

Section VI:

**Contributors to the EHR Advisory Committee
Review of U.S. Undergraduate Education in SME&T**

Acknowledgments

Shaping the Future is the product of many people, and it is a pleasure to acknowledge their contributions to this report. My only fear is that I will overlook someone, and I hope for forgiveness if that is the case.

First, I thank Luther Williams for the idea to do the report in the first place and the unfailing support and encouragement to complete it and to implement it. To Bob Watson, Division Director for Undergraduate Education is owed an enormous debt of gratitude. Bob opened the Division to me, provided whatever I needed to get the job done, allowed me to observe and participate in many aspects of the Division's work, and gave invaluable advice and suggestions at every stage. Throughout, however, he was careful to allow me to be independent. Any lapse of objectivity is my responsibility, not his.

The staff in DUE were helpful beyond belief, though they had a full plate of responsibilities without this review! They provided information and assistance at every turn, seemingly never too busy to answer a question or offer a suggestion. They planned the conference, "Shaping the Future," in such a way as to provide a superb sendoff for our report. Thanks to all of them, who became and still are good colleagues.

Special thanks are due to Myles Boylan and Peter Yankwich, who did most of the staff work, analyzing information, commenting on early drafts, gathering data, and providing invaluable historical perspectives. Anita Broadus was our faithful secretarial support, solving all sorts of problems and providing all sorts of assistance, always with a smile. Ranetta Roseboro was always available as backup, helping me with computer or administrative problems.

Outside the NSF, I acknowledge with gratitude my colleagues at the NRC with whom we worked so closely. Thanks to Don Kennedy, who provided the overall leadership for "From Analysis to Action," along with Brad Moore, Chair of the NRC's Committee on Undergraduate Science Education, and Nancy Devino, NRC staff. They were faithful colleagues whose commitment and wisdom are reflected in many ways in *Shaping*.

The RevUE committee was wonderful. They trusted me, corrected me, improved my writing, made me think, broadened my horizons. The report would not have been nearly so complete or accurate without their invaluable help.

I thank my several institutions, who permitted me the time to work on *Shaping the Future*. I am particularly grateful to the University of Minnesota for giving me the opportunity to do the major part of this work, on an IPA with the NSF. But St. Olaf College and The University of Missouri have also generously shared me (or maybe they were glad to be rid of me!) for some of this work. I trust they will think it has been worthwhile.

Finally, I thank most sincerely all those around the country who participated in the review, through writing letters, testifying at hearings, sending information, responding to my questions, being part of the opening convocation, regional symposia, discussions at professional meetings, or the final conference itself. Your ideas, not mine, are reflected in the report. It was you who have done so much to improve SME&T undergraduate education in the past 10 years—and it is that progress that created a climate in which the vision we tried to articulate in *Shaping* could even be conceivable. Thank you, on behalf of all of our students, today and in the years to come.

Melvin D. George
Columbia, Missouri
March, 1997

Reproduction of the letter sent out by NSF Assistant Director Luther Williams to initiate discussion and commentary on the national state of undergraduate education. Respondents to Dr. Williams' letter, the various NSF and NRC steering committees, participants and contributors to the process are listed following the Description of the review.

OMB 3145-0156
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June 14, 1995

Dear _____

I seek your assistance with a comprehensive review of undergraduate education in science, mathematics, engineering, and technology (SME&T) that is being carried out by the National Science Foundation. SME&T education in the United States takes place in different types of institutions and in very diverse settings; we are seeking guidance from every major sector. At this early stage, I am soliciting the views of a small number of persons experienced and strongly interested in the subject of the review in order to identify major themes, topics, and focal points for consideration.

The attached memorandum, *NSF Review of Undergraduate Education*, describes the structure of the effort, indicates the policy context, lists the goals of the Foundation's SME&T education activities, and indicates some of the broad areas of inquiry to be studied. This solicitation of views occurs at the beginning of *Phase I*.

I invite you to participate now in the Review by writing a substantial letter based on your experience with contemporary undergraduate SME&T education and focusing on two questions:

What are the three most significant improvements in undergraduate SME&T education you have observed in our nation during the past ten years?

What are the three most important problems you and collaborating individuals and organizations encounter in your efforts to assure that the best possible education is delivered to undergraduates in the areas of SME&T?

I hope you will use *student learning in SME&T fields* as the primary frame of reference for your remarks, and the *quality of the resulting student preparation for diverse post-matriculation pursuits* as the primary criterion for judging educational merit. Your letter (or any questions) should be addressed to "Undergraduate Review," c/o Dr. Robert F. Watson, Director, Division of Undergraduate Education, Room 835 at the above address. Your input is needed by August 1, 1995. A report summarizing the findings and recommendations of the review should be available to share with you early in 1996.

Your letter will be an important addition to the contributions you have made to undergraduate education. I thank you for it.

Sincerely,

Luther S. Williams
Assistant Director

NSF Review of Undergraduate Education: Description

The Education and Human Resources (EHR) Directorate of the National Science Foundation (NSF) is undertaking a general review of the condition and needs of undergraduate education in the United States in the areas of science, mathematics, engineering, and technology (SME&T). This review includes wide consultation with students, educators, and employers. It will produce, by late spring 1996, a set of recommendations for accelerating progress in the improvement of undergraduate education. Concurrent with the review is a national dialogue on this subject conducted by the National Research Council and following from the joint NRC-NSF *Convocation on Undergraduate Education* held in April 1995 in Washington DC. The NSF review is coordinated with this dialogue—drawing on it and on other sources of input from individuals, organizations, and groups across the country.

Acting in an advisory capacity to Luther S. Williams, Assistant Director of NSF for EHR, are members of the Subcommittee for Undergraduate Education of the directorate's Advisory Committee:

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The Foundation is undertaking this review of the central enterprise of undergraduate education at a critical moment. National efforts to improve *precollege* education in SME&T, including those of the NSF, have been extensive and have involved efforts to create both innovative local improvement and larger systemic changes. The support of such efforts at the *undergraduate* level is more recent and has emphasized innovative improvement projects at single sites. The necessity for—and possibility of—larger-scale changes in undergraduate education is the primary question the review will investigate. While the Foundation recognizes that it raises this question at a time when the nation's colleges and universities are facing unprecedented financial and programmatic challenges, it is expected that the review will reveal ways of increasing the effectiveness of these institutions in undergraduate education. The provision of excellent educational services requires a robust infrastructure whose components at all institutions include faculty, curriculum, and capabilities for teaching and scholarship. The condition and support of these components will be examined.

The goals of improved undergraduate education in SME&T are:

- citizens who are empowered to be full participants in a scientific and technological society;
- a technically well-prepared workforce that can both participate and lead in a high performance workplace employing advanced technologies;
- teachers who are solidly grounded in both science and pedagogy, and scientists and engineers who are well-prepared for their occupations; and
- young people with diverse backgrounds, reflecting the changing face of America, successfully involved in SME&T.

Consistent with its chartered responsibility to “initiate and support ... science education programs at all levels ...”, the NSF seeks to ascertain the extent of effective innovation in undergraduate education in SME&T, and to determine what steps, if any, should be taken next to bring about further significant improvements. The specific areas of inquiry listed below are designed to lead to implementable recommendations to universities and colleges, scientific societies, and government and private funding and credentialing agencies (including, particularly, NSF itself):

- What are the innovations in undergraduate education and what is the evidence that their adoption represents a superior practice of undergraduate education? [The areas of inquiry regarding superior practice will involve: curriculum of all types and levels, faculty maintenance and development, pedagogy, instructional technology, instrumentation and facilities, research opportunities for students and faculty, and connections of instructional programs to the world of work.]
- What are the unmet educational needs of those who are receiving and have received undergraduate SME&T instruction?
- What infrastructure needs of institutions offering undergraduate instruction must be supported for them to implement the best instructional practices and meet the needs of students and employers?

In the context of an institution’s entire undergraduate enterprise, what are the problems that need to be addressed to achieve the goals of undergraduate SME&T education? What are suggested solutions to these problems? Who should do what, and how?

The effort through which the Foundation plans to address these questions will consist of three phases:

Phase I, now well advanced, involves direct, systematic investigation of the considered points of view of a broad spectrum of individuals and organizations who may be regarded as the “customers” of the diverse educational programs and institutions that deliver undergraduate education. Four major means are being employed: (a) Responses are being analyzed to letters soliciting the views of nearly 200 individuals and organizations. (b) Comments are being invited at a number of disciplinary and educational conferences. (c) Hearings were held to receive testimony from representatives of disciplinary groups, institutions of higher education, and business/industry. (d) Focus groups of students, recent graduates, parents, employers, and graduate/professional schools admission officers are being conducted. In addition, existing reports and data on undergraduate SME&T education are being analyzed.

Phase II of the review will present a summary of preliminary findings and tentative recommendations from Phase I for comment and elaboration to a large number of persons experienced in undergraduate education: individuals and organizations will be contacted, regional hearings will be held, and there will be discussions with faculty and administrators attending key professional society meetings.

In *Phase III*, the review will formulate, based on Phases I and II, specific firm recommendations in a plan for action to achieve the goals stated above for improved undergraduate education in SME&T. The report conveying the results of the review is expected to be ready in the spring of 1996 and will be disseminated first through a major event planned for July 1996 in Washington, DC.

For further information contact the Division of Undergraduate Education of EHR.

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