Defining the Discipline of Science Education

ROBERT E. YAGER
Science Education Center, University of Iowa, Iowa City, Iowa 52242

Recently, many have written about the discipline of science education without elaborating on the parameters of such a discipline and without defining the meaning of such a designation (Hurd, 1980; Renner, 1981; Yager, 1980; Yager, Bybee, Gallagher, & Renner, 1981). Often the term "discipline" is reserved for scholarly pursuits where there is a research base. It is commonly used with the traditional departments in a secondary school or college. It is not common to refer to any area of professional education as a discipline.

This is unusual when one considers the emphasis placed upon the existence of a research base for most areas of education. Most schools and colleges of education are responsible for more graduate research (theses and dissertations) than most other areas of major universities. In a sense, it is curious that the term "discipline" is not in common use when referring to science education.

A major problem of science education (not unlike other areas of education) is the failure of research to affect practice. There is widespread disdain for educational research among science teachers and other school officials. There is almost no recognition of research concerning the teaching of science in colleges. Many have called for actions that would provide correctives for this situation (Hurd, 1980); Kahle & Yager, 1981; NSTA, 1978; Renner, 1981; Watson, 1979; Yager, 1978, 1979, 1980).

Too often science education is thought to be limited to concern for the science that is taught in K–12 schools and/or colleges and universities. Sometimes it is used to emphasize science teacher education—both the professional programs for preservice and inservice teachers and the research associated with such programs. At times science education is viewed as an attempt to help students learn science.

Many of these definitions are appropriate for a given setting or situation. However, they do not provide much insight beyond administrative or teaching situations. Perhaps such definitions of an early discipline can be visualized through practice until an information base develops. A certain maturity is required and certain information is needed for constructing definitions and models from which practice can emerge. Science education may be at such a point.

Recently there have been several reports concerning major shifts in the goals of science education. Helgeson, Blosser, and Howe (1977) reported that the goals of science education at the secondary level are in a period of major transition. An NSTA working paper, entitled *Science Education: Accomplishments and Needs*, identified several new goals for science education for the 80s. An analysis of the paper (Yager, 1981) revealed general agreement among the leadership of five groups

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of science educators that an increased focus upon science and society or science in society was needed. Harms and the Project Synthesis research team reported that a science and society focus is basic if K–12 science teaching is to reach a more desired state (Harms & Yager, 1981). Several college courses have been developed with such an emphasis on the interrelationships between science and society.

These developments of the past five years indicate the centrality of the science–society interface for science education as a discipline. All other goals—those that have characterized the field for the past 50 years—probably can be subsumed by the science–society goal. This new goal may provide a major justification for the study of science in K–12 settings and general education science requirements in colleges.

The authors of the NSTA Accomplishments and Needs paper see the science–society interface as the proper setting for science education (NSTA, 1978). A recent analysis of the paper revealed strong agreement among all levels of the leadership of science education for such a focus (Yager, 1981). Further, the majority of this leadership agreed that current societal problems should provide the most significant influence upon science teaching for the 80s.

Defining the discipline of science education to be the study of the science–society interface removes the restriction that science education is a school or collegiate program. At the same time, it does not exclude such settings as places that the interface may be effectively considered. Such a designation provides parameters for research efforts, curriculum planning, and educational programs.

Science education is defined, then, as the discipline concerned with the study of the interaction of science and society—i.e., the study of the impact of science upon society as well as the impact of society upon science. Their interdependence becomes a reality and the interlocking concept for the discipline. Research in science education centers upon this interface.

An analogy may help explain such a definition. It may help elaborate upon the advantages of such a view for the discipline. The discipline of science education, when defined as the interface between science and society, may be likened to the cell membrane which surrounds the living cell—separating the living material from its surroundings. The membrane is a dynamic one through which all materials must enter and exit the cell itself. Studying the process and the factors controlling such movement, the direct involvement of the membrane in the actions can be used as a parallel in terms of science education and its role in assisting society to understand and to use science while also assisting professional scientists to understand and to affect society.

The vehicle for science education is often a school or college classroom or laboratory. However, with a broader definition the work of the science educator is not restricted to such places. This definition of science education also includes the relationship of research, curriculum and instruction, and teaching approach. It provides a rationale and a coherence that is often missing with more restrictive definitions.

When one uses the cell membrane as an analogy, the importance of the discipline to society as a whole, to the entire scientific community, and to the future of humanity is apparent. Many biologists consider the membrane the most vital aspect (structure and function) of life itself. Similarly, such a definition of science education gives

it a primary role in today's world. Defining science as, "The discipline concerned with the study of the interaction of science and society," provides clear justification for science education by making it clear that science education is a vital link to the future of mankind.

References

Harms, N. & Yager, R. E. *What research says to the science teacher—Volume 3*. National Science Teachers Association Monograph, Washington, DC, 1981.

Helgeson, S. L., Blosser, P. E., & Howe, R. W. *The status of pre-college science, mathematics, and social science education: 1955–1975. Volume I: science education*. Ohio State University: Center for Science and Mathematics Education, 1977.

Hurd, P. D. Transformation of science education: challenges and criteria. *Sci. Educ.*, 1982, *66*(2), 281–285.

Kahle, J. B. & Yager, R. E. Current indicators for the discipline of science education. *Sci. Educ.*, 1981, *65*(1), 25–31.

National Science Teachers Association. *Science education: accomplishments and needs*. NSTA working paper, 1978.

Renner, J. W. *The power of purpose*. Paper presented at the meeting of the National Association for Research in Science Teaching, Grossingers' in the Catskills, New York, April 1981.

Watson, F., Gardner, M., & Smith, H. *Perspectives on Science Education*. Section Q report to Board, American Association for the Advancement of Science, 1515 Massachusetts Ave., N.W., Washington, DC 20005, 1979.

Yager, R. E. Priorities for research in science education. *J. Res. Sci. Teach.*, 1978, *15*(2).

Yager, R. E. Why should it not be so: the second fifty years. *J. Res. Sci. Teach.*, 1979, *16*(2).

Yager, R. E. *Crisis in science education* (Tech. Rep. 21). Iowa City, IA: University of Iowa, Science Education Center, June 1980.

Yager, R. E. *Analysis of current accomplishments and needs in science education*. NSTA and the ERIC Clearinghouse for Science, Mathematics, & Environmental Education, Columbus, OH, 1981.

Yager, R. E., Bybee, R., Gallagher, J. J., & Renner, J. W. An analysis of the current crisis in the discipline of science education. *J. Res. Sci. Teach.*, 1982, *19*(5), 377–395.

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