Introduction

Proceedings of the Symposium on International Science and Education Engineering—An Overview

DURING THE LAST one hundred years, science has played a major role in compressing time and physical space through technological advances. Countries and peoples once thoroughly detached from each other are now linked in economic, political, and cultural cooperation and exchange. The challenges ahead are apparent. Scientists, as well as world leaders, must understand other cultures if they wish to share ideas and values, transfer technology, establish personal relationships, and help tomorrow's leaders in the quest for a peaceful and equitable global society. Responding to these challenges across disciplines, education at the college and university level is becoming increasingly multicultural. However, science education has not risen sufficiently to this challenge. An appreciation and knowledge of foreign cultures, literatures, and languages are essential to science students as well as students in the humanities and social science if they are to assume leadership roles in the new multicultural world.

Because of the critical role that science and technology will play in this new world, the challenge of educating scientists with global competence is urgent. Science students need to be in contact with alternative ways of thinking and doing things from around the globe, and they need to have a better understanding of the global effect of their work. Subtle and not so subtle differences in culture can neither be learned in a classroom nor obtained from books. They must be experienced. In today's world, universities can no longer afford to produce scientific experts who are not adequately prepared for the wider global arena.

Nevertheless, undergraduate science majors seldom participate in international studies and study abroad programs. At many U.S. colleges and universities less than 4 percent of the students graduating with a bachelor's degree in the physical sciences have studied abroad, compared with over 50 percent of the students graduating with a major in the arts of humanities.

Before they can embark on an international science education program, science faculty and students need some idea of the scientific environment into which the students will be placed. As a first step in defining this environment, papers in these proceedings, Section I, discuss the similarities and differences in science education in different cultures. Each presenter provides an overview of science education from kindergarten through the Ph.D. in his or her own culture. The goals of science education and questions of how science students are recruited, including questions or gender representation, are explored. This overview provides a range of models for science education, each with its own strengths and weaknesses. For example, Iris Huang describes the centralized system of science education that characterizes China. Here teachers teach from standard textbooks and must reach curriculum goals established by the national government. In contrast, since the federal government of the United States has no authority to control science education, there is considerable state to state variability in what is covered. Additionally, as described by Audrey Champagne, education in the United States is subject to local economic, political, and cultural factors.

The goals of science education are also quite variable from country to country. On the one hand, as described by T.N. Goh, the main objective of science education in Singapore is to enhance national competitiveness in the world industrial and service sectors. This is in contrast to the objective in Europe, where science is taught because it is considered an area with which an educated person should be familiar.

In order to set the context for the student experience, the second section of this volume addresses some of the global questions raised by science and technology. For example, David Pimentel discusses the problems created by an increasing population whereas Paul Connett addresses the question of economic growth versus sustainable survival. Healing traditions, study abroad for prospective health professionals, and science communication ethics are discussed in other papers in this section. The papers in this section are not meant to be definitive treatises. Rather, they raise these issues to eye level for faculty and students. These discussions provide some of the justification as well as the context for science abroad programs.

Section III is the keystone section of the proceedings. Ben DeWinter provides an overview of the needs, values, and problems of science students participating in study abroad programs. This is followed by discussions of the opportunities, challenges, and models of programs in engineering, the biological/environmental sciences, and the physical sciences.

Section IV present possibilities for the future with discussions about electronic communications, teaching science with a more global perspective, and the future of science education.

The symposium in which these papers were presented was held at Cornell University on June 9-12, 1996. The main sponsor was the New York State Pew Program in Undergraduate Science Education. Cosponsoring institutions included Denmark International Study Program, Leiden University, the University of Manchester, Ben-Gurion University, National Autonomous University of Mexico, and the National University of Singapore.

It is hoped that these proceedings will serve as a road map for future science education programs. It is meant to provide justifications and models for colleges and universities that wish to pursue foreign programs for their students. We hope it will serve as a resource for educators, administrators, scientists, and students who are interested in an international experience for their students.

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