and a teaching laboratory needs only one to a few microcomputers. Interfacing has been found to be useful and motivational in physiology, biology, chemistry, earth science, and physics laboratory courses. Other computer-based technologies, such as interactive videodisc and computer laboratory simulation are useful as well.

A second recommendation is that you experiment with creative applications of computer-based applications in your laboratory course. Your students can be creative as well. Adding this new dimension of technology to your laboratory investigations has all of the advantages listed above.

Finally, you are encouraged to share the results of your creative efforts with computer-based technologies in your laboratory courses through the science teaching journals. We can all help each take full advantage of these exciting technologies.

---

*William H. Leonard is a Professor of Science Education and Professor of Biology at Clemson University, Clemson, SC 29634. He is a member of the National Association for Research in Science Teaching, an organization dedicated to improving science teaching through research.*

#### REFERENCES

- Calvin, C.S. and Lasgowski, J.J. (1978). Effects of computer simulated or laboratory experiments and student aptitude on achievement and time in a college general chemistry laboratory course.
- Curtis, J.B. (1986). Teaching college biology students the simple linear regression model using an interactive microcomputer graphics software package. *Dissertation Abstracts International*, 46(7), a.
- Foley, J.D. (1987). Interfaces for advanced computing. *Scientific American*, 257, 127-135.
- Leonard, W.H. (1987a). Interactive Videodisc: Computer Instruction of the Future? *Collegiate Microcomputer*, 5, 197-201.
- Leonard, W.H. (1987b). A comparison of student performance by interactive videodisc versus conventional laboratory. Paper presented to the Annual Meeting of the National Association for Research in Science Teaching in Washington, D.C., April, 1987.
- Leonard, W.H. (1988a). A comparison of student reactions to biology instruction by interactive videodisc or conventional laboratory. *Journal of Research in Science Teaching*, in press.
- Leonard, W.H. (1988b). Interfacing in the biology laboratory: State

of the art. *The American Biology Teacher*, 50.

- Miller, D.G. (1986). The integration of computer simulation into the community college general biology laboratory. *Dissertation Abstracts International*, 47(6), 2106A.
- Morgan, R.M., Markell, C.S., and Feller, R.F. (1987). A microcomputer exercise on muscle Physiology. *Journal of College Science Teaching*, XVII(10), 23-27.
- Nicklin, R.C. (1985). The computer as a lab partner. *Journal of College Science Teaching*, 15(1), 31-35.
- Rhodes, S.B. (1986). A microcomputer kymograph. *Journal of College Science Teaching*, 15 #6, 523-527.
- Stevens, S.M. (1985). Interactive computer/videodisc lessons and their effect on students' understanding of science. Paper presented to the Annual Meeting of the National Association for Research in Science Teaching in French Lick Springs, Indiana.
- Vernier, D.L. (1987). *How to build a better mousetrap*. Portland, OR: Vernier Software.
- Waugh, M.L. (1987). The influence of interactive videodisc simulations on student achievement in an introductory college chemistry course. Paper presented to the Annual Meeting in Washington, D.C., April, 1987.

---

*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 further information on this topic, contact Dr. Joseph D. Novak, Department of Science and Mathematics Education, Cornell University, 404 Roberts Hall, Ithaca, New York 14853-5901.*

## Research Matters...To the Science Teacher

### ENHANCING LEARNING THROUGH CONCEPTUAL CHANGE TEACHING

By William C. Kyle, Jr. and James A. Shymansky

From the moment of birth infants begin to generate views about their new environment. As children develop, there is a need construct meaning regarding how and why things behave as they do. And, long before children begin the process of formal education, they attempt to make sense of the natural world. Thus, children begin to construct sets of ideas, expectations, and explanations about natural phenomena to make meaning of their everyday experiences. The ideas and explanations that children generate form a complex framework for thinking about the world and are frequently different from the views of scientists. These differing frameworks are referred to in the literature as misconceptions, alternative conceptions, or alternative frameworks. Since the early 1970s, research in science education and cognitive science has enriched our understanding of the importance of the ideas and explanations that students possess prior to instruction. This research has direct implications concerning the nature of learning science, as well as the process of teaching science.

#### Prior Knowledge and Conceptions of Students

Teachers have always recognized the need to start instruction "where the student is." David Ausubel (1968) emphasized this by distinguishing between meaningful learning and rote learning. For meaningful learning to occur, new knowledge must be related by the learner to relevant existing concepts in that learner's cognitive structure. For this reason, Ausubel contends that, "The most important single factor influencing learning is what the learner already knows." Ausubel also commented on the importance of preconceptions in the process of learning, noting that they are "amazingly tenacious and resistant to extinction...the unlearning of preconceptions might well prove to be the most determinative single factor in the acquisition and retention of subject-matter knowledge."

Perhaps the most comprehensive interdisciplinary assessment of children's conceptions of science is the Learning in Science Project in New Zealand (Osborne & Freyberg, 1985). The following examples, from the work of the Learning in Science Project, exemplify conceptions that children ages 5 to 18 possess on a variety of topics, while contrasting those views with the scientific perspective.

#### LIVING

**Scientific Perspective:** Living things are distinguished from non-living things in their ability to carry on the following life processes: movement; metabolism; growth; responsiveness to environmental stimuli; and, reproduction.

**Children's Views:** Objects are living if they move and/or grow. For

example, the sun, wind, and clouds are living because they move. Fires are living because they consume wood, move, require air, reproduce (sparks cause other fires), and give off waste (smoke).

#### ANIMALS

**Scientific Perspective:** An animal is a consumer.

**Children's Views:** Animals have four legs, have fur, make noise, are bigger than insects, and/or are found on land. Cows, dogs, elephants, and lions are easily identified as animals. People are not animals. Similarly, spiders, butterflies, birds, fish, and earthworms are not animals.

#### PLANTS

**Scientific Perspective:** A plant is a producer.

**Children's Views:** A plant is something growing in a garden. Carrots and cabbage from the garden are not plants; they are vegetables. Trees are not plants; they are plants when they are little, but when they grow up they are not plants. Seeds are not plants. Dandelions are not plants; they are weeds. Plants are only things that are cultivated; the more food, water, and sunlight they get the better. Plants take in their food from the environment. They have multiple sources of food. Photosynthesis is not important to plants.

#### ELECTRIC CURRENT

**Scientific Perspective:** A current of electricity, or electric current, is a flow of electrically charged particles through a conductor.

**Children's Views:** Electric current flows from battery to bulb and is used up.

#### FORCE AND MOTION

**Scientific Perspective:** Force is a push or a pull on an object. A body remains at rest or in uniform motion unless acted upon by a force.

**Children's Views:** A body requires a force to keep it in motion. Force is always in the direction of motion. There is no force acting upon a body that is not in motion.

#### GRAVITY

**Scientific Perspective:** Gravity is a force between any two masses. Gravity depends on the size of the masses and the distance between their centers.

**Children's Views:** Gravity is something that holds us to the ground. If there was no air there would be no gravity. For example, above the earth's atmosphere there is no gravity, and you become "weightless." Gravity increases with height above the earth's surface. It is associated with downward falling objects.

Research related to students' conceptual reasoning and the elucidation of alternative frameworks has also been conducted on the following scientific concepts and/or topics: air and air pressure, density, dynamics, the earth, ecological matter cycling, energy, heat and temperature, light and vision, mechanics, natural selection, the particulate nature of matter, and respiration and photosynthesis (readers interested in more comprehensive reviews should refer to Driver & Erickson, 1983; Driver, Guesne, & Tiberghien, 1985; Gilbert & Watts, 1983; West & Pines, 1985; as well as publications available from The Institute for Research on Teaching<sup>1</sup>).

Learning science for most students involves a process of conceptual change. Anderson and Roth (in press) note that students who achieve an understanding of a scientific topic successfully integrate accurate scientific knowledge with their own personal knowledge of the world. Research suggests, however, that many students fail to do this; instead, they view scientific knowledge as being separate and distinct from their personal knowledge. For these students science is merely a compilation of strange, obscure facts rather than a system of conceptual schemes for understanding

their environment.

Formal science instruction does not change the alternative frameworks held by many students. In fact, while we have referred to alternative frameworks in the context of children's views, the alternative conceptions common to elementary school students have been found to exist among high school students and college students. We observe many adults who have conceptions that are substantially different from those of scientists. With this in mind, if preconceptions are as tenacious as Ausubel contends, how can teachers enhance the likelihood of conceptual development and thereby improve students' science conceptions?

### Teaching for Conceptual Change

Driver (1983) notes that the alternative conceptions that students have constructed to interpret their experiences have been developed over an extended period of time; one or two classroom activities are not going to change those ideas. She emphasizes that students must be provided time individually, in groups, and with the teacher to think and talk through the implications and possible explanations of what they are observing — and this takes time. Improving students' science conceptions may begin by recognizing that "less is more." That is, we may need to *decrease* the amount of new material introduced to students each year if we truly desire to enhance their conceptions of scientific phenomenon.

In teaching for conceptual change, students must experience conflict with their expectations. It is only reasonable that students would not accept a new idea with first feeling that their existing views are unsatisfactory in some way. Posner et al. (1982) suggest that if students are going to change their ideas:

1. They must become dissatisfied with their existing conceptions.
2. The scientific conception must be intelligible.
3. The scientific conception must appear plausible.
4. The scientific conception must be useful in a variety of new situations.

Teaching for conceptual change then, demands a teaching strategy where students are given time to: identify and articulate their preconceptions; investigate the soundness and utility of their own ideas and those of others, including scientists; and, reflect on and reconcile differences in those ideas. The Generative Learning Model (GLM) is a teaching/learning model that substantially provides this opportunity. In the GLM, the learner is an active participant in the learning context rather than an empty cup to be filled (refer to Osborne & Freyberg for a more detailed description of the Generative Learning Model). The GLM has four instructional phases aimed at enabling the learner to construct meaning. Using the GLM, a teacher:

1. Ascertains students' ideas, expectations, and explanations prior to instruction.
2. Provides a context through motivating experiences related to the concept.
3. Facilitates the exchange of views and challenges students to compare ideas, including the evidence for the scientific perspective.
4. Provides opportunities for students to use the new ideas (scientific conceptions) in familiar settings.

Teachers who effectively implement the GLM promote a learning environment that engages students in an active search and acquisition of new knowledge. Learning is characterized by a process of interaction between the student's mind and the stimuli providing new information. Such a learning environment enables students to modify their existing cognitive structures. Students experience a dynamic interaction between their preconceptions and the appropriate scientific conceptions.

The generative model for teaching/learning acknowledges a constructivist approach to the process of learning. That is, students construct meaning from their experiences. This is precisely how Piaget viewed the process of learning (1929/1969). Piaget referred to the process of acquisition and incorporation of new data into an existing structure as "assimilation" and the resulting modification of that structure as "accommodation." In learning science then, the new facts, ideas, and concepts that are acquired gain more meaning by being organized (assimilated) into a cognitive structure; at the same time, the existing cognitive structure is given

further clarification and support, or perhaps even changed, by incorporating new information (accommodating itself to the new data). The instructional process to facilitating conceptual change must therefore: 1) identify and address students' alternative conceptions, 2) provide opportunities for students' ideas to evolve, and 3) enable students' new ideas to be applied in a context familiar to them.

### Summary

If teachers are to improve students' science conceptions we must recognize that:

- students come to science class with ideas,
- students' ideas are often different from scientists,
- students' preconceptions are strongly held,
- traditional instruction (rote learning) will not lead to substantial conceptual change, and
- effective instructional strategies enable teachers to teach for conceptual change and understanding. The key to altering the ideas, explanations, and conceptions of science that students possess is to find out and use what students already know. The challenge of teaching science is to ensure that you do not leave intact students' alternative conceptions or fill students with ideas and explanations which have little chance of being understood. The conceptual change teaching literature on generative learning may provide you with a solution to that challenge.

---

<sup>1</sup> Researchers at The Institute for Research on Teaching at Michigan State University are assisting teachers in the process of teaching for conceptual change through curriculum development and teacher education initiatives aimed at improving students' science conceptions.

### REFERENCES

- Anderson, C. W., & Roth, K. J. (in press). Teaching for meaningful and self-regulated learning of science. In J. Brophy (Ed.), *Teaching for meaningful and self-regulated learning*. Greenwich, CT: JAI Press.
- Ausubel, D. (1968). *Educational psychology: A cognitive view*. New York: Holt, Rinehart & Winston.
- Driver, R. (1983). *The pupil as scientist?* Milton Keynes, England: The Open University Press.
- Driver, R., & Erickson, G. (1983). Theories-in-action: Some theoretical and empirical issues in the study of students' conceptual frameworks in science. *Studies in Science Education*, 10, 37-60.
- Driver, R., Guesne, E., & Tiberghien, A. (1985). *Children's ideas in science*. Philadelphia, PA: Open University Press.
- Gilbert, J. K., & Watts, D. M. (1983). Concepts, misconceptions and alternative conceptions: Changing perspectives in science education. *Studies in Science Education*, 10, 61-98.
- Osborne, R., & Freyberg, P. (1985). *Learning in science: The implications of children's science*. Portsmouth, NH: Heinemann.
- Piaget, J. (1929/1969). *The child's conception of the world*. Totowa, NJ: Littlefield, Adams & Co.
- Posner, G. J., Strike, K. A., Hewson, P. W., & Gertzog, W. A. (1982). Accommodation of a scientific conception: Toward a theory of conceptual change. *Science Education*, 66, 211-227.
- West, L. H. T., & Pines, A. L. (Eds.). (1985). *Cognitive structure and conceptual change*. Orlando, FL: Academic Press.

---

*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 further information on this topic, contact Dr. Joseph D. Novak, Department of Science and Mathematics Education, Cornell University, 404 Roberts Hall, Ithaca, New York 14853-5901.*

## Research Matters...To the Science Teacher

### USING INQUIRY LABORATORY STRATEGIES IN COLLEGE SCIENCE COURSES

By William H. Leonard

Systematic observations of college science laboratory classes in a large midwestern university during the late 1970s revealed that students were, for the most part, performing cookbook-like laboratories and were not learning the process skills of science. Instead, students spent a significant amount of laboratory time listening to the instructor transmit information. These observations are probably typical of most university laboratory courses in the sciences and that the use of investigative laboratory teaching strategies at the college level lagged behind those used in the secondary and elementary schools (Kyle, Penick and Shymansky, 1979). There are reports in the literature that most standard laboratory experiments in introductory college science courses contain directions to be followed explicitly so the experiment will generate usable data (Stewart, 1988). Stewart contends that if students are permitted to design their own experiments, the laboratory protocol becomes more important than the laboratory report, and time spent planning and organizing the experiment becomes more important than time spent ascertaining whether or not the results are as expected. Fogle (1985) states that introductory college students do not understand the nature of scientific questioning, and that common misuse of the terms hypothesis, fact, and theory is symptomatic of student misconceptions. He maintains that students must be allowed to experience scientific thinking firsthand.

During the past decade, some interesting experimental studies developed and tested alternative approaches to the traditional laboratory investigation. Most of the innovative approaches are modifications of the inquiry model and employ discovery or inductive approaches to learning. Utilization of science process skills, such as hypothesis formation, identification and manipulation of experimental variables, and inferring from data are characteristic of these newer approaches.

In one such study, students in a physical science class for elementary education majors employed concrete, manipulative laboratory experiences to learn about measurement, pressure, Archimedes' principle, machines and electricity. This class showed greater achievement on some of the concepts, a greater comprehension of all areas taught, and better attitudes toward science than a similar class taught without the manipulative laboratory experience (Splickler, 1984). Kern and Carpenter (1984) found a field-oriented, on-site, instructional approach to geology produced significantly more interest and enjoyment than a traditional laboratory approach. The

laboratory approach associated with a learning center approach for college geology was found to have a significantly greater effect on short-term learning than did a more conventional laboratory approach (Tofte, 1982).

A number of studies of inquiry laboratory approaches have been done in introductory biology. Lawson and Smitgen (1982) found that a series of laboratory investigations to teach formal reasoning was found to improve significantly the ability of students to use formal operational thought. Similarly, cognitive development of college, non-major, biology students was found to be promoted by a laboratory program that emphasized investigation and accounted for limitations of student cognitive ability (Journet, Young, Stanley, and Scheibe, 1987). Walosz and Yeany (1984) found that training in integrated science process skill development improved the performance of college biology students in the use of integrated science process skills. A successful inquiry strategy developed originally by the Biological Sciences Curriculum Study (BSCS) was adapted for use in a university general biology laboratory program and tested experimentally for an entire semester against a well-established commercial program which was highly directive (Leonard, 1986). The BSCS orientation made systematic use of science processes, development of concepts via questioning and requirements of the student to make procedural decisions. The commercial approach primarily required following instructions exactly as stated and answering a few very specific questions. Students using the BSCS orientation scored similarly to those using the commercial approach on a pretest of selected biology laboratory concepts, but scored significantly higher on a post-test (Leonard, 1986). This study was later replicated with students at two small, private colleges. Again, the group using the BSCS orientation scored significantly higher on a test of biological laboratory concepts at the end of the semester (Hall and McCurdy, 1988). Finally, an extended discretion laboratory approach in which students were required to determine their own investigatory procedures and strategies was tested experimentally against a more directive laboratory approach in university general biology. Even though the former approach placed much greater demands on student creativity and decision making, student scores between the two groups on learning measures given at the end of the semester did not differ significantly. One conclusion is that students can learn at least as much when given fewer procedural directions on laboratory investigations (Leonard, 1984).

Studies on the use of investigative or inquiry approaches in college science laboratory courses suggest the following.

- Inquiry laboratory strategies are more student-involved and more inductive than traditional approaches.
- Inquiry laboratory strategies contain less direction and give the student more responsibility of determining procedural options.
- Inquiry laboratory strategies require students to make more extensive use of science process skills.
- Inquiry laboratory strategies produce significantly greater educational gains than traditional approaches.
- Inquiry laboratory strategies appear to work equally well for college students of all ability levels, not just the very academically talented.

Students appear to prefer inquire-style instruction as well. A

survey of 600 students in introductory, non-major science courses showed a clear preference for investigative laboratory activities to the standard, structured activities (Davis and Black, 1985). Inquiry laboratory programs have been found to be workable. For example, research supports recommendation for maintaining the spirit of inquiry in large-enrollment college laboratory classes, for designing process-oriented laboratory investigations, for reducing the cookbook from commercial laboratory investigations, and for helping laboratory instructors become better teachers (Leonard, Journet and Ecklund, 1988).

Meaningful laboratory instruction in college science courses appears to be distinguished from traditional strategies in at least three ways.

Students are engaged in a number of the science inquiry processes, such as observing, classifying, measuring, communicating, collecting and organizing data, inferring from observations, hypothesizing, manipulating experimental variables, analyzing data, and drawing conclusions from data.

Students have the opportunity to manipulate experimental materials, thus providing a "hands-on" experience.

Students learn in an experimental manner specific scientific concepts, such as "plants have cell walls and animals do not" or "some chemical reactions need heat to take place and/or some give off heat."

Recent research on investigative learning approaches in college science laboratory courses looks encouraging. Much more development of laboratory curricula using inquiry approaches and research which experimentally compares them to existing approaches is still needed. There is a definite trend toward wider use of inquiry laboratory strategies in college and university science courses. The use of such strategies is justified by recent research.

**William H. Leonard** is Professor of Science Education and Professor of Biology at Clemson University, Clemson, SC 29634. He is a member of the National Association for Research in Science Teaching, an organization dedicated to improving science teaching through research.

#### REFERENCES

- Davis, W.E. and Black, S. (1985). Student opinion of the investigative laboratory format. *Journal of College Science Teaching*, 15, 187-189.
- Fogle, T.A. (1985). Student-directed biology lab investigations. *Journal of College Science Teaching*, XIV, 345-348.
- Hall, D.A. and McCurdy, D.W. A comparative study of a Biological Sciences Curriculum Study (BSCS) style laboratory and a traditional laboratory approach on student achievement at two private liberal arts colleges. Paper presentation at the Annual Meeting of the National Association for Research in Science Teaching at St. Louis, April 11, 1988.
- Journet, A.R.P., Young, C.C., Stanley, C.M., and Scheibe, J.S. Studies on cognitive development in a non-majors investigative general biology laboratory. Paper presented to the Annual Meeting of the National Association for Research in Science Teaching, Washington, D.C., April, 1987.
- Kern, E.L. and Carpenter, J.R. (1984). Enhancement of student values, interests and attitudes in earth science through a field-oriented approach. *Journal of Geological Education*, 32, (5), 675-683.
- Kyle, W.C., Penick, J.E., and Shymansky, J.A. (1979). Assessing and analyzing the performance of students in college science laboratories. *Journal of Research in Science Teaching*, 16, 545-551.
- Lawson, A.E. and Smitgen, D.A. (1982). Teaching formal reasoning in a college biology course for preservice teachers. *Journal of Research in Science Teaching*, 19, 233-248.
- Leonard, W.H. (1984). An experimental test of an extended discretion laboratory approach for university general biology. Paper presented to the Annual Meeting of the National Association for Research in Science Teaching in New Orleans.
- Leonard, W.H. (1986). An experimental study of a BSCS-style laboratory approach for university general biology. *Journal of*

*Research in Science Teaching*, 23, 807-814.

- Leonard, W., Journet, A., and Ecklund, R. (1988). Overcoming obstacles in teaching large-enrollment laboratory courses. *Journal of College Science Teaching*, 50 (1), 23-28.
- Schellenberg, J.P. (1980). A comparative study of two laboratory approaches in a general education college physical science course. *Dissertation Abstracts International*, 03-A.
- Spinkler, T.R. (1984). An experiment on the efficacy of intuition development in improving higher levels of learning and reasoning in physical science. *Dissertation Abstracts International*, 44 (1) 143-A.
- Stewart, B.Y. (1988). The surprise element of a student-designed laboratory experiment. *Journal of College Science Teaching*, XVII, 269-270.
- Tofte, W.L. (1982). The comparative effectiveness of learning center and traditional approaches for a college introductory geology laboratory course. *Dissertation Abstracts International*, 43, 358-A.
- Wolkosz, M. and Yeany, R.H. (1984). Effects of lab instruction emphasizing process skills on achievement of college students having different cognitive development levels. Paper presented to the Annual Meeting of the National Association for Research in Science Teaching, New Orleans, April, 1984.

*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 further information on this topic, contact Dr. Joseph D. Novak, Department of Science and Mathematics Education, Cornell University, 404 Roberts Hall, Ithaca, New York 14853-5901.*