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ABSTRACT

This publication supports the implementation of science, technology, and society education in schools, as well as news of the nationwide network. Volume 1 includes: "The Present Opportunity in Education," a position paper of the Triangle Coalition for Science and Technology Education; "An STS Learning Cycle for Middle School Students" (Peter Rubba; Carmine DeCarlo); "A Precollege Science Enrichment Program for High School Students Using an STS Approach" (Dianne Robinson); "ERIC and Education about Science/Technology/Society" (John J. Patrick); and "Gypsy Moths in the Classroom" (Erik Mollenhauer). (DB)

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STS REPORTER

SCIENCE TECHNOLOGY AND SOCIETY

SPECIAL ISSUE NOVEMBER 1988

The Present Opportunity in Education is a position paper of the Triangle Coalition for Science and Technology Education. It was produced by a task force chaired by Gary Allen, and has been approved by the Triangle Coalition Steering Committee. We are pleased to disseminate this paper and invite reader comments. Dennis Cheek, Editor

The nation is poised at a decision point. A strong national consensus has developed on the social, economic, and competitive necessity for the improvement of education. It is time for an explicit national educational policy and decisive federal action to implement the policy. The need for action is especially critical in science and technology education. We cannot afford to have another generation of students who are unprepared to work and live in the technology-driven era of the future. From an early report on the present condition:

> **"The nation that dramatically and boldly led the world into the age of technology is failing to provide its own children with the intellectual tools needed for the 21st century."**
>
> The National Science Board Commission on Precollege Education in Science, Mathematics and Technology in *Educating Americans for the 21st Century*, 1983.

Too many American citizens are functionally illiterate in science and technology. This reduces their productivity in technical industries and their ability to play an informed role in social and political decisions with scientific/technological content. Furthermore, the talent pool of excellent U.S students planning for careers in science and engineering is shrinking while foreign students are eagerly filling their places in graduate schools.

This national failure has a direct cost to American industries. A significant amount of the $30 billion, which industry spends annually on training and personnel development, is caused by poor school preparation. In fact, business and industry spend as much annually on the most basic remedial education of employees as the federal government spends on science and mathematics education—and still the product is flawed. Unless drastic reform is brought about, we will see the loss of our industrial supremacy and of the vitality of our democratic processes. The fundamental needs in science and technology education are national in scope; the consequences of our continuing failure will be borne by all.

Thus, a large part of the responsibility for providing adequate resources for innovations and leverage for change in the nation's schools belongs to the federal government. But, despite overwhelming data from a multitude of well-researched studies, (some of which are included in this paper), our nation has yet to develop a comprehensive national policy for investment in science and technology education. While reforms have been undertaken at the local and state levels, and new federal legislation has been passed, a statement of national policy needs to be developed with focussed programs, clear goals, and adequate funding.

A NATIONAL GOAL

The nation must set as a goal the development of a broad pool of citizens who are interested and functionally literate in science and its applications in society.

The Triangle Coalition for Science and Technology Education has identified the key components of such a policy. We offer them here to help focus the national agenda in education on the improvement of science and technology, and specifically to provide guidance for increased and redirected federal spending for science and technology education.

We propose a policy with both short- and long-term significance. Program strategies to implement such a policy must explore options for fundamental educational change, as well as encourage adoption of exemplary programs that have been successful in schools.

A national science education policy must be sensitive to two broad needs:

- Ensuring that most young people have scientific and technological literacy adequate to cope with the demands placed on an individual by a scientific and technologically oriented society.

- Providing a deep pool of persons competent to become American leaders in scientific and technological research and development.

The policy response to these needs must be balanced and pursued in the context of enhanced public appreciation for the benefits of science and technology to the nation. The policy recommendations of the Triangle Coalition will require a critical balance of federal, state, and local investment by both public and private sectors.

POLICY RECOMMENDATIONS

Our fundamental recommendation is that the national science and technology education policy specifically target major areas of identified need.

The present politically driven programs, by evenly spreading assistance over all science disciplines, school districts, geographic areas, and grade levels result in a resource base at the point of need, which is too thin to nurture significant improvement. More than increasing the resource pool is needed. Resources must be concentrated where need is great and expectation of improvement is realistic.

The federal government must undertake major new responsibilities. The bulk of the effort, however, and most of the resources, will continue to be developed and focused at the local level. In particular, the promising new movement of broad-based, community collaborations, in the reform and support of science and technology education, should be deliberately stimulated and supported. Business/industry and others in the technical community must be encouraged to collaborate with educators in all phases of program development and implementation.

Critical Needs

New programs must be developed, present programs strengthened, and old strategies, which do not address these critical needs reexamined, to achieve the sharp focus required. We have identified the following five specific areas of need, which form the basis for the development of a national policy.

- Under-served students
- Inadequately prepared teachers
- Crucial subject matter areas
- Pivotal grade levels
- Neglected geographic areas.

1. Students

As the data we present in the following sections show, only a few U.S. students are performing successfully in school science, but the problem is critical for certain types of students. Initiatives must be developed to open science and technology to women, Blacks, Native Americans, Hispanics, and other minority populations presently underrepresented in technical/science courses and careers. A variety of strategies will be needed including early childhood programs for the economically disadvantaged. New science and technology curricula, with careful focus on the elementary level, need to be developed, and science and technology education must be consciously structured to nurture interest and develop skills at all grade levels.

2. Teachers

Programs must be devised to produce a pool of highly skilled science teachers, and to keep them current as their disciplines (and the techniques of teaching) grow and change. Many of these teachers must be adequately prepared to instruct students in more than one field of science. Priority must be given to increasing the representation, among science teachers, of the minority populations that will be an increasing percentage of the student body.

A priority effort must be given to reform of pre- and in-service education to bring elementary teaching in science and technology to a satisfactory level of competence.

Although the federal government must increase its funding of pre- and in-service education, there are many other mechanisms including programs at museums and the community-based "local alliances" described in the following section, which deserve encouragement and support.

3. Subject Matter

The physical sciences, including physics, chemistry, and the earth and space sciences are poorly presented in most school districts. There are serious shortages of adequately prepared teachers, and of the time and facilities to enable teachers to do these sciences with their students.

There is a corresponding need for new curricula materials in all areas, which present science and technology as an integrated and interactive area of learning. This curriculum must not only relate classroom teaching to the world that the students inhabit, but also must produce graduates with both the interest and the skills to continue to learn about science and its applications. This purpose is not being served by the present system of courses based on encyclopedic textbooks.

4. Pivotal Grade Levels

Deficiencies in science and technology education are most serious at the elementary level. The filtering off of minority students and women begins at this level. If only for this reason, resources for change must be concentrated here.

Undergraduate science and technology instruction is also in need of redirection and reform. U.S. colleges and universities must be encouraged and given the resources to make undergraduate science and technology instruction appropriate for future teachers, lawyers, managers, and other professionals. These institutions must also be encouraged, if not required, to develop programs and student incentives, which will guide more U.S. students, in particular women and minority students, into careers in science and engineering.

5. Geographic Areas

The waste of human resources is most obvious in the inner city. Educational reform programs of many types must be targeted here. Pay back will come, not only in later increases in productivity, but also in the form of decreased costs of retraining, welfare, law enforcement, and incarceration.

In the rural areas also, resource scarcity, isolation, and inappropriate curricula materials are creating a student population, which is grossly under-served by technical education. In rural America, schools in general, and technical education in particular, offer important opportunities for new careers, community development and long-term economic growth.

A New Constituency

The growth of "local alliances"—broad-based, community level collaborations to help teachers and schools improve science, mathematics, and technology education—is a new constituency for education, which should be targeted for support and expansion. The Triangle Coalition has developed links with a network of more than 250 such "local alliances," several of them statewide in nature. Much of the support for these local efforts comes from financial or in-kind contributions from business, industry, and labor. These efforts need recognition, "seed money," tax, and other incentives to strengthen existing groups and stimulate the formation of new ones.

We are encouraged that the recently enacted trade bill contains the following wording under Part B, Chapter 4: ". . . to encourage partnerships in science and mathematics education between the business community, museums, libraries, professional mathematics and scientific associations, private nonprofit organizations, appropriate state agencies and elementary and secondary schools." We look forward to the full funding and early establishment of programs under this authorization.

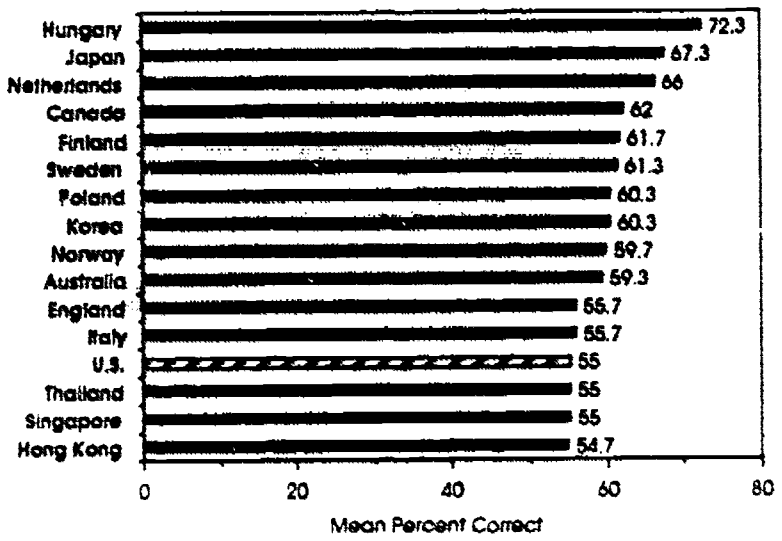
SIX MEASURES TELL THE STORY

To bring the problem into perspective we've selected data from research supported by the National Science Foundation and the U.S. Department of Education. These studies dramatically illustrate needs in each of the policy areas we have identified.

1. International Standing

On an identical international science achievement test, the U.S. ninth grade students ranked only slightly above the lowest of the 16 countries tested, (see Figure 1).

Figure 1. Grade Nine Science Achievement in 16 Countries



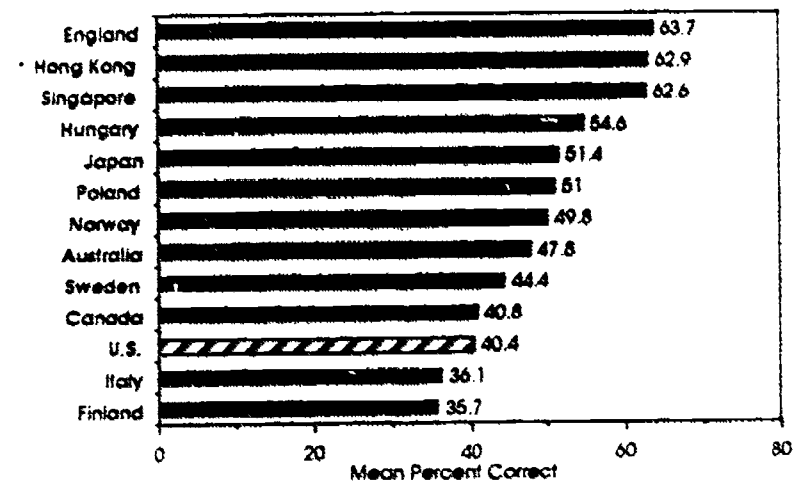
Source: "International Science Report Card" from the second IEA science study. 1988. p.3.

In 1986, U.S. students who were completing a second year of biology, chemistry, or physics were administered, along with students from other countries, a test in their specialty area. These advanced, college bound students scored:

- 13th (last) in biology
- 11th of 13 in chemistry and
- 9th of 13 in physics.

Overall in these three subject areas, U.S. advanced students ranked 11th of the 13 countries tested, (see Figure 2).

Figure 2. Advanced Science Students in Biology, Chemistry, and Physics (average of these tests)



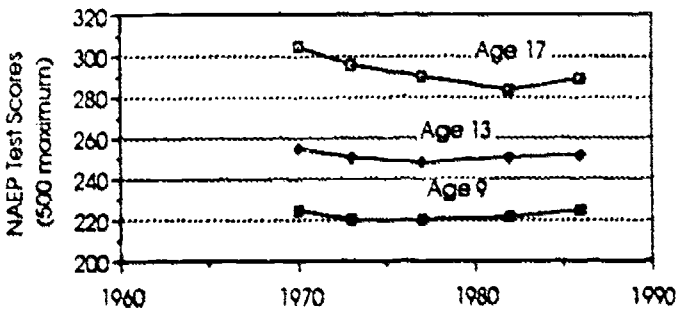
*Hong Kong data is average of two different classes

Source: "International Science Report Card" from the second IEA science study. 1988. composite data pages 4. 5. & 6.

2. National Trends

Performance of 9-, 13-, and 17-year-old students has been measured by the National Assessment of Educational Progress (NAEP) since the 1969-70 school year. After a steady decline in the 1970s, especially at age 17, student performance in science began to improve, but only the 9-year-olds have regained the 1969-70 level of proficiency, (see Figure 3).

Figure 3. National Trends in Average Science Proficiency for 9, 13, and 17-year-olds from 1969-70 to 1986



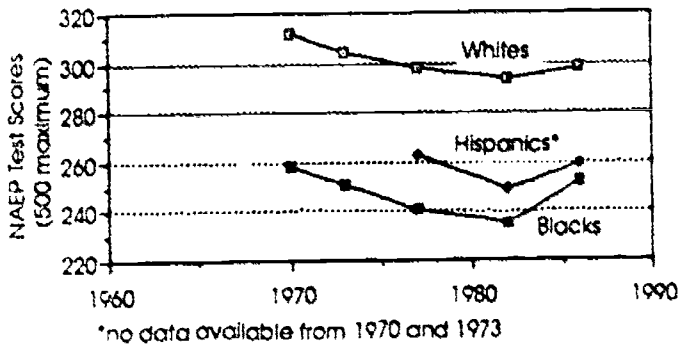
Source: NAEP data from 1970 to 1986, September 1988.

In addition, in their presentation of these data, the NAEP analysts warn us that most of this improvement has been at the rudimentary level—basic science facts and principles—and that even at the high school level, **"a majority of 17-year-olds are poorly equipped for informed citizenship and productive performance in the work place, let alone post-secondary studies in science."**

3. Trends by Gender and Ethnicity

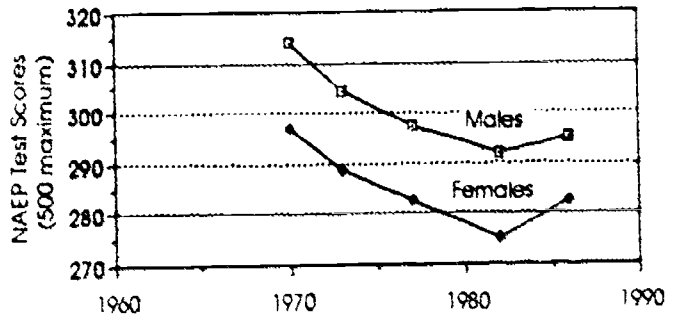
Most of our scientists and engineers are white males, and by 1990 the talent pool of white males will have shrunk by 30 percent. Bright women and minority students who currently avoid technical careers, for whatever reason, must be brought into that talent pool. Unfortunately, NAEP data offer little encouragement. While the gaps in proficiency scores have narrowed in the 80s, non-Asian minorities and women continue to score significantly lower, than their white male peers, in each of the age categories, (Figures 4 and 5 show this for 17-year-olds).

Figure 4. Trends in Average Science Proficiency for Whites, Blacks, and Hispanics age 17



*no data available from 1970 and 1973

Figure 5. Trends in Average Science Proficiency for Males and Females age 17



Source for Figures 4 & 5: NAEP composite data, September 1988.

4. Science Instruction

Among the possible explanations for poor student achievement are:

- Lack of emphasis on science
- Inappropriate curricula and instruction
- Poorly equipped classrooms
- Inadequately prepared teachers.

Here are some critical facts:*

- Recent national surveys found that 68 percent of students planned to stop taking science classes when minimum school requirements were satisfied.

- Over half of all 17-year-olds indicate that the science they learn in class is not useful in everyday life.

*Source: Weiss, I. R., "1985-86 National Survey of Science and Mathematics Education," November 1987.

- **Elementary classes (K-3) typically spend an average of only 18 minutes a day on science, less than half the average time spent on mathematics and one quarter the time spent on reading; upper elementary classes, grades 4-6, spend an average of only 29 minutes a day on science.**

- **One third of all elementary science classes are taught in classrooms that have no science facilities.**

- **Eleven percent of the third graders tested by NAEP reported never having a science lesson and another 13% reported science lessons less than once a week.**

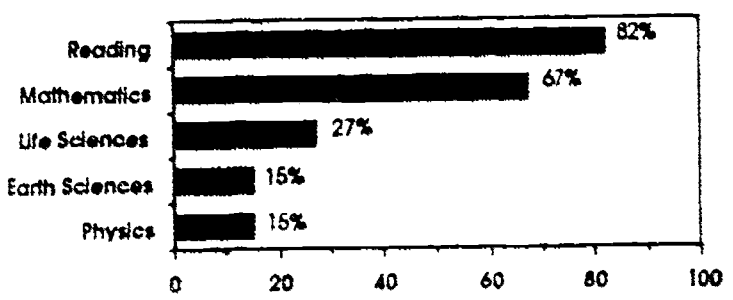
- **Nearly half of all seventh grade students report never having been asked to interpret data in their science classes. Forty percent or more of both seventh and eleventh grade students report that they have performed no science experiments in the past month.**

- **The vast majority of teachers and principals believe laboratory-based science classes are more effective than non-laboratory classes, but, overwhelmingly, lecture and discussion are the methods most often used.**

5. Science Teachers

Results from teacher self-assessments reveal startling data. While 82% of grade K-6 teachers feel well qualified to teach reading, and 67% to teach mathematics, only 27% believe they are well qualified to teach life science and even fewer to teach physical or earth/space science (15% in each case, see Figure 6).

Figure 6. Percentage of Elementary Teachers Who Believe They are Well Qualified to Teach by Subject Area

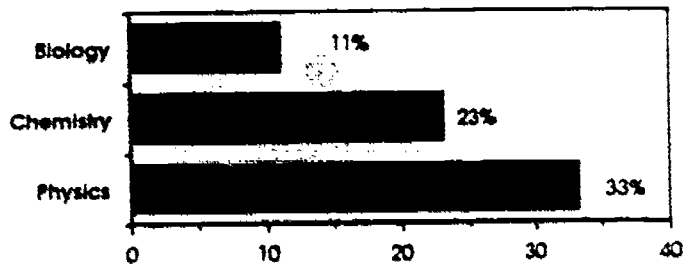


Source: NAEP survey data, September 1988.

It is interesting to note that one half of all the elementary teachers reported they had no in-service science education in the year previous to the assessment.

There is a great deal of "out of field" teaching in American science classes. Roughly half of all high school science teachers are assigned to teach at least one class outside their area of major college preparation. The problem of out-of-field teaching is serious in chemistry and physics, (see Figure 7).

Figure 7. Percentage of High School Classes Taught by Teachers Who did not Major in the Subject

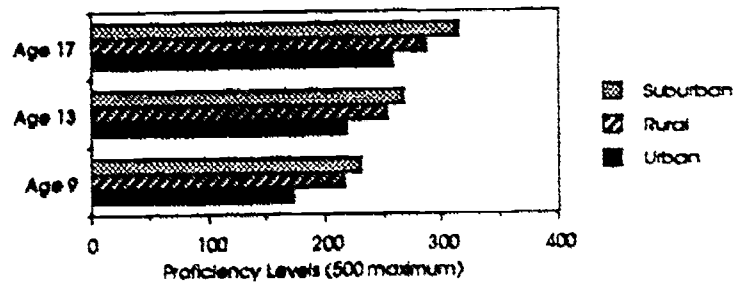


Source: Weiss, I.R., "Course Background Preparation of Science Teachers . . . A Paper Prepared for AAAS Forum on School Science," (1987).

6. Geographic Area

A significant proportion of our precollege students and teachers are in schools and communities where resources for technical education are scarce. This leads to inequality of opportunity and the growing problem of scientific and technological illiteracy among large segments of our youth. The performance differences among students from different geographic conditions are thus substantial. These data show differences much larger for urban-suburban areas than the black-white differences reported above, (see Figure 8).

Figure 8. Average Science Proficiency by Age and Geographic Region (1986)



Source: Weiss, I.R., "1985-86 National Survey of Science and Mathematics Education," November 1987.

Rural and urban elementary science classes are nearly twice as likely as suburban science classes to take place in a classroom with no science facilities, (see Figure 9).

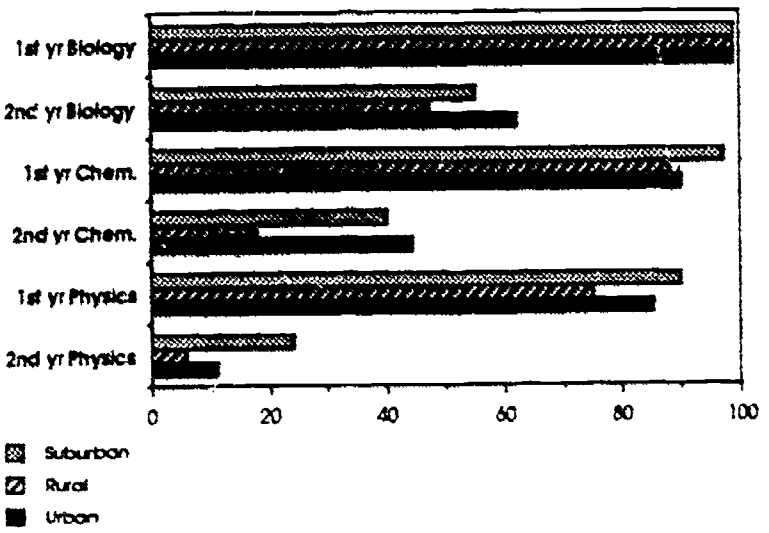
Figure 9. Type of Elementary Science Classrooms (Percent of Classes)

	Suburban	Rural	Urban
Laboratory or special science room.	12%	2%	3%
Classrooms with portable science materials.	61%	53%	50%
Classrooms with no science facilities.	27%	45%	45%

Source: Weiss, I.R., "1985-86 National Survey of Science and Mathematics Education," November 1987.

The differences among geographic areas in terms of both basic and more advanced high school courses normally considered essential to college work in science are shown in Figure 10.

Figure 10. High School Science Course Offerings by Type of Community



Source: Weiss, I.R., "1985-86 National Survey of Science and Mathematics Education," November 1987.

CONSEQUENCES

For most of this century, the United States has been a recognized world leader largely because its industries could out-produce those of any other country. This leadership depended in part on our rich resources of raw materials, but equally important were the production lines where qualified and skilled workers developed, constructed, and marketed high quality, mass-produced, inexpensive products.

Raw materials have now been seriously depleted, and our resource of large numbers of workers with adequate skills is no longer unique. Education has improved all over the world. Now, Europe, and especially Japan, Korea, and other Asian countries have developed mass production capabilities and have workers with more than adequate skills who are willing to work longer hours at lower pay than U.S. workers.

To compete with countries like West Germany, Japan, and Korea we must make a choice: a choice between two futures:

> We can upgrade the skills of a few workers in high-tech production jobs, and consign the rest to lower skilled jobs at low pay, lowering the overall standard of living.
>
> OR
>
> We can change our goals of production from goods to designs, technical services, and high-tech products with a corresponding change in the status and role of the worker. It is clear that the rich societies of the future will be those countries with high productivity and knowledge-based goods and services, countries that have large numbers of "highly skilled" workers using the most advanced technology available.

If we choose the high wage, high standard of living alternative, we face a massive educational challenge calling for immediate and substantial investment. From the evidence displayed earlier, it is clear that neither our existing work force, nor the one being presently educated in our schools has the technical or the reasoning skills to enable them to become the highly skilled workers that are needed.

The challenge is to prepare a well educated and scientifically literate future work force. Our present work force has a direct financial stake in meeting this challenge. When our parents retired, each of their pensions was supported by 17 workers. When the present "baby boom" generation begins to retire, the ratio will be about three workers per retiree, one of whom, on the average, will be a member of a minority population. To keep pensions healthy each of us needs three highly skilled, highly paid workers supporting us; we cannot afford to have any one of them, at age 50, chronically unemployed in a declining economy.

The challenge to the entire educational system is not an unprecedented one. It is much the same challenge, on a far larger scale, that the nation faced in the last century as we moved from a largely agrarian country to an industrial power. It is a lesson that the rest of the world has learned from us. Nevertheless, no country in history has mandated that the majority of its citizens become and remain well-educated. The numbers we are dealing with, of teachers, schools, and students are staggering and so the increase in the investment that will be needed to accomplish these goals, even if spread over a number of years, will be a large one. But, as Harold Hogkinson has repeatedly warned us, we are moving into a period when young people will be a scarce resource, and with a youth shortage, we cannot afford to let any child fail.

The challenge to science educators is quite specific, for science education bears much of the responsibility for developing the key skills for a high technology future. Success will be ensured with the implementation of a national policy of targeted support of critical areas of need. With such support science educators **can** produce students with an understanding of the basics of science and mathematics and the ability to apply them to the solution of technical and societal problems. The nation **can** prepare itself for a high technology future. The price of failure is to continue to slide toward a lower standard of living, and a second class world status.

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The Triangle Coalition for Science and Technology Education is a 501(c)3 nonprofit organization housed at NSTA, which serves as its fiscal agent. The Triangle Coalition staff operation is headed by Dr. John Fowler, Executive Director. 5112 Berwyn Road, 3rd Floor, College Park, MD 20740, (301) 220-0870.

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STS REPORTER

SCIENCE TECHNOLOGY AND SOCIETY

VOL. 1, NO. 2 FEBRUARY 1989

From the Editor's Desk . . .

The Fourth National Technological Literacy Conference (TLC IV), held February 3-5, 1989 at the Crystal Gateway Marriott Hotel in Arlington, VA was a gold mine of information and ideas for K-12 STS educators. Educational themes were evident throughout the conference, most notably on the opening day of the conference as Dr. James Rutherford, Chief Education Officer of AAAS and Director of Project 2061, focused attention on "Education for Societal Solutions". Dr. Mary Budd Rowe, former President of NSTA and Dr. Alan McClelland of the National Science Foundation gave considered responses to Dr. Rutherford's presentation. A series of moderators then led break out discussion sessions for the remainder of the morning.

The afternoon was filled with exemplary materials, courses, and programs for K-12 as well as college educators. Additional programs and materials were featured at workshops on Friday evening and Saturday. A listing of some programs featured and one of the presenters for each session is provided to enable you to solicit further information from presenters since many of our readership were not able to take advantage of this conference on site. A brief letter of enquiry regarding your interests and informational needs should receive replies from presenters and information on the costs of obtaining additional materials. Some of the presenters at TLC IV will briefly describe aspects of their programs for us in upcoming issues of the **Reporter.** Extended descriptions of many programs as well as other conference papers will become available as Conference Proceedings through the ERIC Network sometime in late summer. We will announce in the **Reporter** when those Proceedings are on line within the ERIC system.

— "Five Part NSF Project for Reforming K-8 Education in Phoenix, AZ", Dr. Frederick A. Staley, Division of Curriculum and Instruction (FEE), Arizona State University, Tempe, AZ 85287-0911

— "Middle School Approaches for Teaching Critical Issues: An Integrated Social Science/Science Perspective", Sherry L. Riley, Riley Elementary School, Walnut & Thomas, Fostoria, OH, 44830

— "The Use of Vertebrate Animals in Biomedical Research and Product Testing" (a high school level module), Stephen Baier, Emmaus High School, Emmaus, PA, 18049

— "An STS Academic Text for High School", Dr. Glen Aikenhead, Dept. of Curriculum, College of Education, University of Saskatchewan, Saskatoon S7N OWO, Saskatchewan, Canada

— "Sowing the Seeds of STS", Marilyn McClain, Secondary Gifted Program, South Area Office, Dade County Public Schools, 9040 SW 79th Avenue, Miami, FL, 33156

— "Appropriate STS Activities & Materials for the Elementary Classroom", JoAnne Wolf, Science Education Specialist, SSRC, Mesa Public Schools, 153 S. Alma School Rd., Mesa, AZ, 85234

— "STS Activities for Elementary Grades K-6", John A. Bartley, Science Supervisor, K-12, Springfield School District, 111 W. Leany Avenue, Springfield, PA, 19064

— "STS Efforts in Iowa: The Chautauqua Project", Susan M. Blunck, Coordinator, Iowa Chautauqua Program, University of Iowa, 767 Van Allen, Iowa City, IA, 55242

— "CHEMCOM: Future Opportunities for Promoting Chemistry Literacy", Dr. Sylvia Ware, Director, Education Division, American Chemical Society, 1155 Sixteenth St., NW, Washington, D.C. 30303

— "Tools for Implementing STS in the Science and Social Studies Curriculum", Lynn Parisi, Senior Staff Associate, Social Science Education Consortium, 855 Broadway, Boulder, CO 80302

An STS Learning Cycle for Middle School Students

Peter A. Rubba & Carmine L. DeCarlo

Looking for a hands-on, inquiry teaching strategy for use with middle school students that includes an STS dimension? The "learning cycle" may fulfill your needs.

The learning cycle is a well established instructional strategy first used in the SCIS elementary science project and later adopted by secondary science teachers. John Renner and Edmund Marek's book, *The Learning Cycle and Elementary School Science Teaching*, Heinemann, NY, 1988, is an excellent source on using the learning cycle with plenty of good, worked through examples from various fields of science.

The Learning Cycle

Learning cycle lessons are multiple sequences of three phases: exploration, concept introduction, and concept application. During exploration, learners are involved in concrete experiences with materials. These hands-on interactions are designed to challenge learners' cognitive structures by raising questions that the learner cannot answer based upon their current ways of viewing the world.

The next phase of the learning cycle, concept introduction, is designed to help learners deal with their mental disequilibrium from the exploration activity. The concept may be introduced by the teacher, the textbook, a film and/or other medium. Often the learners' mental structures remain unchanged and the disequilibrium persists.

The goal of the last phase of the learning cycle, concept application, is to attack this persistence of inadequate cognitive structures, by applying the concept to a broad range of new examples. For most students, these multiple conceptualizations result in both equilibration and understanding. A concept application can serve as an exploration phase for the next concept to be introduced, thus the name "learning cycle".

Using the Learning Cycle to Teach the Greenhouse Effect

Upper elementary and middle school teachers can incorporate the pedagogical strengths of the learning cycle with the timeliness and importance of an STS issue. We developed a STS learning cycle lesson on the greenhouse effect with six steps. In Step I, an exploration, learners observe the temperature inside two one-liter plastic soda bottles (one with holes cut into it) placed next to one another in sunlight (or under a heat lamp). Learners record their observations and inferences on a worksheet.

Step II (a concept introduction) begins with a review of the observations and inferences made in Step I. The teacher uses a sphere of clay placed on the tip of one of the thermometers that extend into each bottle to help learners draw an analogy between the plastic bottles and the earth's atmosphere, particularly the CO_2 in the atmosphere. The temperature data from Step I is used to introduce the "greenhouse effect". Climatic temperature changes over the past century as the amount of CO_2 in the atmosphere has increased are discussed.

For Step III (an application and exploration) groups of learners compile lists of human activities and natural processes that generate CO_2 and take CO_2 out of the atmosphere, and suggest ways by which we might reduce atmospheric CO_2.

Step IV (a concept introduction) begins with a discussion of Step III. The synthesized lists of activities and processes is used to focus on major contributors to atmospheric CO_2, e.g. fossil fuel use and deforestation. We decided to

continued on page 4

> "If I had control of education, I should expose children to the most vehement and eloquent advocates on all sides of every topical question, who should speak to the schools from the B.B.C. The teacher should afterwards invite the children to summarize the arguments used, and should gently insinuate the view that eloquence is inversely proportional to solid reason. To acquire immunity to eloquence is of the utmost importance to the citizens of a democracy."
>
> Bertrand Russell,
> Famous philosopher & mathematician

A Precollege Science Enrichment Program for High School Students Using an STS Approach

Dianne Robinson

General Telephone and Electric Company (GTE) funds a science enrichment program at Hampton University in Virginia for minority high school students. Thirty-eight students participate in the two year program, which provides a variety of experiences in science that relate to both the technology students use and the society in which they live. The program, upon initial review, shows success in both fostering interest in and instilling knowledge of science.

The target population for the program were not gifted students as identified by traditional academic tests. Instead, the participating students, after nominating themselves, were selected on the basis of recommendations from their teachers. The program sought students who were perceived, in spite of their failure to excell academically, as being very capable underachievers.

Student involvement commenced with six Saturday sessions during their junior academic year in high school, continued with a two week summer session, and will conclude with six Saturday sessions during their senior year. The activities stressed not only content enrichment, but also development of student interest in the sciences. All science activities were developed along STS lines, stressing the impact of science on technology and society. In addition to the science activities, the program continually interwove short sessions on the process of applying for admission to college, financial aid information, and study skill development.

During the first Saturday session, students were given an overview of the program. For the remainder of the day, they participated in small groups in an environmental simulation focused on current problems in the Chesapeake Bay and estuary (Hampton University is situated along this estuary). These activities, as well as several others, were recorded on video tape for purposes of documentation of the program and student feedback.

Another Saturday's activity involved hands-on experience in the area of chemistry and physics. In the chemistry program, students were involved in inorganic experiments followed by discussion of the relationship of these activities to technology and society at large.

During another session, students were exposed to physics in connection with work with lasers and laser light phenomenon. These activities stressed the use and impact of this technology both on today's world and possible implications for the future. Students developed a mini "Mr. Wizard" series to demonstrate science to younger children using this activity as a model. These student demonstrations before younger students not only serve to foster participants' interest in science but also provide enrichment and modeling for these younger children.

Additional Saturdays involved marine science and wildlife management. The marine science component was conducted at the University's marine science center, where both physical and biological oceanography were explored. The wildlife management program was conducted in cooperation with the Newport News Park Nature Center. Students observed animal habitats in the wild, and became aware of conservation efforts focused upon ways in which man and animals can more effectively coexist in their environment. Students were exposed to techniques of wild animal capture, and to various strategies used to control animal populations within a nature preserve.

During the entire two week summer period, students were transported by bus to and from the university campus. They became familiar with the college environment by eating lunch with mentor graduate students in the cafeteria. Additional activities included areas of personal improvement, study skills enhancement, and preparation for college. Extra enrichment activities were offered by university personnel from the offices of admissions and student assessment. The science-related activities of the summer session were conducted on campus and at various locations which would allow single day excursions. One such off-campus activity involved the study of marine and coastal water at the Wachapreague research station on the Eastern Shore of Virginia. Here the students took an active part in dredging, seining, and other sampling activities. An island in the process of development was also explored.

During the students' senior year in high school Saturday sessions will continue. They

will emphasize the further development of study skills which students will need to succeed in college.

The program has clearly fostered interest in science among minority students. Although initially designed for twenty students, applications were received from over one hundred qualified students. The initial interest has not waned. In fact, every student who participated in the junior academic year chose to apply for the upcoming summer program. Continuation of this program and its implementation in other localities, should increase minority participation in the study of science and technology at the college level. To encourage the implementation of similar programs, the program administrator will be happy to furnish a detailed daily schedule and additional information to interested readers. Address your request to Dr. Dianne Robinson, Director of Interdisciplinary Science Center, Phenix Hall, Rm. 202, Hampton University, Hampton, VA 23668.

"Our society has two needs in technical training and education. One is the need of our industries, universities, and public sector for highly educated scientists and engineers. The second need is also vital, but less appreciated. It is the need for a scientifically literate public.

Let me also make a more general point. In nearly all of our nation's science and engineering affairs, we have neglected in the past to gain broad public acceptance. We have not educated the public as to our intentions; why the need exists, what the problems are, what the solutions are, and so forth. As a consequence, we don't receive public support at the point at which we really need it."

Eric Bloch,
Director, National Science Foundation

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"Students should acquire enough science literacy in high school to enable them to function as educated citizens in the body politic....If we are attempting to make them biologists in their first course, we are not going in the right direction."

Evelyn E. Handler,
President of Brandeis University

STS Learning Cycle

continued from page 2

focus on deforestation, its connections with the carbon and hydrologic cycles, and the role of trees in preventing soil erosion. In addition, the social studies associated with land reform in third-world nations, like Brazil, could be introduced. The list of actions provides an opportunity to introduce or reinforce the STS concept of "no free lunch".

Students construct and administer a questionnaire in Step V (an application) to determine what actions, if any, people in the community are willing to take to help resolve the greenhouse effect. The data are analyzed in class. Conclusions and implications are drawn for communication through media such as a school newspaper.

Step VI (an application) focuses on involving students in a tree planting project (or some other action relevant to the greenhouse effect). A visit to a tree farm or a classroom visit by a conservation agent is recommended.

Suggested teacher resources on the greenhouse effect include: "A Green Fix to the Global Warm-up" by Sandra Postel (*Worldwatch*, October 1988) and "Endless Summer: Living with the Greenhouse Effect" by Andrew Revkin (*Discover*, October 1988).

An AppleWorks text copy of our "Greenhouse Effect" lesson plan can be secured by sending a blank 5 1/4 inch floppy disk and a pre-addressed floppy disk mailer with correct postage applied to the authors at 165 Chambers Building, The Pennsylvania State University, University Park, PA, 16802.

Peter A. Rubba is Associate Professor of Education and Carmine DeCarlo is a Doctoral Student in Science Education at Penn State.

REVIEWS OF CURRICULUM MATERIALS & RESOURCES

This issue introduces a different fo[illegible]t for reviews. All STS materials will be reviewed using the symbols and number designations d[illegible]ed below. A separate category titled "Also of interest" will contain narrative reviews of non-STS but potentially useful materials.

Overall Appraisal

1 — **Highly recommended.** The material contains no serious errors or deficiencies, and the reviewer thought the content and presentation were excellent.

2 — **Recommended.** The material contains no serious errors or deficiencies, and the reviewer thought the content and presentation were above average.

3 — **Acceptable.** The material contains no serious errors or deficiencies, and the reviewer thought the content and presentation were average.

4 — **Not recommended.** The material contains serious errors of fact and/or deficiencies in development.

Audience Suitability

K Preschool or kindergarten
EP Elementary, grades 1 & 2
EI Elementary, grades 3-5
MS Middle school, grades 6-8
HS High school, grades 9-12
AP Advanced placement HS students only
T Teaching professional

Two consecutive levels are separated by a comma; e.g. **K, EP.** Three or more consecutive levels are condensed to show youngest and oldest age groups, and the symbols for these separated by a dash; e.g. **K-EI. T** is always noted separately.

STS Criteria

The material is assigned a number for each lettered criterion by the reviewer. 0 means that criterion is nonexistant. 1 is minimally present. 2 is adequately present. 3 is obviously present and presented well. The criteria are as follows:

A — The relations of technological or scientific developments to societally-related issues are made clearly, early, and in compelling ways to capture attention.

B — The mutual influences "technology", "science", and "society" on each other are clearly presented.

C — The material develops learners' understanding of themselves as interdependent members of society and responsible agents within the ecosystem of nature.

D — The material presents a balance of viewpoints about the issue(s) and options without necessarily striving to hide the author's perspective.

E — The material helps learners to venture beyond the specific subject matter to broader considerations of science, technology, and society, including the treatment of personal and societal values/ethics.

F — The material engages students in developing problem-solving and decision-making skills.

G — The material encourages learners to become involved in a societal or personal course of action after weighing the trade-offs among values and effects drawn from various scenarios or alternative options.

H — The material uses this STS linkage to foster learners' confidence in handling and understanding at least one limited "science-technology" area, and/or handling and using some quantification as an aid to judgments in the STS area.

Stop by and say Hello to us at ASCD National in Orlando or NSTA National in Seattle!

The National STS Network booth will be at both conventions. Plan to drop by and meet other STS educators. Find out more about The Network and efforts in your region of the nation.

STS Trade Books Reviews

The State of the States–1987.

Fund for Renewable Energy and the Environment, Wash., D.C., 1987.

OVERALL APPRAISAL: 1

AUDIENCE SUITABILITY: EI – HS

STS CRITERIA:

A	0	1	2	3
B	0	1	2	3
C	0	1	2	3
D	0	1	2	3
E	0	1	2	3
F	0	1	2	3
G	0	1	2	3
H	0	1	2	3

The State of the States 1987, is a brief publication prepared by the Fund for Renewable Energy and Environment (FREE). Its purpose is to "call attention to states that have effectively responded to mounting environmental problems." These environmental problems are: air pollution, solid waste recycling, soil conservation, hazardous waste management, and renewable energy conservation.

A crisp introduction frames the challenge: "the United States has reached a turning point in environmental progress. As costs for protection of (the public) have risen, the federal government has retreated from its traditional support." A description of each problem, its role in the life cycle, and its status of treatment according to FREE criteria follow. Tables, charts, graphs, and "Model Treatment Snapshots" supplement the national analysis.

The format and content of *State of the States* are ideal for the STS approach. Students can readily compare local and state efforts to the "models." The myriad illustrations can double as classroom tools or as catalysts to provoke community clean-up action.

The only defect of *State* is its provincialism. Nothing is said about the global dimension. The assumption seems to be that if U.S. problems are corrected, the world will flourish. An international effort with the same format would be welcome.

Mark Welter
Robbinsdale-Cooper High School
Minneapolis, MN

Science and Social Issues.

David E. Newton, J. Weston Walch Pub., Portland, ME, rev. ed., 1987.

OVERALL APPRAISAL: 1

AUDIENCE SUITABILITY: HS, T

STS CRITERIA:

A	0	1	2	3
B	0	1	2	3
C	0	1	2	3
D	0	1	2	3
E	0	1	2	3
F	0	1	2	3
G	0	1	2	3
H	0	1	2	3

Each day when we pick up the newspaper we are faced with a wide array of issues that affect our well-being and that of the societies we live in. How are we to react to a Chernobyl, or genetically engineered mice or AIDS? What does it all mean to us? It is essential with such a flood of technical and complex information that we have some measure of understanding of the science behind the issues and an ability to process the information in a meaningful way. David Newton's book, *Science and Social Issues* helps develop such skills. The book is divided into three parts, Issues for the Biological Sciences, Issues for the Physical Sciences and Science as a Social Institution. There are thirty-eight topics in all, covering such diverse areas as **"Defining Death," "Pesticide Problems"**, and **"Government Control of Science."** Each follows a similar format: an introduction, that provides a brief background to the subject matter; a case study, which leads to a major question that students must take some action on; further questions and a reading list. I liked the way in which the issues were presented and feel that they could readily be incorporated into the regular science curriculum. Additionally, the book could stand alone in a course where science and social issues were the primary focus.

Christine O'Sullivan
McCorristin High School
Trenton, NJ

Science in the Marketplace,

Florence G. Korchin, Tiger Pub., Red Bank, NJ, 1983.

OVERALL APPRAISAL: 2

AUDIENCE SUITABILITY: MS, HS

STS CRITERIA:

A	0	1	2	3
B	0	1	2	3
C	0	1	2	3
D	0	1	2	3
E	0	1	2	3
F	0	1	2	3
G	0	1	2	3
H	0	1	2	3

Science in the Marketplace offers a wide variety of information and lab alternatives for use in curriculum with a STS approach. The text contains 70 lab experiences which includes basic mathematical formulas and operations for scientific application; biology (nutrition and diet emphasis), physics (heat, electricity and energy conservation) and chemistry (emphasizing product testing). It allows students to study science as it exists in the 'real' world. The lab experiences use common materials which students can easily obtain.

The best utilization of the text would be in grades 7-12. Little or no science and math background is required for the use of the readings or labs. The format and content of the text stresses the use of science information in making good decisions and emphasizes being a smart and informed consumer. The information is relevant, accurate, and of high interest to students.

I believe this text would best be used as a supplemental and resource text rather than the sole source of information in a course or unit. The book would be a valuable source of ideas and information for anyone using an STS approach in the classroom.

Morgan Masters
Chariton Community Schools
Chariton, Iowa

Energy for a Sustainable World,

Jose Goldemberg, T.B. Johansson, A.K.N. Reddy, R.H. Williams, World Resources Institute, Wash., D.C., 1987.

OVERALL APPRAISAL: 1

AUDIENCE SUITABILITY: AP and T

STS CRITERIA:

A	0	1	2	3
B	0	1	2	3
C	0	1	2	3
D	0	1	2	3
E	0	1	2	3
F	0	1	2	3
G	0	1	2	3
H	0	1	2	3

This title is a comprehensive attempt to bring the energy crisis into focus in a relevant fashion. The book presents the findings of the End-Use Global Energy Project that the writers organized. The authors use the oil-price shocks of the early 1970's to tie in technological and scientific developments with the critical issues facing society in the 1980's and beyond.

Liberal use of statistics in the form of charts and graphs covering a variety of energy forms and use are utilized. All of these appear to be extremely relevant to the average consumer. For example, Chapter V entitled, "Changing the Political Economy of Energy", makes many salient points about the benefits of energy consumption comparing the individual consumer and society in general.

Suitable for Advanced Placement classes and for teaching professionals, the average reader might become overwhelmed by the vast array of statistical data presented, e.g. Chapter III, "Alternative Energy Futures". In general, this text is well written and superbly illustrated and would make an excellent supplemental textbook for a STS high school course not only in the area of energy, but also in areas such as economics and population.

Earl Lawrence Munger
North Kansas City Public Schools
North Kansas City, Mo.

MATERIALS RECEIVED BY THE STS REPORTER

A Basic Guide to Nuclear Power, Barbara Martocci, Greg Wilson, Edison Electric Institute, Washington, D.C., 1987.

A Brief History of Science, A. Rupert Hall, Marie Boas Hall, Iowa State University Press, Ames, IA, 1988, reprint of 1964 title.

A Guide to Career Planning and Job Hunting, Raynor Cannastra Associates, Eds., Edison Electric Institute, Washington, D.C., 2nd rev. ed., 1988.

Biology Updated, David E. Newton, J. Weston Walch Pub., Portland, ME, 1987.

Biomedical Ethics — Opposing Viewpoints, Julie S. Bach, Ed., Greenhaven Press, St. Paul, MN, 1987.

Born Different: The Amazing Stories of Some Very Special People, Frederick Drimmer, Macmillan Pub., New York, 1988.

ChemCom — Chemistry in the Community, American Chemical Society, Kendall/Hunt Publishing Co., Dubuque, IA, 1988.

Chemistry Updated, David E. Newton, J. Weston Walch Pub., Portland, ME, 1986.

Citizen Participation in Environmental Affairs, 1970-1986: A Bibliography, Frederick Frankena, Joann Koelln Frankena, AMS Press, New York, 1988.

Citizen's Guide to Global Issues, Walter H. Corson, Ed., Global Tomorrow Coalition Inc., Washington, D.C., 1985.

Connecting Science, Technology, and Society in the Education of Citizens, John J. Patrick, Richard C. Remy, Social Science Education Consortium Inc./ERIC Clearinghouse for Social Studies/Social Science Education, Boulder, CO, 1985.

Construction Technology, Mark W. Huth, Delmar Publishers, Inc., 2nd ed., 1989.

Cooperative Learning, Cooperative Lives — A Sourcebook of Learning Activities for Building a Peaceful World, Nancy Schniedewind, Ellen Davidson, Wm. C. Brown Pub., Dubuque, IA, 1987.

Creative Role Playing Exercises in Science & Technology, Lynn Parisi, Ed., Social Science Education Consortium, Boulder, CO, 1986.

Dawn of Modern Science, Thomas Goldstein, Houghton Mifflin Co., Boston, 1988.

Development Education — Making It Work In and For Your Organization, Beth Rosenthal, Care, NY, n.d., 1987(?)

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Exploding the Hunger Myths — A High School Curriculum, Sonja Williams, The Institute for Food and Development Policy, San Francisco, 1987.

Findings from the 1986-87 Nationwide Survey of Secondary School Teachers of Physics, Michael Neuschatz, Maude Covalt, American Institute of Physics, New York, 1988.

Food First Curriculum — An Integrated Curriculum for Grade 6, Laurie Rubin, the Institute for Food and Development Policy, San Francisco, 1984.

Futuristics, Joey Tanner, Zephyr Press, Tucson, 1981.

Global Population Trends — Challenges Facing World Leaders, Population Reference Bureau, Washington, D.C., 1986.

Great Lives — Exploration, Milton Lomask, Charles Scribner's Sons, New York, 1988.

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Investigating Science with Young Children, Rosemary Althouse, Teachers College Press, Columbia University, New York, 1988.

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Light, Lasers, and Optics, John H. Mauldin, TAB Books, Blue Ridge Summit, PA, 1988.

Living in the Environment, G. Tyler Miller Jr., Wadsworth Pub., Belmont, CA, 5th ed., 1988.

Living with Technology, Michael Hacker, Robert Barden, Delmar Publishers, New York, 1988.

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More Science For You 112 Illustrated Experiments, Bob Brown, TAB Books, Blue Ridge Summit, PA, 1988.

More Wires and Watts: Understanding and Using Electricity, Irwin Math, Charles Scribner's Sons, New York, 1988.

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Science as Power — Discourse and Ideology in Modern Society, Stanley Aronowitz, University of Minnesota Press, Minneapolis, 1988.

Science, Engineering, & Ethics — State of the Art and Future Directions, Mark S. Frankel, Ed., AAAS, Office of Scientific Freedom and Responsibility, Washington, D.C., 1988.

Science Fair: Developing a Successful and Fun Project, Maxine Haren Iritz, TAB Books, Blue Ridge Summit, PA, 1987.

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Scientists and Technologists, Irene M. Franck, David M. Brownstone, Facts on File Publications, New York, 1988.

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Strengthening Geography in the Social Studies, Salvatore J. Natoli, Ed., National Council for the Social Studies, Washington, D.C., 1988.

STS — Model Lessons for Secondary Social Studies Classes, Robert LaRue Jr., Ed., Social Science Education Consortium, Boulder, CO, 1988.

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The Big Rock, Bruce Hiscock, Atheneum, New York, 1988.

The Cultural Dimensions of Educational Computing — Understanding the Non-Neutrality of Technology, C. A. Bowers, Teachers College Press, Columbia University, New York, 1988.

The Environmental Crisis — Opposing Viewpoints, Julie S. Bach, Lynn Hall, Eds., Greenhaven Press, St. Paul, MN, 1986.

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The Learning Cycle and Elementary School Science Teaching, John W. Renner, Edmund A. Marek, Heinemann Educational Books, Portsmouth, NH, 1988.

The Nature of Science, Frederick Aicken, Heinemann Educational Books, Portsmouth, NH, 1984.

The Origin and Evolution of our Own Particular Universe, David E. Fisher, Atheneum, New York, 1988.

The Roadside, David Bellamy, Clarkson N. Potter Inc. Pub., 1988, distributed by Crown Pub., New York.

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The Timetables of Science — A Chronology of the Most Important People and Events in the History of Science, Alexander Hellemans, Bryan Bunch, Simon and Schuster, New York, 1988.

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Transportation, Energy, and Power Technology, Anthony E. Schwaller, Delmar Publishing Co., New York, 1989.

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Also of Interest . . .

Science for Children: Resources for Teachers.

National Science Resources Center. National Academy Press, Wash., D.C., 1988.

Science for Children: Resources for Teachers should be on every teacher's bookshelf. Prepared by the National Science Resources Center as a joint undertaking of the National Academy of Sciences and the Smithsonian Institution, this guide admirably fulfills its stated purpose: to assist those working to improve elementary science education. The materials described in this guide provide valuable support for implementing or maintaining effective hands-on, inquiry-based programs. The first section of the guide, Curriculum Materials, contains printed descriptions of currently available activity-based science materials. Teachers have ready access to those printed resources that are most appropriate for their classroom needs. In this reviewer's eyes, just knowing where to obtain out of print material, such as ESS units, is well worth the price of this resource guide. Section two lists valuable supplementary resources available to science educators. Sources of information and assistance are listed in section three of the guide. Museums and science technology centers that provide local outreach, kits, publications, teacher training, or other services, are listed here. Although this book contains nothing on science computer software, it is still the most comprehensive resource guide for elementary science teachers.

John Shimkanin, is on leave of absence from Northern Potter School District while pursuing doctoral studies at Penn State.

Science and the Making of the Modern World.

John Marks. Heinemann Educational Books. Portsmouth, NH, 1983.

In *Science and the Making of the Modern World*, the author makes an attempt to set out what the educated scientist needs to know to bring an informed and critical mind to the contemporary place and influence of science in society. This book aims to give an account of how science has developed and how it has come to play a very important part in our daily lives. It provides background knowledge essential to make an intelligent contribution to current issues on the interactions between science, technology and society. The book begins with a historical overview to the end of the 19th century and a descriptive review of the major scientific advances in the 20th century. It shows how scientific knowledge must be tentative by describing the ways in which ideas, once firmly believed, have been modified. Next it reports how, as science grew, specialist sciences developed and how many of these special fields reunited in some of the great discoveries of this century. It also indicates the ways science depends on the climate of thought prevailing at any particular time and how much of science is cumulative and universally valid. Finally, the book describes how science has developed in different societies and how these societies have made use of science. In addition, the book includes case-studies of problem areas such as environmental pollution and the development of nuclear power. The approach offered by this text differs from many other books on science and society because it deals with case-studies after the historical and comparative material has been presented.

The main focus throughout this volume is the development of scientific knowledge which, despites its limitations, is the most substantial and universal body of interlocking theoretical and empirical knowledge yet achieved. Scientists, teachers and students will find this text intellectually satisfactory and it will enable them to make a more balanced assessment of controversial issues of science policy.

Rene Pico is a GTE fellow in Science, Technology and Society at Penn State.

Learning in Science — The Implications of Children's Science

Roger Osborne and Peter Freyberg, Heinemann Publishers, Portsmouth, NH, 1985.

Successful engagement of students regarding STS issues requires adequate knowledge of scientific concepts. This book presents findings from recent studies which show that even very young children have developed faulty meanings for words and views about the world which influence their subsequent learning in science. These misconceptions can be considered by children to be more sensible and more useful than the scientific explanations presented to them by teachers.

The authors cite studies in which a large proportion of pupils had incorrect meanings of words such as *life* and *animal*. Gravity, to many children, increased with height above the earth's surface. A significant proportion of 17-year-old chemistry students believed that on evaporation water changes into oxygen and hydrogen gases. The purpose of a science activity perceived by pupils is frequently not the purpose intended by the teacher.

Freyberg and Osborne discuss these studies, explore how discrepancies between teachers' intentions and learners' experiences can be reduced, and consider assumptions we as teachers make about teaching and learning. Part Four of the book describes several teaching models and introduces one which outlines how children's views might be clarified, challenged and modified. Part Five indicates some of the implications of this research for other areas of the curriculum and for teacher education. This is a well-written book and a worthwhile addition to an educator's bookshelf.

Barry Brucklacher is an experienced science teacher at both HS and elementary levels and currently a doctoral student in science education at Penn State.

Materials Received by the STS Reporter

continued from page 10

200 Illustrated Science Experiments for Children, Robert J. Brown, TAB Books, Blue Ridge Summit, PA, 1987.

Urban Stress Test, Zero Population Growth, Washington, D.C., 1988.

U. S. Population: Charting the Course, Population Reference Bureau, Washington, D.C., 1988.

U.S.A. by Numbers Teaching Kit, Zero Population Growth, Washington, D.C., 1988.

Values and Biology, Charles H. Butterfield, J. Weston Walch Pub., Portland, ME, 1983.

World Food Day Curriculum, Grades K-12, Office on Global Education, Church Wor'd Service, Baltimore, MD, 1986.

World Hunger — Twelve Myths, Frances Moore Lappe, Grove Press, New York, 1986.

World Population: Facts in Focus, Population Reference Bureau, Washington, D.C., 1988.

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STS REPORTER

SCIENCE TECHNOLOGY AND SOCIETY

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ERIC and Education about Science/Technology/Society

by John J. Patrick

What are the major trends and issues on teaching and learning of science-related social issues? What do the latest surveys reveal about the technological literacy of secondary school students? What do studies of textbooks and curriculum guides reveal about STS content in elementary and secondary school courses? What is the impact of STS instruction on middle school students of science? If you want information about these kinds of questions, then turn to ERIC.

What Is ERIC?

ERIC (Educational Resources Information Center) is a federally-funded nationwide system of sixteen clearinghouses. It is managed by the Office of Educational Research and Improvement (OERI) of the U.S. Department of Education. Each ERIC clearinghouse is responsible for acquiring, processing, and reporting the significant educational literature in its subject field. The ERIC Clearinghouse at Indiana University's Social Studies Development Center, for example, is responsible for monitoring and disseminating information about education in the social studies. This component of the ERIC system—the Clearinghouse for Social Studies/Social Science Education—is widely known by its acronym, ERIC/ChESS.

A rich flow of information regularly moves through ERIC/ChESS in various formats: research reports, curriculum guides, conference papers, model classroom lessons, policy papers, journal articles, and so forth. Many of these documents pertain to education about STS. ERIC/ChESS prepares these items for entry into the ERIC database, where it is stored and made available to researchers, teachers, educational policymakers, and other interested parties. Data are reported monthly in *Resources in Education (RIE)* and *Current Index to Journals in Education (CIJE)*.

Resources in Education (RIE)

ERIC clearinghouses solicit documents on educational research and practice, which they index, abstract, and send to the ERIC Processing and Reference Facility. The abstracts of processed ERIC documents are announced in a monthly publication, *Resources in Education*. ERIC/ChESS provides all of the input to RIE in its subject field, which includes documents on the societal aspects of STS. Documents that primarily treat the science/technology facets of STS are handled by the ERIC Clearinghouse for Science, Mathematics, and Environmental Education, which is located at the Ohio State University.

Here are eight examples of documents (among hundreds) included in the ERIC database and announced in RIE, which pertain to education about science/technology/society.

— ED 293 690, *Goals Attainment in Science/Technology/Society Education: A Probe into the Case of British Columbia* by Uri Zoller and others, 1988.

— ED 293 214, *Science/Technology/Society Education and Citizen Participation* by Leonard J. Waks, 1988.

— ED 292 641, *Assessing Impact of S/T/S Instruction in 4–9 Science in Five Domains* by Robert E. Yager and others, 1988.

— ED 289 737, *Science/Technology/Society: Preparing for Tomorrow's World, Teacher's Guide* by Louis A. Iozzi, 1987.

— ED 288 783, *Science/Technology/Society: A Framework for Curriculum Reform in Secondary School Science and Social Studies* by Faith Hickman and others, 1987.

— ED 287 794, *Connecting Science and Free Government in Citizenship Education: Teaching*

about Our Legacy from the Age of Enlightenment by John J. Patrick, 1987.

— ED 278 610. *The Role of the Secondary Social Studies Curriculum in Developing Technological Literacy* by Charles S. White, 1987.

— ED 278 609. *Including Science/Technology/Society Issues in Elementary School Social Studies: Can We? Should We?* by Gerald W. Marker, 1987.

Each document if the *RIE* database has an ED number, which can be used to identify and gain access to the document. Documents may be purchased in microfiche or paper copies from the ERIC Document Reproduction Service (EDRS), 3900 Wheeler Avenue, Alexandria, Virginia 22304-5110; telephone numbers of EDRS are (703) 823-0500 and (800) 227-3742. ERIC documents are also available for viewing in microfiche at libraries that subscribe to the ERIC database.

Current Index to Journals in Education (CIJE)

The ERIC clearinghouses monitor education journals in their respective subject fields, and each clearinghouse indexes and annotates articles in the journals assigned to it. The ERIC Clearinghouse for Social Studies/Social Science Education (ERIC/ChESS) for example, indexes and annotates articles from more than eighty-five journals that publish articles on the social studies/social sciences. Some of these publications include articles on various aspects of education about STS.

All annotations of journal articles covered by the ERIC clearinghouse appear in the *Current Index to Journals in Education*, which is published monthly and is available at libraries throughout the country. Articles listed in *CIJE* are not available through the EDRS. They are likely to be found in most libraries and can be located easily by using information in *CIJE*. Copies of most articles listed in *CIJE* are also available from University Microfilms International (Article Clearinghouse), 300 North Zeeb Road, Ann Arbor, Michigan 48106; the telephone number is (800) 732-0616.

Submitting Documents to ERIC

ERIC/ChESS wants to receive documents from STS educators for inclusion in the database. Examples of kinds of materials collected by ERIC are research reports, position papers, monographs, evaluation studies, teaching guides, bibliographies, curriculum guides, units of instructional materials, syllabi, papers presented at conferences and conventions, and project reports. ERIC seeks both published and unpublished documents for the database. Unpublished documents ("fugitive" materials"), not usually available through conventional channels, are especially desired by ERIC.

Documents accepted by ERIC are reproduced on microfiche and distributed to the more than 750 current subscribers to the ERIC microfiche collection. ERIC documents are constantly available because a master microfiche, from which copies can be made, is kept at the ERIC Document Reproduction Service (EDRS).

Documents in the ERIC database can be identified through online database retrieval services, such as BRS, DIALOG, and ORBIT. In addition, there are hundreds of locations, including university libraries, offering computer searches of ERIC based on compact disk (CD-ROM) systems.

Conclusion

ERIC, the world's largest database on education, includes significant information for educators in the emerging field of science, technology, and society. STS educators are invited to make regular use of this database through computer searches of it and through purchases of ERIC documents from EDRS. Teachers and researchers are also urged to contribute to the ERIC database. Please send these kinds of items to the ERIC/ChESS headquarters address for consideration as entries into the database:

John J. Patrick
Director, ERIC/ChESS
Social Studies Development Center
2805 East Tenth Street
Bloomington, Indiana 47408-2698.
Telephone: (812) 855-3838.

"Scientific understanding is more and more a prerequisite for informed citizenship. . . . If U.S. citizens of tomorrow are not scientifically literate, we put our democracy at risk."

Mary H. Futrell
President of NEA

Gypsy Moths in the Classroom

Erik Mollenhauer

Introduced to Massachusetts in the 1860's from Europe, the gypsy moth quickly spread to become probably the most notorious insect pest in the Northeast. Millions of dollars have been spent to eliminate the moth, or halt its spread, with little success. Much of this money has been spent on chemical insecticides. As a result, the gypsy moth has become for many communities a social problem as well as an environmental problem, and the question "to spray or not to spray" is the source of many heated debates. Gypsy moths are now solidly established in 15 states of the Northeast and Michigan, while spot infestations occur all the way west to California.

Yet very little effort has been made to use the gypsy moth in the classroom. It is time the gypsy moth went to school.

"Gypsy Moths in the Classroom" is a new elementary science curriculum project currently being developed with a grant from the US Forest Service. The project involves rearing and study of the gypsy moth in elementary classrooms over a period of several months, spanning the natural life cycle of the gypsy moth. During this time, students will participate in a series of science lessons and activities designed to teach about the gypsy moth and its interactions with the environment, their social consequences, and what people can do to live with them.

"To be fair to our youth who will not be scientists, and to provide a broader base for future personnel in science, we must develop excellent programs at the elementary level. This improvement requires more money for schools, better salaries for teachers, and more demanding curricula. But all of that may not help unless there are imaginative changes in instruction that will make science fun and build confidence while helping students to a real understanding of scientific approaches. We have tried money without imagination, and it has failed. We have provided imagination without money, and it has failed. Perhaps this time, by analyzing the problem deeply, we can provide both ingredients simultaneously. It might be fair, effective, and fun all at the same time."

Daniel E. Koshland, Jr.
Editor of *Science*

"

• • • it is not only on aesthetic grounds that a case is made for giving pupils an understanding of the nature of the scientific enterprise. Just as personal knowledge in science empowers pupils to act in their everyday lives, so a critical appreciation of the way scientists work empowers them, as future citizens in a participatory democracy, to query, question and seek alternative views on scientific and technological decisions which affect their lives. Interpreted in this way, science in schools has an enabling rather than an alienating function and has a critical role to play in a liberal education."

Robin Millar & Rosalind Driver
Studies in Science Education, 14:58, 1987

The final product of the project will be a curriculum package that will show teachers in the Northeast how to rear and use the gypsy moth in their classroom. There will be three major sections included in the package: a) History and Life Cycle of the Gypsy Moth, b) Rearing Gypsy Moths, and c) Classroom Activities. The activities range from simple observation to measurement, experiment, and games. While specifically designed to be used in kindergarten through fourth grades, the activities could be easily adapted to Middle School and High School students. First copies of the package should be available by August 1989, allowing this free, easy-to-get resource to be used as an effective instructional tool on a topic of considerable social and environmental importance. For further information contact:

Erik Mollenhauer, Project Director
Department of Educational Development
University of Delaware
Newark, Delaware 19716
Phone 302-451-8708

The STS REPORTER was prepared under Grant Number TEI-8751239 from the Science and Mathematics Network, National Science Foundation. The points of view or opinions expressed in this document are those of the authors and do not represent the official position or policies of the NSF.

REVIEWS OF CURRICULUM MATERIALS & RESOURCES

STS trade books are reviewed using the symbols and number designations described below. A separate category titled "Also of interest" contains narrative reviews of non-STS but potentially useful materials. Curriculum materials are reviewed using a special matrix.

Overall Appraisal

1 — **Highly recommended.** The material contains no serious errors or deficiencies, and the reviewer thought the content and presentation were excellent.

2 — **Recommended.** The material contains no serious errors or deficiencies, and the reviewer thought the content and presentation were above average.

3 — **Acceptable.** The material contains no serious errors or deficiencies, and the reviewer thought the content and presentation were average.

4 — **Not recommended.** The material contains serious errors of fact and/or deficiencies in development.

Audience Suitability

K Preschool or kindergarten
EP Elementary, grades 1 & 2
EI Elementary, grades 3-5
MS Middle school, grades 6-8
HS High school, grades 9-12
AP Advanced placement HS students only
T Teaching professional

Two consecutive levels are separated by a comma; e.g. **K, EP.** Three or more consecutive levels are condensed to show youngest and oldest age groups, and the symbols for these separated by a dash; e.g. **K-EI. T** is always noted separately.

STS Criteria

The material is assigned a number for each lettered criterion by the reviewer. **0** means that criterion is nonexistant, **1** is minimally present, 2 is adequately present, 3 is obviously present and presented well. The criteria are as follows:

A — The relations of technological or scientific developments to societally-related issues are made clearly, early, and in compelling ways to capture attention.

B — The mutual influences "technology", "science", and "society" on each other are clearly presented.

C — The material develops learners' understanding of themselves as interdependent members of society and responsible agents within the ecosystem of nature.

D — The material presents a balance of viewpoints about the issue(s) and options without necessarily striving to hide the author's perspective.

E — The material helps learners to venture beyond the specific subject matter to broader considerations of science, technology, and society, including the treatment of personal and societal values/ethics.

F — The material engages students in developing problem-solving and decision-making skills.

G — The material encourages learners to become involved in a societal or personal course of action after weighing the trade-offs among values and effects drawn from various scenarios or alternative options.

H — The material uses this STS linkage to foster learners' confidence in handling and understanding at least one limited "science-technology" area, and/or handling and using some quantification as an aid to judgments in the STS area.

STS Trade Books Reviews

Earth, Anne H. & Paul R. Ehrlich. Franklin Watts. NY. 1987.

OVERALL APPRAISAL: Recommended

AUDIENCE SUITABILITY: MS, HS, T

STS CRITERIA:

A	0	1	2	3
B	0	1	2	3
C	0	1	2	3
D	0	**1**	2	3
E	0	1	2	3
F	0	**1**	2	3
G	0	1	**2**	3
H	0	1	2	3

Have you ever been in a discussion with someone who does not understand the magnitude of the problem and you wished you had a book which would crystalize your point of view? *EARTH* provides an excellent summary of the world's environmental situation. The authors, Anne & Paul Ehrlich, have presented an analysis of the environment on a global level through chapters about the earth's carrying capacity, impact of man upon the biosphere, and the human response to this predicament. *EARTH* is well written and contains numerous photographs and illustrations which support and enhance the concepts discussed by the authors. A point of weakness in this book is the chapter "The Spirit of Folly." Throughout this chapter those individuals or situations which oppose the author's position are rejected by simplistic statements in the captions of the illustrations. This book is a good starting point for introducing students to how human actions impact the world. It reminds the reader that positive steps toward maintaining the environment are still possible.

James C. Woodland
State Science Consultant
Nebraska Dept. of Education
Lincoln, NE

Superconductivity — The Threshold of a New Technology, Jonathan L. Mayo. TAB Books. Blue Ridge Summit, PA. 1988.

OVERALL APPRAISAL: Highly recommended

AUDIENCE SUITABILITY: HS, AP, T

STS CRITERIA:

A	0	1	**2**	3
B	0	1	2	3
C	0	1	2	3
D	0	1	**2**	3
E	0	1	2	3
F	0	1	**2**	3
G	0	1	2	3
H	0	1	**2**	3

Superconductivity is a good introduction for teachers and high school students. The text provides a brief history of superconductivity and describes in detail the more recent developments. The easy-to-follow text is served up in small doses. The book describes the merits of various theories but does not become so technical as to lose the reader. Pictures, diagrams, and charts compliment the text. A large portion of the book discusses the present and future impact of superconductivity on the military, medicine, electronics, transportation, and high energy physics. A glossary helps the reader with unfamiliar terms. The final chapter presents the race for superconductivity from the international perspective. The book does not deal with social issues in detail but rather introduces topics and suggests possibilities. The book is ideal for introductory superconductivity and would be a good starting point for Science Technology and Society Issues Examination. The bibliography lists numerous sources for future study. After completing the book, I felt that I had a good grasp of superconductivity and its possible impact on our society.

Robert L. Foor-Hogue
Science Teacher
Carroll County Public Schools
Sykesville, MD

World Hunger — Twelve Myths.

Frances Moore Lappé. Grove Press. NY. 1986.

OVERALL APPRAISAL: Highly recommended

AUDIENCE SUITABILITY: HS, T

STS CRITERIA:

A	0	1	2	3
B	0	1	2	3
C	0	1	2	3
D	0	1	2	3
E	0	1	2	3
F	0	1	2	3
G	0	1	2	3
H	0	1	2	3

World Hunger: Twelve Myths is a versatile book because it is pedagogically divisible. For example, in an economics class, the chapters relating hunger to free trade and free markets are useful; while in a biology class, the chapters concerning nature and hunger can be integrated. Chapters developing justice and hunger can serve as a concrete case for classroom discussions and thoughtful essay assignments concerning ethical considerations.

The format of *World Hunger* is uniform. In each of twelve chapters, a myth is expressed succinctly, followed by a response that uses data from a wide variety of recognized sources. One example. Myth: "Hunger is caused by too many people pressing against finite sources. We must slow population growth before we can hope to alleviate hunger." From numerous illustrations focusing on the issue of population and hunger, the authors conclude "to attack high birth rates without attacking the causes of poverty and the disproportionate powerlessness of women is fruitless." The overcoming of powerlessness, whether among the starving or the well-fed, is the primary motivation of this short book.

World Hunger seeks successfully to go beyond guilt, dogma and inactivity to examine precise dimensions of the plaguing issue of hunger, using clear, crisp action prose, helpful scholarly bibliographies and action resource guides that serve to motivate the student to go beyond a comfortable compassion for the hungry to challenge the institutional and personal dogmas that inhibit us from realizing the paramount value of human life.

Dr. John Welckle
Social Studies Teacher
Burnsville Senior High School
Burnsville, MN

Living in the Environment.

G. Tyler Miller Jr., Wadsworth Pub., Belmont, CA. 5th ed., 1988.

OVERALL APPRAISAL: Highly recommended

AUDIENCE SUITABILITY: AP, T

STS CRITERIA:

A	0	1	2	3
B	0	1	2	3
C	0	1	2	3
D	0	1	2	3
E	0	1	2	3
F	0	1	2	3
G	0	1	2	3
H	0	1	2	3

This classic text contains a very inclusive overview of the main topics/issues in ecology. The discussions are thorough and detailed. A sufficient amount of supplementary material is included. Diagrams, tables, charts are easily interpreted. Graphical interpretations are timely as well as pointed.

Social issues are presented alongside scientific facts. This is appropriate for STS studies. Issues are discussed & then the student is encouraged to draw conclusions and formulate opinions.

The academic level of this book appears to be directed to advanced high school science students, AP classes, and undergraduate college levels. It would not be appropriate for a general high school elective. Anyone concerned with the environment should acquire this book for a handy compendium of relevant, up-to-date information and analysis.

Rebecca Tucker
Science Teacher
Stonewall Jackson High School
Charleston, WV

Connecting Science, Technology, and Society in the Education of Citizens

John J. Patrick, Richard C. Remy, Social Science Education Consortium Inc./ERIC ChESS, Boulder, CO, 1985.

OVERALL APPRAISAL: Highly recommended

AUDIENCE SUITABILITY: T

STS CRITERIA:

A	0	1	2	3
B	0	1	2	3
C	0	1	2	3
D	0	1	**2**	3
E	0	1	2	3
F	**0**	1	2	3
G	**0**	1	2	3
H	**0**	1	2	3

This important book is "must" reading for educators on all levels. A well-documented case is made for STS and the necessity for informed citizens. The authors believe that schools must use interdisciplinary instruction for all students and resist the challenge by antagonists of modern science and technology who "attempt to subvert science education in schools. . . ." Using assessment data, they point to the large gap between curricular goal statements that espouse STS and actual student awareness. Various surveys describe overwhelmed teachers with meagre resources and little training ending up with chaotic classrooms as they attempt this curricular reform. The book stresses the need for teaching historical perspective and decision-making skills which might be the "strongest integrative threads in the curriculum." Despite the amount of space given to the problems STS faces, the authors provide hope as they suggest the use of the following instructional practices: decision trees and case studies, role plays and simulations, and instructional television and microcomputers. The 90-page text is easy to read and has complete notes at the end of each chapter as well as a select bibliography. School systems should make the book required reading for curriculum supervisors and social studies, science, and technology teachers.

Jo L. Blackwood
Capital High School
Charleston, WV

Ownership and Productivity of Marine Fishery Resources,

Elmer A. Keen, The Macdonald and Woodward Pub. Co., Blacksburg, VA, 1988.

OVERALL APPRAISAL: Recommended

AUDIENCE SUITABILITY: HS

STS CRITERIA:

A	0	1	**2**	3
B	0	1	**2**	3
C	0	**1**	2	3
D	0	1	**2**	3
E	0	1	**2**	3
F	0	**1**	2	3
G	0	**1**	2	3
H	0	1	**2**	3

The Author presents the idea of "a fishery commons" in a straight forward, forthright manner. He clearly presents several examples of fishery resources being exploited to near extinction. He believes the fishing industry and those who currently regulate it, will continue to make rules for the exploitation of fishery resources which are not in the best long-term interests of the public. The Author makes a case for developing public interest in the management of marine fishery resources. He presents several case studies to support his thesis of Fishery Management.

The pros and cons of interest groups are presented and provide a basis for continued discussion. This book will be useful to a teacher developing similar case studies, for classroom debate, as an example of economic pressures leading to exploitation of a species, and for student investigation. I would recommend this essay on conflict in the use of ocean pastures to fellow STS Teachers.

Joe R. Moore
Educational Consultant
Keystone AEA
Elkader, IA

Curriculum Materials

U.S.A. by Numbers, Ed. Susan Weber. Zero Population Growth. Wash., D.C., 1988.

Evaluation Criteria	N/C	Poor	Fair	Good	Excellent
STS Content **Accuracy**				B	V
STS Content **Up to date**				B	V
STS Content sufficiently **broad** for issue(s) presented		B		V	
Explanations of major unifying STS concepts			B	V	
Organization of materials				B	V
Understandable by intended audience(s)					B
Practicality of activities					
Utility of activities in promoting STS education			B		V
Stimulates **awareness** of STS interrelationships			B		V
Teaches and or promotes **Decision Making Skills**			B	V	
Presents a balance of **Viewpoints** on STS issues			VB		
Fosters awareness of **interdependency** of learners to society and world at large			B		V
Encourages personal action on part of learners regarding STS issues				VB	
Treatment of personal and societal values/ethics			VB		
Increases learners confidence in ability to understand and make decisions in at least one STS area				B	V

Note: N/C = not covered V = science teacher evaluation
B = social studies teacher evaluation

OVERALL APPRAISAL: Recommended

AUDIENCE SUITABILITY: MS-HS, T

USA by Numbers Teaching Kit is a teacher resource and ought not be considered as a curriculum publication that can "stand alone." The kit contains (1) a bound book of 13 chapters illustrating data on demographic, socioeconomic, and environmental changes; (2) 14 class activity lessons; and (3) a glossary of 17 terms. The first five chapters of the book are basic demographic chapters (population growth, density, immigration, fertility, natality, mortality), while the last eight chapters are more issue related (adolescent sexuality, abortion, jobs, rich & poor, water use, air pollution, hazardous waste, and habitat problems.)

The fourteen classroom activity lessons can be applied to various types of learning situations. Their cross-disciplinary nature is apparent, making this kit appropriate for language arts, science, social studies, and mathematics classes. While there is a heavier emphasis on chart reading, interpretation, and graph related skills, also demanded are critical thinking, communication, value analysis, library research, and writing skills. Decision-making, problem-solving, and cooperative learning strategies must be taught. All components of an STS curriculum are evidenced in this kit.

Keep in mind that this kit is produced by ZPG, a concerned, reputable, and active group. While the data presented *seems* to be presented in an honest and straightforward manner, this reviewer felt an insidious editorial force to link and interpret data according to the ZPG agenda. These materials *ought not* be considered teacher-proof or ZPG-proof.

David Phoebus
Science Teacher
Dulaney High School
Timonium, MD

"Rather than being competing goals, it would appear that the approach which focuses on promoting science literacy for a wide proportion of students, and the approach that emphasizes high-level instruction for the ablest and most interested students, are actually complementary strategies for improving physics instruction in our nation's high schools."

***Physics in the High Schools*, 1988**
American Institute of Physics

"To understand the role of, say, agriculture in American life, teachers and students do not have to understand the intricacies of planting and harvesting. Nor do they need to master the details of modern science to understand its causes and consequences. What teachers need to know, and their students need to learn, is what might be called the "civics" of science and technology—how the two work as institutions, how they relate to society, and how they influence government actions and policies."

J.L. Heilbron, professor of history at the University of California at Berkeley and Daniel J. Kevles, professor of humanities at the California Institute of Technology.

OVERALL APPRAISAL: Recommended

AUDIENCE SUITABILITY: HS, AP

Published by Zero Population Growth, *U.S.A. by Numbers*, includes an 164 page compendium of statistical tables, maps, and commentaries ranging from the conventional tables of American historical growth to a state by state map of effluent discharge. Accompanying the compendium are fourteen lesson plans which seek to familiarize the student with statistical interpretation and evaluation.

In the hands of an able and experienced teacher, much can be gleaned from *U.S.A. by Numbers*, the least of which is not the agenda and perspective of Zero Population Growth. The implicit message throughout the tables, maps and commentaries is that the pressures of growing population are the root causes of our domestic travails. Obviously, population growth is involved in the creation and perpetuation of our domestic problems (and our international ones as well), but so are our economic, political, ethical, and moral responses which in the long run might offer students more insights into American society than all the numbers in the U.S.A.

George McCeney
Social Studies Teacher
Dulaney High School
Timonium, MD

Transportation, Energy, & Power Technology, Anthony E. Schwaller.

Delmar Pub., NY, 1989.

Evaluation Criteria	N/C	Poor	Fair	Good	Excellent
STS Content **Accuracy**					AB
STS Content **Up to date**				B	A
STS Content sufficiently **broad** for issue(s) presented.				AB	
Explanations of major, unifying STS concepts			B		A
Organization of materials				B	A
Understandable by intended audience(s)				B	A
Practicality of activities					AB
Utility of activities in promoting STS education					AB
Stimulates **awareness** of STS interrelationships					AB
Teaches and/or promotes **Decision Making Skills**					AB
Presents a balance of **Viewpoints** on STS issues					AB
Fosters awareness of **interdependency** of learners to society and world at large				B	A
Encourages personal action on part of learners regarding STS issues				B	A
Treatment of personal and societal values/ethics				AB	
Increases learners confidence in ability to understand and make decisions in at least one STS area				B	A

Note: N/C = "not covered" A = J. Swanson B = D. Kuhn

OVERALL APPRAISAL: Highly recommended

AUDIENCE SUITABILITY: HS, T

This text approaches the areas of transportation, energy and power technology in a unique and new way: together. Traditionally these subjects have been taught as separate units of study. This new integrated approach to these subjects is sound and is treated in the text from a systems approach, so appropriate in the teaching of Technology today. The text is person-centered and provides for a basis of making decisions about our use of energy in all areas of daily life.

Transportation, Energy And Power Technology has particular merit for teaching Technology in today's schools. There are provisions for teaching critical thinking skills, problem solving as well as the cognitive areas of subject matter. The chapter activities are well thought out and will provide a hands on method of learning as well as reinforcing the chapter objectives. A chapter on *safety* is included. There is good use of chapter/subject embellishments: *Boxed Articles* are interspersed and provide for practical application and interesting background reading. Mathematical and scientific principles, formulae and facts are highlighted under the heading *Tech Link*.

The book format is most attractive. The use of color, graphs, charts and drawings along with descriptive pictures will capture and sustain the reader's attention. The text will be a useful instructional tool in Technology programs in grades 7–12, as well as a valuable resource for the teaching professional.

Lacking are special sections *to the teacher* which would make the text more immediately useful for course/classroom introduction. With the varied backgrounds of today's science/technology teacher, it would be appropriate and beneficial to provide sections that help teachers with course development as well as creative hints for using the text. A workbook of three-ring punched, tear-out worksheets based on the activities sections of the chapters would also be a helpful addition for immediate implementation of this very interesting and useful text.

John T. Swanson
Technology educator
Montgomery High School
Skillman, NJ

OVERALL APPRAISAL: Recommended

AUDIENCE SUITABILITY: HS

This is a clearly written and interesting textbook. The laboratory activities are engaging for high school students and appropriate in content. This textbook is geared toward a survey course in power technology. The content and activities in this book provide students an opportunity to gain a good understanding on the various phases of transportation energy, and power technology. STS linkages are explicit in many units and activities and are implied in others. This book is an excellent class text for a technology education course and should promote some interesting activities and lively discussions.

David Kuhn
Technology educator
Gettysburg High School
Gettysburg, PA

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• • • one point has struck me forcibly in my own experience; namely, the unexpected value of general culture in teaching special subjects. The man who knows science admirably, but knows nothing else, prepares boys well for an examination; but his teaching does not stick. The man of wide culture and refinement brings fewer pupils up to a given mark within a given time: but what he has taught remains with them; they never forget or fall back. I am not sure that I understand the phenomenon, but I have noted it repeatedly."

W. Tuckwell
***Nature*, Nov. 4, 1869**

Construction Technology,

Mark W. Huth, Delmar Pub., NY, 2nd ed., 1989.

Evaluation Criteria	N/C	Poor	Fair	Good	Excellent
STS Content **Accuracy**					AB
STS Content **Up to date**					AB
STS Content sufficiently **broad** for issue(s) presented.				A	B
Explanations of major, unifying STS concepts	B			A	
Organization of materials					AB
Understandable by intended audience(s)				A	B
Practicality of activities				B	A
Utility of activities in promoting STS education				A	B
Stimulates **awareness** of STS interrelationships	B			A	
Teaches and/or promotes **Decision Making Skills**				A	B
Presents a balance of **Viewpoints** on STS issues	B				A
Fosters awareness of **interdependency** of learners to society and world at large	B			A	
Encourages personal action on part of learners regarding STS issues	B			A	
Treatment of personal and societal values/ethics	B			A	
Increases learners' confidence in ability to understand and make decisions in at least one STS area				A	B

Note: N/C = "not covered", A = D. Suplee, B = D. Kuhn

OVERALL APPRAISAL: Recommended

AUDIENCE SUITABILITY: HS

The author has sufficiently covered all the major aspects of the construction industry and has offered many interesting, challenging, and practical activities. Of special note were the safety hints included in each activity unit. However, these should not preclude lessons on safety within each unit.

This reviewer found the book to be all that was listed in the preface and more. I totally agree with the author that this book's features will help to make learning fun and easy. Each unit appears to more than meet the stated objectives. The listing of key words helps to build vocabulary and understanding. The application of math principles throughout the book where appropriate and in special sections help the student to relate math to practical applications.

The book would make an excellent text for an everyday, year-long high school course.

Donald Suplee
Technology educator
Montgomery High School
Skillman, NJ

OVERALL APPRAISAL: Highly recommended

AUDIENCE SUITABILITY: HS

A clearly written and interesting text. The laboratory activities focus on topics which the students might easily relate to in a general construction technology course. Since most schools include a course in construction technology, this textbook should be used for the beginning survey course. The content and activities in this book enable students to gain a good understanding of the various phases of construction technology and gives glimpses of laser usage, solar applications, and construction in space. STS linkages, while shown very briefly in some lessons/activities, are virtually non-existant.

David Kuhn
Technology educator
Gettysburg High School
Gettysburg, PA

Curriculum Guide for Contemporary Science and Student Enrichment Materials, Ronald T. Truex,

Township of Ocean School District,
163 Monmouth Rd., Oakhurst, NJ 07755

Evaluation Criteria	N/C	Poor	Fair	Good	Excellent
STS Content **Accuracy**				X	
STS Content **Up to date**				X	
STS Content sufficiently **broad** for issue(s) presented.			X		
Explanations of major, unifying STS concepts			X		
Organization of materials					X
Understandable by intended audience(s)					X
Practicality of activities					X
Utility of activities in promoting STS education					X
Stimulates **awareness** of STS interrelationships				X	
Teaches and/or promotes **Decision Making Skills**				X	
Presents a balance of **Viewpoints** on STS issues				X	
Fosters awareness of **interdependency** of learners to society and world at large				X	
Encourages personal action on part of learners regarding STS issues				X	
Treatment of personal and societal values/ethics				X	
Increases learners' confidence in ability to understand and make decisions in at least one STS area				X	

Note: N/C = "not covered"

OVERALL APPRAISAL: Highly recommended

AUDIENCE SUITABILITY: MS, HS

Ronald Truex's *Curriculum Guide for Contemporary Science* (1987) and *Student Enrichment Materials* (1988) offer a teacher and secondary students (7–12) an opportunity to examine carefully selected science-related interdisciplinary topics. The topics range from Population and Noise Pollution to Astronomy and Meteorology. The Curriculum Guide must be used with the Student Enrichment Materials. The latter's activities aid students substantially in understanding the issues.

The Curriculum Guide is organized into twelve units subdivided into the following sections: Background Information, Objectives, Content Outline, Activities, Audio-Visual Aids, References and Resources. In addition, there is a pre/post matching/multiple choice test (with answer key), and student and parent surveys. The Guide provides brief summaries of the topics, word/phrase content ideas and one sentence activities, thus requiring the teacher to do independent research on each topic in order to present the content in a thorough and understandable manner. The Guide does, however, serve to organize the material and highlight the major concepts and ideas.

The Student Enrichment Materials provide four to ten activities for each unit. For each activity the author states the purpose, objective(s) and materials needed. He then outlines the procedures to be followed. The activities are clearly presented with some providing the background information missing in the Curriculum Guide. Many activities have well-designed masters for copying; however, the print quality does not always allow for clear reproduction.

The units offers a good conceptual framework for a contemporary science course emphasizing the impact of science on the earth and on human society.

Virginia S. Wilson
James A. Little
North Carolina School
of Science and Mathematics
Durham, NC

Also of Interest . . .

The Nature of Reality,

Richard Morris, The Noonday Press, NY, 1987.

The Nature of Reality is a book for the individual who wants to understand how science (especially physics and chemistry) has defined reality. The author examines the various scientific theories of the immediate past and how they have interacted with each other. He looks at why various theories were put forth and accepted while others were rejected. A look at individuals involved with defining reality and how they affected each other's ideas rounds out the book.

This is not a textbook for a science class. It does not go into any quantitative analyses. It does give a very understandable qualitative analysis of various theories on reality. It covers quantum mechanics, relativity, special relativity, string theory, atomic theory, GUTs and many other important theories that have been used to try to understand reality. If you would like to understand what each theory was trying to accomplish this is the book for you.

The Nature of Reality is a background resource for the chemistry and physics teacher who wants to teach more than just equations. It contains information like other scientists and theories which helped Neils Bohr to define his model of an atom. Who agreed with him and who did not and why. For an STS teacher the insights found in this book should be as valuable as knowing the equations.

Franz Foltz
Research Assistant
STS Program
Penn State

Man Masters Nature: Twenty-five Centuries of Science, Roy Porter, Ed.,

George Braziller, NY, 1987.

First published in England in 1987 by BBC Books, *Man Masters Nature* was written to "accompany" a BBC radio series by the same name. In book form, the series traces scientific understanding from the time of the ancient Greeks to the twentieth century. From its perspective, science is Western science which it characterizes as unified, integrated, and rational. Seventeen essays comprise the series. Each essay is introduced briefly with a historical comment. Illustrations of the scientists, further readings, and an index are also included.

Each essay is written by a different but knowledgeable author. Included are chapters on Aristotle, Ptolemy, Galileo, Kepler, Harvey, Newton, Priestley, Lavoisier, Watt, Faraday, Darwin, Pasteur, Einstein, Bohr, Turing, Watson and Crick. These individuals serve as springboards for discussing the theory and practice of science. Scientific theory is explored in regard to astronomy, chemistry, mathematics, and physics. Practical applications are less evident except in the discussion of the steam engine and computer. A synthesis of these diverse contributions is not provided.

Suitable for teacher reference and study, *Man Conquers Nature* is a useful, if limited, review of Western science as embodied by "great men." It does explore the capacity of scientific thinkers to extend intellectual and technical horizons, albeit in a pretentious fashion. Unlike the essays, the introductory chapter suggests a more interesting book with broader scope could have been written about its subject — the twenty-five centuries of science.

James Hantula
Social Studies Teacher
Laboratory School
University of Northern Iowa
Cedar Falls, IA

Technology in America: A History of Individuals and Ideas,

Ed. Carroll W. Pursell Jr., The MIT Press, Cambridge, MA, 1981.

A paper bound collection of essays on the diffusion of American technology, its primary focus is upon individuals who contributed much to this process. The essays are divided between the nineteenth and twentieth centuries. A brief introductory essay highlights an occupational type, the artisan during America's Wooden Age. Subsequent essays describe in eighteen brief chapters "great technocrats" from Jefferson to Goddard.

These essays first appeared in a volume published by the Voice of America and were based upon a series of overseas broadcasts designed to celebrate the centennial of the United States. For the more able student, it identifies significant persons and ideas which are basic to understanding the role of technology. From it, U.S. History students gather valuable insight into the role of individuals. Industrial Technology students discover the importance of

ideas in the development of technology. Language Arts/English class students are challenged in a study of biography.

In this collection, limited information is provided about the role of women and, particularly, minority "technocrats." A concluding chapter synthesis is not provided. Some significant individuals are not discussed. In addition, the date of publication indicates these research efforts were probably based upon information available in the 1970s. Nevertheless, *Technology in America* remains a useful addition to a STS teacher and to any teacher seriously interested in the history of technology and the United States.

James Hantula
Social Studies Teacher
Laboratory School
University of Northern Iowa
Cedar Falls, IA

Science Study Skills Program: People, Energy, and Appropriate Technology, Lisa Smulyan, David Marshak, Eds., NSTA, Wash., D.C., 1988.

I found coverage of the various types of study skills to be more than adequate. The program deals not only with the general skills needed by all students in all areas of learning but also with skills specific to science.

The use of important societal issues to help teach the various study skills adds an increased meaningfulness to the activity. The reading for meaning activity offers two selections: "Spaceship Earth" and the "Energy Crisis." The articles are both short enough to hold the students' attention for several readings and simple enough to be understood. Students who do this activity would be learning about two very serious ideas, almost subliminally.

The presentation of skills needed specifically in science is handled well. I am concerned about some to the units that are used in the "Working With the Metric System" and "How Can We Store Energy" section. The use of the "calorie" unit has long been abandoned. I feel it inappropriate to teach a concept no longer in use. The use of the word "weight" when the more appropriate term "mass" should have been used, also caused some concern. That does not mean that this activity is not a good activity; only that its wording is not the best.

The Teacher's Guide that accompanies the text is excellent. It gives a teacher all the advice and support to be able to teach any one of the activities. A teacher would not have to put off doing an activity because of lack of knowing how to organize it. Each activity is listed, given a time frame, a summation of what the students are being asked, background information, and the answers to the student questions.

Overall I feel that this is an excellent book on study skills. It is most appropriate for middle school students and upper elementary levels. If students could arrive at high school with all of the study skills used in this program the students would show a greater mastery of science. The societal and technological issues that are used are ones of great concern to the future of the students. By using these issues to teach study skills, a more aware group of students is being created. I liked the subtle way the issues were presented. It seemed like the "bitter" medicine of science was being disguised by the "sweet" sugar of study skills and STS.

Barbara S. Burns
Science Teacher
Liberty High School
Carroll County Maryland

LIST OF MATERIALS RECEIVED

Ancient Tragedy and the Origins of Modern Science, Michael Davis, Southern Illinois University Press, Carbondale, 1988.

Building a Global Civic Culture — Education for an Interdependent World, Elise Boulding, Teachers College Press, Columbia University, New York, 1988.

Children's Ideas in Science, Rosalie J Driver, Edith Guesne, Andree Tiberghien, Eds., Open University Press, Philadelphia, 1985.

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Ecology and Our Endangered Life-Support Systems, Eugene P. Odum, Sinauer Associates Inc., Sunderland, MA, 1989.

Education for Democratic Citizenship — Decision Marking in the Social Studies, Shirley H. Engle & Anna S. Ochoa, Teachers College Press, Columbia University, New York, 1988.

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Mathematician and Administrator, Shirley Mathis McBay, Mary Ellen Verheyden-Hilliard, The Equity Institute, Bethesda, MD, 1985.

Nuclear Arms — Opposing Viewpoints, 1988 Annual, Greenhaven Press, San Diego, 1988.

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Science, Ethics, and Technological Assessment, Donald Hatcher, American Press, Boston, 1987.

Science for the Fun of It — A Guide to Informal Science Education, Marvin Druger, Ed., National Science Teachers Association, Washington, D.C., 1988.

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Science, Technology, and Society — Emerging Relationships: Papers from Science, 1949–1988, Rosemary Chalk, Ed., American Association for the Advancement of Science, Washington, D.C., 1988.

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Scientist and Administrator, Antoinette Rodez Schiesler, Mary Ellen Verheyden-Hilliard, The Equity Institute, Bethesda, MD, 1985.

Scientist and Astronaut, Sally Ride, Mary Ellen Verheyden-Hilliard, The Equity Institute, Bethesda, MD, 1985.

Scientist and Governor, Dixy Lee Ray, Mary Ellen Verheyden-Hilliard, The Equity Institute, Bethesda, MD, 1985.

Scientist and Physician, Judith Pachciarz, Mary Ellen Verheyden-Hilliard, The Equity Institute, Bethesda, MD, 1988.

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Scientist and Puzzle Solver, Constance Tom Naguchi, Mary Ellen Verheyden-Hilliard, The Equity Institute, Bethesda, MD, 1985.

Scientist and Strategist, June Rooks, Mary Ellen Verheyden-Hilliard, The Equity Institute, Bethesda, MD, 1988.

Scientist and Teacher, Anne Barrett Swanson, Mary Ellen Verheyden-Hilliard, The Equity Institute, Bethesda, MD, 1988.

Scientist from Puerto Rico, Maria Cordero Hardy, Mary Ellen Verheyden-Hilliard, The Equity Institute, Bethesda, MD, 1985.

Scientist from the Santa Clara Pueblo, Agnes Naranjo Stroud-Lee, Mary Ellen Verheyden-Hilliard, The Equity Institute, Bethesda, MD, 1985.

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Society and Technological Change, Rudi Volti, St. Martins Press, New York, 1988.

Teaching Modern Science, Arthur A. Carin, Robert B. Sund, Merrill Publishing Co., Columbus, OH, 5th ed., 1989.

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