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AUTHOR	Berlin, Donna F.; Kumar, David D.
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ABSTRACT

This study was designed to determine the number of states that are currently implementing Science-Technology-Society (STS) education and similar society-based, science education programs (STS-surrogates) in the United States and to describe the nature of this implementation. STS is operationally defined as the interaction between science, technology, and society. STS-Surrogates denote science or technology education programs which are society-based as they look at societal issues, concerns, and problems but do not use the term "STS" in their titles and are not directly related to the STS curriculum movement. Data from all 50 states were obtained through a telephone survey of state science supervisors. This data indicates that 6 states require, 9 states recommend, and 19 states encourage STS education in their science curricula. Two states will require STS education by 1993 and one state will encourage STS education by 1994. Forty-five states will have some form of STS education implementation by 1994. Twenty-two states report that 3,237 school districts (21% nationwide) have implemented STS education. To date there have been 968 inservice training/workshops conducted related to STS education. (PR)

THE STATUS OF STS IMPLEMENTATION IN THE UNITED STATES AND ITS IMPLICATIONS

Donna F. Berlin and David D. Kumar

The National Center for Science Teaching and Learning
The Ohio State University
1929 Kenny Road
Columbus, OH 43210

Paper presented at the 66th annual meeting of the National Association for Research in Science Teaching, Atlanta, GA, April 15-19, 1993.

Abstract

This study, Phase I, was designed to determine the number of states that are currently implementing Science-Technology-Society (STS) education and similar society-based, science education programs (STS-Surrogates) in the United States and describe the nature of this implementation. STS is operationally defined as the interaction (issues, concerns, and problems) between science, technology, and society. STS-Surrogates denote science or technology education programs which are society-based in as they look at societal issues, concerns, and problems but do not use the term "STS" in their titles and are not directly related to the STS curriculum movement. Three levels of implementation (require, recommend, encourage) by State Departments of Education were chosen because implementation of educational policies varies depending upon the legislative structure of the states. Data from all 50 states was obtained through a telephone survey of state science supervisors. This data indicates that six states require; nine states recommend; and nineteen states encourage STS education in their science curricula. Two states will require STS education by 1993 and one state will encourage STS education by 1994. Eight states report some nebulous combination of require, recommend, and encourage STS education implementation. Two states encourage STS-Surrogates. Three states have neither STS education nor STS-Surrogate implementation. According to the survey, forty-five states will have some form of STS education implementation by the year 1994. Generally, STS education is targeted for grades K-12. Twenty-two states report that 3,237 school districts (21% nationwide) have implemented STS education. To date, there have been 968 inservice training/workshops conducted related to STS education. Information obtained from this study will be used in subsequent studies.

Literature Review

Science-Technology-Society (STS) education has been "a focus of activity in science education" (Rubba & Wiesenmayer, 1988, p. 38), and "one of the significant curriculum developments in school science" (Yager, 1987, p. 19) in the United States. Hurd (1991) has stated that " ... STS goals for science education are deeply embedded in our culture and have been for the past 200 years" (p. 258). By definition, STS education are those approaches to science education that make use of the interactions between science, technology, and society (Bybee, 1987). According to Hurd (1975) "science provides knowledge; technology provides ways of using that knowledge; and our value concepts guide what we ought to do with both" (p. 29). Based upon a comprehensive review of the literature, Kumar and Berlin (1993) suggest that science and technology are distinct but intertwined as both operate within a social milieu that involves the interactions and symbiotic influence of all three. Hurd (1991) provides a comprehensive historical review of perspectives that have led to a rationale for Science-Technology-Society education in the science curriculum. Throughout the history of science education in the United States, there have been efforts to unite science, technology, and society. Hurd traces 200 years characterized by periods of attention, neglect, or denial. These periods were reflective of science curricula that at various times were oriented toward social progress, a practical and technological base, or a discipline and career focus. The most no periods of attention to STS include: British philosopher Herbert Spence's 1859 list of examples in which science, technology, and society interact; the early recognition of the relationship between science and society by Benjamin Franklin and Thomas Jefferson; the reorganization of science in secondary education based upon the needs of science, technology, society, and students as recommended in the 1920 report of a committee appointed by the U.S. Bureau of Education; and the Harvard University Report of 1945 entitled "General Education in a Free Society" which affirmed the relationship between science and technology and that science education should relate to societal problems. There were also periods of neglect and denial (1950s and 1960s) in which science curricula focused upon content, the practice of science, and career preparation.

Improving the American public's understanding of science and technology as it relates to individual and societal needs has been one of the goals of science education reform movements in the U. S. beginning with the goal clusters of Project Synthesis (Harms, 1977; Harms & Kahle, 1981; Harms & Yager, 1981; Yager, 1990). According to Project Synthesis, science education should help students to meet personal needs, resolve current societal issues, assist with career choices, and prepare for further study. Science-Technology-Society: Science Education for the 1980s (1982), published by the National Science Teachers Association (NSTA) set the stage for the current attention to STS as a major curriculum reform theme in the United States. According to this NSTA position paper, the goal of science education is to develop scientifically literate individuals who understand how understand how science, technology, and society interact with one another, and who are able to use this knowledge in their everyday decision making; use the skills and knowledge of science and technology as they apply to personal and social decisions; and to study the interaction among science-technology-society in the context of science-related societal issues (pp. 1-6).

Support for STS education surfaces in documents published by a variety of professional organizations and funding agencies. The Triangle Coalition for Science and Technology

Education (1988) in its position paper The Present Opportunity in Education proposed "the development of a broad pool of citizens who are interested and functionally literate in science and its applications in society" (p. 2) as the national goal for science education. The American Association for the Advancement of Science in their publication Science for All Americans (Rutherford & Ahlgren, 1990) believe that the scientifically literate person is one who "... understands keys concepts and principles of science; is familiar with the natural world and recognizes both its diversity and unity; and uses scientific knowledge and scientific ways of thinking for individual and social purposes" (p. ix). Sensitive to the present state of science education, the science competency level of U. S. students, and recognizing the importance of the teaching and learning of science and technology in the context of individual and societal needs, the U. S. House of Representatives adopted "The House Concurrent Resolution 57". Introduced by Representative Tom Sawyer, this resolution states that "it is the sense of the Congress that this nation should dedicate its resources to the development of a broad pool of citizens who are functionally literate in science, mathematics, and technology..." (p. 28) and accordingly design science education policies to improve public scientific literacy. In 1990, the National Science Foundation announced new guidelines for the improvement of science curriculum and instruction for all students with the aim to "boost science literacy and citizen understanding of science related issues...the influence of technology on the physical world and the human condition-at every educational level" (p. 1).

Reflecting upon what seems to be broad-based support for STS education, one might expect widespread STS education implementation in the U.S. A nationwide survey conducted in 1986 by Rubba, Barchi, and Wambaugh (1987) reported that six states (Florida, Maryland, Michigan, New York, Washington, and Wisconsin) have some form of STS implementation in science education. Kumar and Berlin (1993) report STS education implementation in California and Pennsylvania in addition to the states indicated by Rubba, Barchi, and Wambaugh (1987). STS-Surrogates (society-based, science or technology education programs) have also been implemented according to Kumar and Berlin (1993). In general, a review of STS education literature reveals a sparse picture of STS education implementation in the U.S.A. The paucity of published literature and the lack of detailed technical information related to STS education implementation suggests that a literature review may not be sufficient enough to systematically identify STS education implementation nationwide.

Rationale

Bybee (1991) has stated that providing information useful for reducing the gap between policy and practice seems to be the central issue in STS education. Unless there are public mandates for implementing policies for STS education, STS may become "just one more passing fancy in education..." (Rutherford, 1988, p. 126). However, to develop a national model for mandating STS themes and issues into science curricula, a lot remains to be learned about STS education. Therefore, in order to fully understand the status of STS education nationwide, it is critical to conduct a nationwide survey to determine its mandated role in the curriculum. Also, in order to find out if STS education is only a name change, it is essential to survey the status of other society-based, science curricula which do not use the title "STS" and compare their curricula. Implementation models can then be developed in order to facilitate the infusion of STS themes and issues into school science throughout the nation.

Method

Focus Area 5: Integration of Content Across Curriculum (Donna Berlin, Coordinator) of the National Center for Science Teaching and Learning at The Ohio State University has proposed a Three Phase Project entitled "Towards a Model for Implementing Science-Technology-Society Education" (Kumar & Berlin, 1992). Phase I involves a national survey to determine the number of states that are currently implementing STS education or STS-Surrogates and to gather information about their implementation. In addition, comprehensive descriptions of these curricula will be collected in order to analyze and compare them in subsequent studies. Phase I is also supported by a seed grant from The Ohio State University, Newark Campus. It is anticipated that the information obtained from Phase I will be used in Phase II to conduct statewide studies of the outcomes of STS education and STS-Surrogates. Based upon the findings of Phase I and II, a national model for the implementation of STS education can then be developed (Phase III).

Operational Definitions

Science-Technology-Society (STS) - denotes the interaction (issues, concerns, and problems) between science, technology, and society.

STS-Surrogates - denotes society-based, science or technology education programs which look at societal issues, concerns, and problems but do not use the term "STS" in their titles and are not directly related to the recent STS curriculum movement. (e.g., technological literacy).

Implementation - refers to STS education in the science curricula that has been required, recommended, or encouraged by State Departments of Education. Three levels of implementation have been chosen to reflect variations in state educational policies. Some states by virtue of their legislative structure are unable to require specific educational policies (e.g., Ohio).

STS Implementation: Require - STS themes and issues are required to be taught as a part of school science education as mandated by the State Departments/Boards of Education.

STS Implementation: Recommend - STS themes and issues have been recommended for teaching as a part of school science education by the State Departments/Boards of Education, but not enforced by any state mandates.

STS Implementation: Encourage - STS themes and issues have been encouraged to be taught as a part of science education by the State Departments/Boards of Education through volunteer efforts by individual teachers.

Procedure

According to John Dillman (1989) of the U.S. Census Bureau and a national expert in survey designs, telephone surveys have become "today's dominant survey methodology" particularly with respect to small group research "to ask the right question of the right groups and to do so in a time frame that was particularly useful" (p. 4). Accordingly, a telephone survey procedure was developed for Phase I of the project in order to obtain current information about STS education and STS-Surrogate implementation in the United States. Telephone protocols and recording sheets were developed. Two university students in the College of Education were given training to conduct the telephone interviews. In addition, the students were given various STS-related documents to read prior to conducting the survey. The survey sought the following information from state science supervisors:

- A brief definition of STS for respondents' reaction. The definition read as follows:

"STS is the interaction between science, technology, and society."

- The nature of STS education implementation (Require, Recommend, or Encourage)
- Year of STS education implementation
- Grade level(s) implementing STS education
- STS education document(s) in print and a request for a copy of the STS education document(s)
- Number of school districts implementing STS education
- Number of inservice teacher training/workshops in STS education
- If the state has not implemented STS education, then the above information was sought for any STS-Surrogate programs.

Telephone interviews of all 50 state science supervisors were conducted between the months of late March and early September of 1993. One of the most challenging tasks was scheduling telephone interview appointment times with each state science supervisor amidst his/her busy schedule. Twenty percent of the telephone survey responses were randomly chosen and sent to their respective respondents for validation. Only one survey required a minor modification.

Results

The telephone survey data collected was analyzed using descriptive statistical procedures. Based upon the telephone interviews with 50 state science supervisors/consultants, the following results were obtained:

Definition

1. All 50 states concurred with the operational definition of STS education.

2. Nine states suggested some augmentation to the definition of STS education. The most frequent suggestion (N=6) was to include "personal responsibility in decision making" in the definition.

Implementation

1. Six states require STS education as a part of their science curricula.

2. Nine states recommend STS education as a part of their science curricula.

3. Nineteen states encourage the use of STS themes and concepts in their science curricula.

4. Eight states report some nebulous combination of require, recommend, and encourage STS education in their science curricula.

5. STS education implementation has been in effect from as early as 1966.

6. In two states, STS education will be required in 1993.

7. In one state, STS education will be encouraged in 1994.

8. Two states have implemented STS-Surrogates.

9. Three states have no STS education or STS-Surrogate implementation.

Grade Level

1. STS education is primarily implemented in grades K through 12 (N=29).

2. Five states have implemented STS education in grades 6 through 12.

3. Three states each have implemented STS education in grades 7 through 12 or grades 9 through 12.

4. One state each has implemented STS education in grades K through 10, 1 through 8, 4 through 12, or 7 through 9.

5. One state has implemented STS education in grades 1 through 6 and grades 9 through 12.

6. The two STS-Surrogate programs are implemented in grades K through 12.

Documentation

1. Twenty-two states have documents that address STS education or incorporate STS themes and issues. Examples are the STS Modules (Hawaii) and the Michigan Essential Goals and Objectives for Science Education (Michigan).

2. Five states use STS education documents from other states and/or university projects.

3. One state has a document for their STS-Surrogate program.

School Districts

1. Twenty-two states report a total of 3,237 school districts currently implementing STS education. This represents 21% of the number of school districts nationwide (National Education Association, 1992).

2. One state will be implementing STS education in 55 school districts by 1993.

3. One state will be implementing STS education in 17 school districts by 1994.

Inservice Training/Workshops

1. Thirty-four states have provided inservice training/workshops addressing STS education.

2. Twenty-two states have provided approximately 931 inservice training/workshops addressing STS education.

3. One state has provided 25 inservice training/workshops addressing STS education at regional levels.

4. One state has provided 12 inservice training/workshops addressing STS education as a part of the "Iowa Consortium".

5. Twenty-one states did not have information available on the number of inservice training/workshops addressing STS education. Some of these state science supervisors were aware of inservice training/workshops addressing STS education conducted at district or local levels. This survey did not make any attempt to tabulate this data.

Summary and Implications

At present, the national survey shows a promising picture of STS implementation nationwide. Based upon the data, forty-five states will have some form of STS education implementation by the year 1994. The results of this study have led to a proposed research agenda directed toward (1) analysis of the role of STS education and STS-Surrogates in the science curricula of each state, (2) conducting statewide studies of the outcomes of STS education and STS-Surrogates, and (3) developing an implementation model for STS education nationwide.

Other possible sources of STS education policy implementation may include state supervisors of social studies education and technology education. These supervisors were not contacted due to financial limitations and should be interviewed in subsequent research.

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References

Bybee, R. W. (1987). Science education and the science-technology-society theme. Science Education, 71(5), 667.

Bybee, R. W. (1991). Science-Technology-Society in science curriculum: The policy-practice gap. Theory into Practice, 30(4), 294-301.

Dillman, D. A. (1989, Third Quarter). Our changing sample survey technologies. Choices, 12-15.

Harms, N. C. (1977). Project synthesis: An interpretive consolidation of research identifying needs in natural science education. A proposal prepared for the National Science Foundation. Boulder, CO: University of Colorado.

Harms, N. C., & Kahle, S. (1981). The status and need of pre-college science education: Report of Project Synthesis. Washington, DC: National Science Foundation.

Harms, N. C., & Yager, R. E. (1981). What research says to the science teacher, Vol. 3. Washington, DC: National Science Foundation.

Hurd, P. D. (1975). Science, technology, and society: New goals for interdisciplinary science teaching. The Science Teacher, 42(2), 27-30.

Hurd, P. D. (1991, Autumn). Closing the educational gaps between science, technology, and society. Theory into Practice, 30(4), 251-259.

Kumar, D. D., & Berlin, D. F. (1993). Science-Technology-Society policy implementation in the USA: A literature review. The Review of Education, 15, 73-83.

Kumar, D. D., & Berlin, D. F. (1992). Towards a model for STS education: Recommendations for research. Bulletin of Science, Technology & Society, 12, 136-137.

National Education Association. (1992). 1991-92 Estimates of school statistics, 50th anniversary edition. Washington, DC: Author.

National Science Foundation. (1990). NSF to support statewide reforms in science, math, and Engineering education. NSF Directions, 3(3), 1.

National Science Teachers Association. (1982). Science-Technology-Society: Science education for the 1980s: NSTA position statement. Washington, DC: Author.

Rubba, P. A., Barchi, B. A., & Wambaugh, R. J. (1987). STS in the nation's schools: Six states take the lead. SSTS Reporter, 3(1), 1-4.

Rubba, P. A., & Wiesenmayer, R. L. (1988). Goals and competencies for precollege STS education: Recommendations based upon recent literature in environmental education. Journal of Environmental Education, 19(4), 38-44.

Rutherford, F. J. (1988). STS -- here today and .... ? Bulletin of Science, Technology & Society, 8(1), 125-127.

Rutherford, F. J., & Ahlgren, A. (1990). Science for all Americans. New York: Oxford University Press.

Sawyer, T. C. (1989). A national strategy for excellence in math, science & technology. The Generational Journal, 2, 28.

Triangle Coalition for Science and Technology Education. (1988). The present opportunity in education. Washington, DC: NSTA.

Yager, R. E. (1987). Problem solving: The STS advantage. Curriculum Review, 26(3), 19.

Yager, R. E. (1990). The Science/Technology/Society movement in the United States: Its origin, evolution, and rationale. Social Education, 54(4), 198-200.