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ABSTRACT

An emerging focus on pre-college education in the 1980s is the interaction of science and technology in terms of their combined interrelationships with society. The characterizations of the science/technology/society (S/T/S) theme, as advanced by science educators, social studies educators, and environmental educators, exhibit similarities. It is the purpose of this document to highlight the interconnections of the S/T/S perspectives of the three fields and, in particular, to note contributions that environmental education might make to the implementation of the various S/T/S goals of general education. This involves the description of the S/T/S involvements of all three threats, comparisons of the work of individuals and of organizations working toward similar goals, and an examination of the question, to what extent should attempts to implement S/T/S goals include and emphasize environmental education components? Goal statements relating to the S/T/S threats from all three fields are listed/referenced, as well as those proposed by some associated global education and citizenship education efforts. Examples of programs that are already including environmental education components in S/T/S oriented materials are described. (TW)

ERIC Clearinghouse for Science, Mathematics and Environmental Education

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No. 3, 1986



# Locating The "E" In S/T/S

An emerging focus of pre-college education in the 1980s is the interactions of science and technology in terms of their combined interrelationships with society. A number of recent reports, the most prominent of which was *A Nation at Risk* (National Commission on Excellence in Education, 1983), have identified a need to improve education for effective citizenship in a modern, complex society, explicitly emphasizing the science/technology/society (S/T/S) interface as a major concern. Similar arguments, past and present, have been advanced by Conant (1945), Rockefeller Brothers Fund Panel on Special Studies (1958), Boyer (1983), and Goodlad (1984).

According to A. King (1972), the mass of current problems facing society are to some extent direct side effects of technological growth, appearing to have three interactive causes: the increase in world population and accumulation of population in urban areas; an increase in levels of affluence; and the unmanaged upsurge of technology, which has been the agent for producing affluence and urbanization.

Two of the more popular treatments of the modern dilemma were prepared by Meadows, et al. (1972), and by Barney, et al. (1980). According to the latter (p. 1):

> If present trends continue, the world in 2000 will be more crowded, more polluted, less stable ecologically, and more vulnerable to disruption than the world we live in now. Serious stresses involving population, resources, and environment are clearly visible ahead.

Among many others, Sterling has proposed that a systematic, organic worldview is needed to guide future thought and action for the environment, stating that an understanding of history is critical in the development of an integrated environmental ethic and proposing a philosophical framework that recognizes the integrity of human communities and natural systems in a modern technological world. He has listed a set of "inadequate, constraining, and mutually reinforcing values and assumptions which permeate the 'classical scientific worldview,' " (1985, p. 220) rendering that world view inadequate in today's world. His listing includes items dealing with humans as separate from natural systems, not recognizing the interconnectedness of phenomena and events, regarding knowledge and experience as distinct "subjects" and modes, regarding empirical knowledge as more real than the real world, divesting nature and human creativity of spiritual and aesthetic qualities, misusing the concepts of objectivity and neutrality, being reluctant to show commitment, seeing problems in cause/effect terms and preferring technical solutions to multidimensional approaches, preferring analysis to synthesis, and having little sense of desirable scale with regard to human activities.

## Interconnections Among Perspectives

The similarities among characterizations advanced by science educators, social studies educators, and environmental educators are striking. It is the purpose of this *Bulletin* to highlight interconnections among the three, in particular by noting contributions that environmental education might make to the implementation of the S/T/S goals of general education, and most specifically by highlighting the experiences of the environmental education community which may be of value to science educators, to social studies educators, and to the educational enterprise in general. This involves the further description of the S/T/S involvements of all three thrusts, comparisons of the work of individuals and of organizations working toward similar goals, and an examination of the question, "To what extent should attempts to implement S/T/S goals include and emphasize environmental education components?"

A major goal cluster of Project Synthesis, a comprehensive research synthesis effort conducted by science educators during the past decade, stresses the central role of science education in producing informed citizens prepared to deal with science-related social issues (Kahl and Harms, 1981, pp. 7-8). Project Synthesis challenged science educators to a major redefinition and reformulation of goals for science education "to develop a curriculum which would focus on direct student experiences, technology, and personal and societal concerns" (Volk, 1984, p. 25).

Social studies educators generally address the S/T/S theme within the context of citizenship education, initiating their argument for the development of a scientifically literate citizenry from the Jeffersonian perspective: "Every government degenerates when trusted to the rulers of the people alone. The people themselves, therefore, are its only safe depositories. And to render even them safe, their minds must be improved" (Jefferson, 1785, p. 188). Patrick and Remy (1985, p. 1) currently note

> ... three new kinds of challenges, ... which are associated with the pervasive influences of science and technology in modern American society:
> - the challenge of informing citizens about complex social issues and decisions related to advances in science and technology;
> - the challenge of connecting in the school curriculum diverse fields of knowledge relevant to understanding decisions about complex social issues;
> - the challenge of resisting antagonists of science and technology in our society, who threaten the integrity and success of scientific and technological ventures.

## S/T/S and Environmental Education

Those associated with the environmental education movement of the past 20 years have emphasized similar concerns. Although disagreement and some fuzziness with respect to definitions and terminologies have been associated with their efforts, pro-

ponents of environmental education generally have agreed that environmental education is aimed at (among other things) . . . "producing a citizenry that is knowledgeable about the biophysical and sociocultural environments of which man is a part, aware of environmental problems and management alternatives of use in solving these problems, and motivated to act responsibly in developing diverse environments that are optimal for living a quality life" (R. Roth, 1970, p. 6; after Stapp, et al., 1969, pp. 30-31).

More recently, Borden (1985) has traced the development of ecological thought and ideas and has suggested a "new human ecological perspective" stressing the need for meta-disciplinary views and proposing greater exploration of the subjective, aesthetic, historical, and psychological implications of ecology.

The inclusion of S/T/S philosophies in science education programs has been consistently promoted during the past decade. The findings of Project Synthesis were an outgrowth of three major studies funded by the National Science Foundation during the late 1970s, reported respectively by Helgeson, et al. (1977), Weiss (1978), and Stake and Easley (1978). Research reports indicate that Project Synthesis provides a model for the science education programs of the future, and that S/T/S is a key element of that model. Analysis of the reports also emphasizes that most current school science programs do not approach the stated goal clusters of Project Synthesis, which are:

> **Personal Needs:** Science education should prepare individuals to utilize science for improving their own lives and for coping with an increasingly technological world;
> **Societal Needs:** Science education should produce informed citizens prepared to deal responsibly with science-related societal issues;
> **Academic preparation:** Science education should allow students who are likely to pursue science academically as well as professionally to acquire the academic knowledge appropriate for their needs;
> **Career education/awareness:** Science education should give all students an awareness of the nature and scope of a wide variety of science and technology-related careers open to students of varying aptitudes and interests (Kahl and Harms, 1981, pp. 7-8).

The Project Synthesis staff concluded that only those goals related to academic preparation were receiving significant emphasis in existing science education. In response, Harms (1981, p. 119) recommended that:

> The goals of preparing the majority of students to use science in their everyday lives, to participate intelligently in group decisions regarding critical science-related societal issues and to make informed decisions about potential careers in science and technology are equally as important as the goal of preparing a minority of students for more advanced coursework in science.

Also cited in the same report were statistics indicating that 90 per cent of practicing science teachers emphasize goals directed toward preparing students for further formal study of science, that 99 per cent of science teachers had a philosophical orientation only toward a specific science discipline, and that more than 90 per cent of the time, the textbook in effect sets the course outline, the framework, the parameters for student experience, testing, and their worldview of science. Yager (1984, pp. 35-37) has also noted that actual implementation of S/T/S programs has been minimal, as has implementation of the goals of Project Synthesis beyond the goal of academic preparation.

The National Science Teachers Association (NSTA) has recognized the trend toward viewing science as a discipline appropriately concerned with the study of the interactions and mutual impacts of science and society (NSTA, 1978). As an emerging conceptual model for science education, S/T/S has been identified as a potentially effective response to recent calls for educational reform such as those noted above (NSTA, 1982; Hurd, 1984; Bybee, 1985).

### S/T/S and Social Studies Education

From the perspective of the social studies education community, Patrick and Remy (1985, p. 2) have noted:

> Decisions about science/technology/society issues often require 'tradeoffs' between conflicting values in which there is no clear view of right and wrong. Many environmental issues, for instance, force citizens to choose either clean air or water or production and jobs. Most people agree that pollution by factories is bad; they also tend to agree that unemployment and a big drop in factory output are bad. At times, the problem has been to decide how to limit pollution enough to protect health and environment while still maintaining production and jobs. Making a decision in a conflict between economic and ecological values requires careful consideration of alternative factual and ethical claims. The eventual choice may result from a compromise between conflicting positions and values.

A descriptive analysis of the separation of "science" from "society" in terms of public perceptions was provided more than 20 years ago by Snow (1963), in a concise identification of "the two cultures," as he termed the scientific and humanistic communities. His argument was that the gap between them might more appropriately be viewed as a chasm. Snow characterized them as having essentially polar perspectives (after Patrick and Remy, p. 5):

| Sciences | Humanities |
|---|---|
| Present, future-oriented | Roots in past |
| Technical, precise | Figurative, metaphorical |
| Ideas subject to challenge | Perpetuation of dominant social faith |
| Precise definitions | Qualitative definitions |
| Seek precise truths, laws | Employ allusive questions |

Woyach (1984) has pointed out that ecopolitical issues, rising from human manipulation of the natural environment, precipitate problems from the limited capacity of the natural environment to satisfy human needs. He argues that secondary school courses treating ecopolitical issues should emphasize a basic conceptual framework for understanding, interpreting, and making and judging decisions about these issues. This framework should help students to organize, interpret, and appraise information and ideas about the "limits to growth" debate (Meadows, et al., 1972). In addition, it should help students understand the sociopolitical context of

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Patricia E. Blosser
Bulletin Editor

these issues and develop a global perspective on them. Finally, students should have opportunities to develop skills in making and evaluating decisions about ecopolitical issues.

### What Should Be, What Is

Social studies educators also note a disparity between "what should be" and "what is" with respect to theory and practice, similar to that identified by the science education community. The pedagogical attractiveness of the integration of content areas for teaching and learning purposes has long been attractive to social studies educators, as to others. For example, Tyron commented (1935, pp. 527-528):

> The day of isolation (between subjects) is probably gone in theory, even though it still remains in practice. The future will probably see more and more emphasis on the interrelationships of the social sciences. This, of course, does not mean that history, political science, economics, and sociology will necessarily disappear as independent subjects of study in the schools. It simply means that as independent subjects each will be expected to live other than a hermitic life. The services of each to all will be central in organizing them for teaching purposes.

Present goals calling for integration between the social and natural sciences for instructional purposes are more demanding than those addressed by Tyron. Hindsight indicates that his prediction was overly optimistic for the more limited integration he envisioned.

### Why Environmental Education?

The term "environmental education" means many things to many people, including those who profess to be "environmental educators." This multiplicity of meanings is at least in part an outgrowth of the relative newness (about 20 years) of the term, the nature of its origins, and the variance in the goals of its professionals. Defining environmental education, particularly for the benefit of those who reside in the relatively established niches of the academic world, has been described as a continuing dilemma (Disinger, 1983). An evolution from nature study, conservation education, and outdoor education has been addressed in the literature of the field since the term first appeared (McInnis, 1972; Swan, 1975; Johnson, 1977). Nonetheless, although neither a universally accepted definition nor a consensus concerning focus exists, a substantive structure and framework have been identified, and a set of goal levels advanced (Hungerford, et al., 1980, pp. 42-47):

- ecological foundations;
- a conceptual awareness of issues and values;
- an investigation and evaluation of these issues; and
- training in and application of citizenship action skills.

These goals are reflective of those advanced earlier by the participants in the 1977 UNESCO/UNEP Intergovernmental Conference on Environmental Education held in Tbilisi, Georgia, USSR (UNESCO, 1978), and are also in accordance with a previous statement of "the superordinate goal of environmental education" (Harvey, 1978, p. 1):

> To aid citizens in becoming environmentally knowledgeable and, above all, skilled and dedicated citizens who are willing to work, individually and collectively, toward achieving and/or maintaining a dynamic equilibrium between quality of life and quality of the environment.

For the purposes of this paper, Bogan's (1973, pp. 1-3) characterization of environmental education as the interdisciplinary process of inquiry into both the specific and the general environmental implications of human activities viewed from the perspective of social needs and values as they relate to society may be most useful, in that it clearly foreshadows today's S/T/S emphases. To some extent the environmental education community serves as a common thread joining nature study, conservation education, and outdoor education, but it also has explicit and necessary interconnections with science and technology and the issues and problems of society (Disinger, 1986). It is generally accepted that the impetus for the synthesis which led to environmental education circa 1970 was increased concern for environmental quality (or, stated negatively, fear of severe deterioration of quality of life caused by reported and anticipated plummeting of environmental quality - viz., due to pollution and associated concerns). Thus, the rationale for initiating environmental education was in effect to refine and redirect the goals of those predecessors, as well as to fill an educational vacuum which was not being served by other entities, including, as they were then practiced, science education and social studies education-attention to the interrelationships between humans and environments. The extent to which "environmental education" has actually been operationalized, in any significant sense, in pre-college education has not been a subject of rigorous study, but is generally conceded to be minimal.

### Unavoidable Negativism?

Demonstrating that environmental education can be a positive, proactive approach to an educational consideration of environmental problems has been a major challenge, difficult to meet, and to date essentially unmet. The common perception is that environmental education focuses on what is wrong with science/technology/society interrelationships, rather than what is right (Disinger, 1986). Many believe that fundamental American cultural values and beliefs are at the root of environmental problems (Bowman, 1977). Moreover, there has been a belief among much of the American population that technology can and will solve environmental problems-i.e., a "technology got us into these problems, and technology will get us out" attitude, which in its extreme form places unquestioning faith in the capabilities of the technological enterprise to resolve environmental problems, and in fact all problems, independently of the input of the natural and social sciences and especially independently of the layperson, educated or otherwise. That belief generally seems to decrease as educational levels increase (Donahue, et al., 1974; Melton, 1976; Silvernail, 1978), but it remains pervasive for many.

### Common Goals, Content

Clear connections between and among science education, social studies education, and environmental education are apparent when one considers the S/T/S interrelationships with which each group is concerned.

In a recent survey (Bybee and Mau, 1986), 262 science educators from 21 countries were asked to rank twelve global problems relating to science and technology. The top six in the rankings were:

- world hunger and food resources;
- population growth;
- air quality and atmosphere;
- water resources;
- war technology; and
- human health and disease.

Respondents also indicated that: 1) they expected science and technology-related global problems to be worse by the year 2000; 2) they, as science educators, were slightly to moderately knowledgeable about the problems; 3) they believe that it is important to study global problems in schools; 4) they detect a clear trend toward S/T/S in teaching and learning; 5) they believe that an integrated approach should be used to teach about environmental problems; and 6) there is public support for including global problems in school curricula.

Bybee, et al. (1986) reported similar findings in a study involving college students, who identified air quality, world hunger, and war technology as the most important of twelve global problems.

The S/T/S focus group of Project Synthesis earlier had recommended eight major topics for inclusion in S/T/S educational programs (Harms and Yager, 1981):

- energy;
- population;

- human engineering;
- environmental quality;
- utilization of natural resources;
- national defense and space;
- sociology of science; and
- the effects of technological development.

An "Environmental Agenda for the Future" (Cahn, 1985) was recently developed as a result of a four-year study initiated by the chief executives of ten major environmental and conservation organizations—the Environmental Defense Fund, the Environmental Policy Institute, Friends of the Earth, The Izaak Walton League of America, National Audubon Society, National Parks and Conservation Association, National Wildlife Federation, Natural Resources Defense Council, Sierra Club, and The Wilderness Society. Though the report was not aimed directly at educators, the content and thrust of its report are of interest here. For example, the eleven topics around which its findings and recommendations are organized include: nuclear issues, human population growth, energy strategies, water resources, toxics and pollution control, wild living resources, private lands and agriculture, protected land systems, public lands, urban environments, and international responsibilities.

### The Global Possible

Yet another listing, produced by an international group of leaders from science, business, government, and environmental affairs at "The Global Possible" conference of the World Resources Institute (1984), reports these key concerns:

- loss of crop and grazing land due to desertification, erosion, conversion of land to non-farm uses, etc.;
- depletion of the world's tropical forests;
- mass extinction of species, principally from loss of habitat;
- rapid population growth;
- mismanagement and shortages of fresh water resources;
- overfishing, habitat destruction, and pollution in the marine environment;
- threats to human health from mismanagement of pesticides and hazardous substances and from pathogens in human wastes and aquatic vectors;
- climate change due to buildup of "greenhouse gases" in the atmosphere;
- acid rain and its associated effects; and
- mismanagement of energy fuels and pressures on energy sources.

Volk (1984, pp. 23-33) has made a rigorous comparison of the Project Synthesis purposes for science education and the Hungerford, et al. (1980) goals for environmental education; she concludes that they have much in common, and are in fact identical in many respects. She also notes that much of the experience the educational community has had with S/T/S education has been accomplished under the rubric of environmental education, and that a strong research and literature base for S/T/S has been reported as environmental education research and literature. For example, analysis of the contents of the North American Association for Environmental Education's Summary of Environmental Education Research, 1971-1982 (Iozzi, 1984) reveals much of pertinence to S/T/S educators.

The similarities among the lists above are clear; allowing for differences in professional vocabularies and for some variance in specific interests, they are essentially the same. Thus, there is significant congruence of opinion as to what the problems are, and in fact what needs to be learned and taught relative to the interrelationships between and among science, technology, society, and environment.

Hurd (1985) has described an "acceptable pre-college science curriculum" as one that has cultural as well as scientific and technological validity. He identified as elements essential for the reformation of science education the following:

- required instruction of science for all students from kindergarten through grade 10;
- organization of courses in a social context rather than in the special disciplines;
- a balance of science and technology with an emphasis on their interrelationships with each other, society, and human values;
- a concentration on critical thinking skills and responsible decision making; and
- a framing of courses around persistent social problems, associated with the environment, health, and technology.

In the same paper, Hurd noted as critical a reconceptualization of the science curriculum for the transformation of science education, stressing the importance of the promotion of a framework of strategic policies to precede these efforts so that social progress will be promoted, quality of life improved, and meaning attached to the work and leisure life of the individual. Similar discussions and conclusions have been reported by Lockard (1985), Brunkhorst and Yager (1986), and others.

In a more recent paper, Hurd (1986) raised a set of questions to help formulate expression of central issues to be faced in a reform of the school science curriculum:

- "What is to be selected from the total of all that is known in science and technology for a 10- or 11-year core curriculum in science?
- "Should the search for new subject matter be in terms of integrative concepts or a sampling of information from a number of distinct fields of research?
- "How do we assure that a modern science curriculum has both scientific and cultural validity?"

### S/T/S and Citizenship Education

As suggested above, social studies educators generally frame their rationales for S/T/S education within the purview of citizenship education. For example, Remy (1976, p. 360) identified four elements of decision making by citizens that are intrinsic to S/T/S issues:

- confrontation with the need for choice;
- identification of values and goals that pertain to the occasion for decision;
- identification of alternative response to the occasion for decision; and
- prediction of the positive and/or negative consequences of alternatives in terms of values and goals.

In discussion of the above, Patrick and Remy (1985, pp. 49-50) note that facts are involved in the identification of alternative courses of action, that decision making about S/T/S issues generally involves uncertainty about the likely social or environmental consequences of alternative courses of action, and that risk is involved because of uncertainty. Uncertainty leads to the necessity of assigning probabilities to the likelihood of particular consequences for a given alternative, and in fact for all alternatives. Thus, the need for integrated study of all possible factors is supported.

Also noted is a high level of "crossover" between the S/T/S aspects of citizenship education and a developing focus on global education, alluded to above on several occasions. Global education is typically approached in terms of the dilemma resulting from need for development in the third world, and that need's potential and actual ramifications with respect to rapid population growth, food and other shortages and/or maldistribution, environmental degradation, and so on. Social studies educators are intensively involved in this area. A format much like those proposed by science educators has been proposed by members of the social studies educational community (Guidelines for Teaching..., 1983). D. King (1980) has offered an agenda for developing educational approaches that provide a global perspective as a way of enhancing students' abilities to understand and cope with issues of social change. He argues for the necessity of a global perspective, with focus placed on educational needs, the emergence of a global society, growth in employment of Americans in foreign posts, environmental and nuclear issues, the changing environment of the workplace, ag-

ing, and the decline of U.S. dominance within the world economy.

Anderson (1984) examined the impacts of technological innovation on nine strands in the sociocultural system -science, engineering, technology, societal needs and values, the economic system, the political system, the family system, the educational system, and the religious system. A systematic analysis led to the outlining of goals and objectives for developing technological literacy in students:

- developing a holistic view of society and culture;
- developing an understanding of conflict as part of the necessary tension within a cultural system;
- establishing competence in understanding technological change; and
- developing respect for the natural world.

### Guiding Principles

The North American Association for Environmental Education (NAEE) has adopted a set of guiding principles which involve S/T/S rhetoric (NAEE, 1984, p. vi):

Environmental Education should:

- consider the environment in its totality-natural and built; biological and physical phenomena and their interrelations with social, economic, political, technological, cultural, historical, moral, and aesthetic aspects;
- integrate knowledge from the disciplines across the natural sciences, social sciences, and humanities;
- examine the scope and complexity of environmental problems and thus the need to develop critical thinking and problem-solving skills and the ability to synthesize data from many fields;
- develop awareness and understanding of global problems, issues, and interdependence, helping people to think globally and act locally;
- consider both short and long term futures on matters of local, national, regional and international importance;
- relate environmental knowledge, problem solving, values and sensitivity at every level;
- emphasize the role of values, morality, and ethics in shaping attitudes and actions affecting the environment;
- stress the need for active citizen participation in solving environmental problems and preventing new ones;
- enable learners to play a role in planning their learning experiences and providing an opportunity for making decisions and accepting their consequences; and
- be a life-long process-should begin at a preschool level, continue throughout formal elementary, secondary, and post-secondary levels, and utilize non-formal modes for all age and educational levels.

In a practical sense, it is clear that S/T/S education, however defined and delimited, subsumes to a significant extent the content which environmental education was initiated to purvey, and in fact requires that content for substance. It has been argued that, if only for purposes of clarity, the inclusion of the term "environment" in the title of the S/T/S thrust makes sense (Disinger, 1986; Lubbers, 1986)-S/T/S/E, S/S/T/E, S/E/T/S, for possible examples. It is just as clear that, if either or both of "technology" or "environment" are to be receive significant attention in precollegiate curricula, they must do so, at least under present circumstances, primarily within the context of the natural and/or social sciences, for the simple reason that those existing entities, both established in school curricula, offer the best apparent fits-and because there is interest among both theorists and practitioners within the science education and social studies education communities. Another reason is, of course, that there is no widespread curricular entity called "technology education," nor has environmental education established a niche as a distinct curricular offering.

However, evidence already cited clearly indicates that current levels of implementation of S/T/S goals, or of any goals relating to "technology" and/or "environment," are modest at best; the gap between theory and practice in this instance may be of similar magnitude to that described by Snow between "science" and "humanities." As C. Roth pointed out (1978, pp. 21-22), leaders tend to move faster than the pack; at some point, it becomes incumbent upon theorists, the "conceptualizers," to advance such overwhelming arguments that practitioners will provide, or provide for, their own leadership for the implementation stages, or to wait until those who must do the implementing catch up at their own speeds, or to help provide for facilitation, leadership and assistance-that is, to find ways to "get on with it."

### Efforts Underway

In actuality, a number of efforts have been initiated with respect to providing practical support for S/T/S education; generally, they make extensive use of the content, and frequently the teaching and learning methodologies, of environmental education. An example is the *Science Through Science, Technology and Society Reporter*, a periodical newsletter published by the S-STS Project at The Pennsylvania State University. In a recent article (Working Party, 1986, pp. 7-21), a skeletal "Model for a One-Year Course In Science Technology & Society" was offered, based on a survey of existing courses, to suggest principles which might guide the development of S/T/S courses, and to provide examples of well-developed courses. Eight goals are listed:

- to clarify the relations of technological and scientific developments to socially relevant issues;
- to show the mutual influences of technology, science, and society on one another;
- to develop learners' understandings of themselves as interdePendent members of society, and of the interdependencies between society and "the eco-system of nature;"
- to examine differing viewpoints about S/T/S issues and options;
- to include personal and societal ethics in broad considerations of S/T/S;
- to develop and apply problem-solving and decision-making skills with respect to S/T/S;
- to encourage learners to become involved in personal action with respect to S/T/S options, after weighing advantages and disadvantages; and
- to foster students' confidence in understanding and using quantified, scientific, and technological information as a basis for making judgments about S/T/S issues.

An earlier issue of *S-STS Reporter* (Reviews..., 1986) provided summaries of seven instructional modules focusing on S/T/S topics, discussing module features, sources, appropriate grade levels, and other relevant information. The modules were judged on the basis of criteria illustrating distinguishing features of S/T/S materials.

Currently, complementary surveys of the 50 state education agencies are being conducted by Penn State's Center for Education in Science, Technology and Society (Rubba, 1986) and by the ERIC Clearinghouse for Science, Mathematics, and Environmental Education to determine the extensiveness of S/T/S and/or S/S/T/E education nationwide. Plans call for the early publication of the results of each survey.

An ERIC search will locate many instructional materials of probable use to those seeking ideas for infusing these ideas into school curricula. A number of such materials have been produced over the past several years, though not all of them use the current "buzz words." Among representative examples are:

- Bybee, et al.'s (1984) compendium of activities dealing with science and society, designed for use in elementary, middle, and junior high schools;
- Hungerford, et al.'s (1978) "Investigation and Action Skills for Environmental Problem Solving;"
- Iozzi's (1982) "Preparing for Tomorrow's World" program, consisting of

modules addressing moral/ethical dilemmas;
- A middle school program (Melcher, 1982) which includes lessons on applied technology topics;
- A social studies activities text (Melnick and Ronan, 1984) designed to provide high school students with various approaches for thinking about future resources;
- A set of five simulations for addressing science-related social issues in either science or social studies secondary classrooms (Parisi, 1986);
- A "Contemporary Issues in Science" program offering secondary teachers a case study approach to examining S/T/S related concerns (Staten Island Continuum of Education, 1982); and
- An exploration of the interactions of science and technology with society for middle school students (University of the State of New York, 1985).

As the most recent in its series of environmental education teaching activities volumes, the ERIC Clearinghouse for Science, Mathematics, and Environmental Education is publishing *Teaching Activities in Science-Society-Technology-Environment* (Disinger and Lisowski, 1986), which contains a number of instructional activities, generally selected from documents in the ERIC system, which stress the environmental aspects of science-technology-society-and environment.

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