



A Report to the National Science Foundation

**EDUCATION AND
TRAINING IN THE SOCIAL,
BEHAVIORAL, AND
ECONOMIC SCIENCES:
A PLAN OF ACTION**

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SBE

social, behavioral, and economic sciences

MAY 2004
Washington, DC

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Behavioral, and Economic Sciences:**

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May 2004

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A National Workshop on Improving Education
in the Social, Behavioral, and Economic Sciences

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Preface

We are honored to have been asked by the National Science Foundation (NSF) to co-chair the June 2003 National Workshop on “Improving Education in the Social, Behavioral, and Economic Sciences” and to prepare this report. In convening this National Workshop and seeking guidance in the form of an action plan, the Social, Behavioral, and Economic Sciences (SBE) Directorate at NSF took a major step forward—looking beyond its investments in research to assessing how best to invest in building human capacity. The leadership and staff of the SBE Directorate deserve considerable thanks and appreciation for their determination to pursue this effort and take seriously the results.

Norman Bradburn, Assistant Director of the Social, Behavioral, and Economic Sciences Directorate through March 2004, gave both priority attention to this activity and engaged the full support and partnership of Judith Ramaley, Assistant Director of the Education and Human Resources Directorate. Richard Lempert, Director of the Division of Social and Economic Sciences, and Philip Rubin, until September 2003, Director of the Division of Behavioral and Cognitive Sciences, also provided important guidance for this enterprise.

No one individual, however, is more responsible for persisting in the ambition that NSF commit itself to public literacy in the SBE sciences and to building a strong, competent, and diverse talent pool of SBE scientists than Bonney Sheahan, Director of the Cross-Directorate Activities Program in the SBE Directorate. For many years, Bonney Sheahan has urged and pursued NSF activities to promote education in the SBE sciences. We hope this report advances that goal.

The report benefited from the information and wisdom provided by NSF, including data and reports. While we undertook considerable study of NSF’s structure and programs as well as needs and challenges in the SBE sciences, the work of the participants at the National Workshop provided the basis for the report. We also benefited directly from reviews of drafts provided by breakout group chairs and reporters and many other Workshop participants. Our role in planning the National Workshop and in preparing this report was made possible by a grant from the National Science Foundation (SES-0335575) to the first author through the American Educational Research Association (AERA). While there is much for NSF to assimilate in this report about expanding opportunities for training and education in the SBE sciences, it is our hope that the report offers a useful roadmap in pursuit of that end.

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May 2004

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Executive Summary

Over the last quarter of a century, the world has undergone rapid change. Almost every aspect of human life is more complex and interdependent, requiring knowledge of human and social systems as well as physical and biological systems. The social, behavioral, and economic (SBE) sciences¹ contribute penetrating insights on such issues as the causes and consequences of conflict, how individuals and groups perceive and misperceive hazards, how they understand or misunderstand the risks they run in their daily lives, and how they organize and structure their interactions and transactions. Understanding and utilizing this knowledge require basic competence in the SBE sciences in all citizens, and a talent pool of SBE scientists to undertake research and teach about it.

Determining how best to improve education and training in the social and behavioral sciences is a challenge. Under the aegis of the Social, Behavioral, and Economic Sciences (SBE) Directorate, and with the active participation of the Education and Human Resources (EHR) Directorate, the National Science Foundation (NSF) has committed itself to this task. This report, undertaken at the request of NSF, is an outgrowth of that ambition. The purpose of the report is to provide guidance to NSF on the development of a strategic plan for education and training in the SBE sciences.

The report focuses on four levels of education—K-12, undergraduate, graduate, and postdoctoral and early career stages—and on diversity issues. In each area, the report addresses key needs, impediments and challenges, and best practices as well as the components of an action plan. The action plan itself is presented in three parts: enhancements to existing NSF programs, new opportunities and initiatives, and immediate steps. An outline of the plan is presented in the Action Plan Summary Table (see pages 19-20).

NSF's commitment to SBE science education and training complements two priorities in the Foundation's five-year strategic plan (FY 2003-2008), NSF's *Workforce for the 21st Century* initiative and the *Human and Social Dynamics* priority area. In 2003, NSF took explicit steps to engage the wider scientific community in providing guidance on education and training in the SBE sciences. First, in January 2003, representatives of approximately 20 social and behavioral science societies attended a Planning Meeting and discussed the state of education and training in their respective fields. Second, in June 2003, 120 leading social and behavioral scientists and educators participated in a National Workshop. (Appendices A-C provide information on the Workshop.) At the June Workshop, participants engaged in intensive discussions about ongoing

¹Anthropology, cognitive science, economics, geography and regional sciences, history of science, law and social science, linguistics, decision and management science, political science, psychology, social psychology, sociology, and statistics, among others.

programs, innovations, and opportunities at the four stages of education and examined key needs, impediments, and best practices in education and training in the SBE sciences. In the plenary sessions and breakout groups, all participants addressed the topic of diversity.

Considerable research and analysis were undertaken in the preparation of this report and action plan. Also, information presented at the January Planning Meeting and the background papers and materials prepared for both meetings contributed valuably to the report. While all of this work was very useful, the deliberations at the National Workshop provided the basis for the report. In that sense, this plan of action is a collective product reflecting the ideas and input of many experts.

Improving Kindergarten through Grade 12 Education in the SBE Sciences

Current Context

Key Needs

The social, behavioral, and economic (SBE) sciences are largely absent from the K-12 curriculum, and their presence in the high school curriculum is limited, especially compared to the natural sciences. Major investments in curriculum, materials, and teacher training are required to meet current and future needs.

Impediments and Challenges

Impediments and challenges include determining where the SBE sciences should be situated in the K-12 curriculum (especially with respect to general science and social studies); developing appropriate curriculum, content, and materials; and focusing on pre-service and in-service teacher preparation. Interest in SBE science education comes at a time when the current emphasis in the No Child Left Behind Act of 2001 on reading and mathematics coupled with state-based assessment is preoccupying. Also, the absence of the SBE sciences in the National Science Education Standards and in education improvement programs affects the integration and legitimacy of these fields.

Best Practices

Some of the SBE disciplines and scholarly associations offer models of what can be done to improve SBE science education at the K-12 level. National committees of economists developed the Voluntary National Content Standards in Economics (1997), and the American Psychological Association developed and approved National Standards for the Teaching of High School Psychology (1999). Anthropology, economics, geography, psychology, and sociology, among others, have produced instructional materials and mounted teacher-training programs. Largely through the efforts of relevant scholarly societies, advanced placement courses are offered in economics, geography, political science, and psychology. An advanced placement sociology course is in development.

Components of an Action Plan

A commitment by the National Science Foundation to improve social, behavioral, and economic science education in the K-12 curriculum would send a strong signal to the scientific and education communities about the importance of capacity building and the inclusion of the SBE sciences in the “family” of science. Much can be done to advance SBE science education within the contours of existing EHR Directorate programs. Also, NSF should invest in innovations at the K-12 level to enhance the presence and quality of SBE education.

Enhanced SBE Funding through Existing EHR Programs

Greater attention to the SBE sciences and access of SBE investigators to a number of existing programs in the Directorate for Education and Human Resources (EHR) could materially advance SBE science education at the K-12 level. For example, a competition to support a Center for Learning and Teaching with a specific concentration in the SBE sciences could yield a cadre of professionals prepared to incorporate the SBE sciences in K-12 education. Also, the Instructional Materials Development Program, the Teacher Professional Continuum Program, and the Informal Science Education Program are ripe for proposals from and funding in the SBE sciences.

New Opportunities and Initiatives

The SBE and EHR Directorates should consider establishing a new, integrated initiative to advance education in the social, behavioral, and economic sciences at the high-school level. The SBE and EHR Directorates should also collaborate on a Teacher Training Initiative, and on the establishment of a “Bridges to SBE Science Education” Program similar to the joint program between the EHR and the NSF Engineering Directorates. The SBE Directorate should consider establishing a Research Experiences for High Schoolers (REHS) Program similar to the existing Research Experiences for Undergraduates (REU) Program.

Immediate Steps

Three immediate steps to help reshape understandings of the SBE sciences in the K-12 and science communities are: an article co-authored by the Assistant Directors for the EHR and SBE Directorates suitable for *Education Week*, *Science*, or a similarly prominent publication stressing the importance of integrating SBE science education into the K-12 curriculum; a request from NSF to the National Research Council’s (NRC) Committee on Science Education K-12 (COSE K-12) to include the SBE sciences in the National Science Education Standards; and a request to the American Association for the Advancement of Science (AAAS) to integrate the SBE sciences into its Project 2061.

Improving Undergraduate Education in the SBE Sciences

Current Context

Key Needs

The progress made by groups convened by national professional associations or higher education commissions notwithstanding, there remains substantial need to move beyond “trickle down” knowledge, notable initiatives, and institutional symbols of support to structural and institutional change. Colleges and universities all grapple with the dual purposes of exposing undergraduates to the thoughts, materials, and methods of fields of inquiry while simultaneously attracting, nurturing, and preparing some of these students to pursue advanced degree training. In almost every SBE science, recognition of the importance of a sequenced and integrated curriculum, sound methodological training, and research-based experience far outstrips implementation of these objectives.

Impediments and Challenges

Key impediments to enhancing literacy in the SBE sciences and enlarging the pool of individuals attracted to scientific careers include the absence of well-defined objectives for SBE general education; the complexity of designing courses that meet the needs of majors and non-majors; structural differences that impede the transition from associate to baccalaureate-degree programs; the inertia, inadequate resources, and absence of rewards that limit faculty collaboration on curriculum change; and the overall absence of an explicit plan for research-based training and mentoring of SBE majors. While the impediments to improving SBE science education at the community college and baccalaureate levels are a varying mix of individual, financial, and institutional factors that depend on specific contexts and circumstances, NSF’s strong and historic leadership role in supporting the SBE sciences places the Foundation in a unique position to overcome these challenges.

Best Practices

Best practices in SBE undergraduate education emphasize research opportunities and research-related activities. Institutional change at the department level has been slow to occur. Exemplary practices include attention to an integrated and sequenced curriculum, methodological training and research experiences, active learning techniques, and quality mentoring. The American Sociological Association’s Minority Opportunities through School Transformation Program emphasized department-wide, sustainable change in these areas. The Council on Undergraduate Research (CUR) promotes the full integration of the SBE sciences in programs to stimulate undergraduate research and mentoring in all fields of science. Efforts like the UCLA Student Research Program provide a context and infrastructure to support student research and mentoring. Summer programs like the American Psychological Association’s Summer Science Institute expose undergraduates to the elements of scientific inquiry and to research areas, researchers, and a cohort of students with research interests and potential.

Components of an Action Plan

Increased investments by NSF would make a major difference in improving and transforming SBE undergraduate education. Strategies that make NSF's existing programs much more accessible to the SBE sciences offer the quickest results at the least cost.

Enhanced Funding for Critical SBE and EHR Programs

Greater access and enhanced funding for SBE sciences in EHR programs designed to attract and retain underrepresented minorities should be a priority. The long-term absence of funding the SBE sciences in programs like the Lewis Stokes Alliance for Minority Participation (LSAMP) Program or Historically Black Colleges and Universities Undergraduate (HBCU-UP) Program is problematic. Other initiatives appropriate for enhanced support for the SBE sciences include the Course, Curriculum, and Laboratory Improvement (CCLI) Program and the Science, Technology, Engineering, and Mathematics Enhancement (STEP) Program. Immediate returns would also be realized through major increases in funding for the Research Experiences for Undergraduate (REU) Program in the SBE Directorate and in particular for the site awards.

New Opportunities and Initiatives

Collaboration of the SBE and EHR Directorates on the workshop that led to this report augurs well for continued cooperation on such efforts as a Systemic Reform of SBE Undergraduate Education Initiative to encourage long-term sustainable change, an SBE Educational Innovation Program that would seek to infuse SBE research results and advances into courses and curriculum, and an Undergraduate Faculty Enhancement Initiative that would provide support to institutions to prepare new faculty and retool experienced faculty in pedagogy or methods related to research courses or supervision of students in research.

Immediate Steps

Three immediate actions that would advance and call attention to the importance of undergraduate education and training in the SBE sciences are: encouragement of nominations for the NSF Director's Award for Distinguished Teaching Scholars (DTS), convening a workshop of recent REU site grantees and SBE-CCLI grantees to examine their innovations, and a request from the highest levels of NSF leadership to the National Research Council that its Committee on Undergraduate Science Education explicitly include SBE sciences in future workshops and reports as well as in the composition of the committee.

Improving Graduate Education in the SBE Sciences

Current Context

Key Needs

The SBE sciences of the 21st century need advanced skills and methodological tools in order to address the vexing problems facing society. The contexts wherein SBE scientists work are also changing. Graduate training in the SBE sciences should be rethought to produce excellent researchers with skills appropriate to diverse work settings. The core curriculum, research training, and mentoring merit fresh consideration in light of changing opportunities and changing career goals and motivations of graduate students. Notwithstanding the fact that the SBE sciences are generally more diverse than other fields of science, there remains a need for a workforce that includes the fuller participation of underrepresented minorities in these sciences. Efforts to meet these needs should be guided by a cohesive human resource policy for the SBE sciences, as is warranted in all fields of science.

Impediments and Challenges

Longstanding practices and perceptions are the greatest impediments to transforming graduate education in the social, behavioral, and economic sciences, including the dominant academic culture and the homogeneity of college and university faculty, limited funds for graduate student training and research, less explicit attention to mentoring and supervised research training than is desirable, and the absence of SBE scientists on most national commissions and committees (e.g., those convened by the NRC or AAAS) charged with improving science education.

Best Practices

Current strategies to improve graduate education in the SBE sciences include programs devised by scholarly societies, academic institutions, various foundations, and combinations of two or three of these stakeholder types. For example, in political science, NSF's support for Empirical Implications of Theoretical Models (EITM) is permitting summer training institutes at universities over a five-year span to enhance the capacity of future researchers to link theory and inquiry. In education research, the American Educational Research Association leads two major initiatives with components directed to early graduate career and dissertation training. One of these efforts, funded since 1990 by NSF with contributions from the National Center for Education Statistics, focuses on the use of large-scale education databases in research.

The Preparing Future Faculty Initiative (PFF), spearheaded by the Council of Graduate Schools and the Association of American Colleges and Universities, includes the SBE fields of communications, political science, psychology, and sociology and partners with universities and two- and four-year colleges in their ambition to train and mentor students in the full range

of faculty roles and responsibilities. The Carnegie Initiative on the Doctorate, which includes education among six scholarly fields, supports multiyear projects and experiments designed to enhance doctoral training and produce training models.

Components of an Action Plan

No effort is more crucial to capacity building in the SBE sciences than NSF's increased involvement in SBE graduate education and training. NSF can play a significant role by supporting initiatives to transform graduate education, create innovative training programs, and attract a wider and more diverse pool of talented students using strategies of the type set forth below.

Enhanced Funding for Critical SBE and EHR Programs

NSF programs that rank high on potentially offering major returns in improved graduate education in the SBE sciences are the Integrative Graduate Education and Research Traineeship Program (IGERT) in the EHR Directorate, the NSF Graduate Teaching Fellows in K-12 Education (GK-12) Program in the EHR Directorate, and the Research Experiences for Graduates (REG) Supplements in the SBE Directorate. Expanded funding and increased access and visibility for these forms of support could have an important impact on SBE graduate students and on how institutions train SBE graduate students.

New Opportunities and Initiatives

The SBE and EHR Directorates need to collaborate on and invest in new opportunities to educate and train SBE graduate students. Priority consideration should be given to support for a Transformed Grants for SBE Doctoral Dissertation Improvement Program with an increased amount of funding (\$25,000 to \$30,000) to allow resources to be used for student stipends in addition to direct research costs. Also strongly recommended and worthy of priority consideration are a Transition and Early Career Initiative for Graduate Students, a Graduate Education Reinvention Program that would fund the development and implementation of model training programs, and a Preparing Future SBE Scientists Program that would emphasize research training in non-academic research institutions.

Immediate Steps

Short-term actions to improve graduate education in the SBE sciences include modifying the NSF proposal review criteria to include a proposal's effectiveness in advancing graduate student career development; holding a small SBE leadership conference on the 1995 National Academy of Sciences Report, *Reshaping the Graduate Education of Scientists and Engineers*; providing a venue for a meeting of principal directors and advisory committees working on Carnegie Initiatives, PFF Programs, and other graduate-level programs directed to rethinking graduate education; and commissioning or partnering on a study of SBE graduate education, focusing on the rates and causes of attrition and retention of graduate students in the SBE sciences.

Improving Postdoctoral and Early Career Education in the SBE Sciences

Current Context

Key Needs

Most SBE disciplines invest primarily in the development and design of doctoral education and devote less attention to professional growth and education after doctoral training. The absolute number of postdoctoral appointments in science and engineering has increased rapidly, but relatively few of these opportunities to enrich the doctoral research experience and establish a research program exist for SBE scientists. The SBE sciences would benefit greatly from a significant increase in the number of postdoctoral positions and programs. Beyond postdoctoral appointments, new PhDs in all employment sectors would benefit from explicit professional support during the first several years of their careers. The skills and competencies requisite to scholarly productivity and to the advancement of scientific careers require continued development during early career stages, especially for women and underrepresented minorities.

Impediments and Challenges

Postdoctoral training and early career development remain underdeveloped in the SBE sciences, absolutely and in comparison with the attention given in the natural sciences, biomedical sciences, and engineering. The fact that research tends to be funded on a small scale where resources are more limited for postdoctoral and junior-level appointments, that there is little of a tradition of providing systematic advice and mentoring beyond the doctorate degree, and that junior scholars get preoccupied with the day-to-day responsibilities of first positions without a structure of support for developmental opportunities creates impediments for SBE scientists' building strong research programs and careers. Also, graduate department faculties tend to know best environments like their own, and thus there is limited exposure of advanced graduate students, postdoctoral trainees, and junior colleagues either to other academic options or to career opportunities in other sectors of employment. NSF resources and support can create the conditions and incentives for investing more heavily in this professional stage.

Best Practices

Government agencies, academic institutions, and scholarly societies have supported postdoctoral and early career initiatives directed to the professional development challenges encountered by SBE scientists. Although extant programs are insufficient in number and levels of support, they offer examples of mechanisms that could be extended or transported across disciplines or institutions. The National Institutes of Health (NIH) have among the most successful programs of support for institutional training and individual fellowships to ensure well trained scientists, including SBE scientists, in areas of health. An NIH award, for example, to the Carolina Population Center at the University of North Carolina, Chapel Hill supports one-year postdoctoral and predoctoral fellows with an emphasis on research, strong mentoring, and

working in a center environment on all aspects of research competencies. Focusing on education research, the American Educational Research Association (AERA) operates an intensive three-year postdoctoral training program supported by the Institute of Education Sciences in the U.S. Department of Education.

Outside of formal postdoctoral programs, there has been only limited attention to early career development of SBE scientists. For example, again from the area of health, the National Institute of Mental Health offers research support for early career transitions. Research societies also aim to do their part largely through professional development courses and workshops. Each summer, the American Psychological Association offers four-day Advanced Training Institutes to provide exposure to advanced technologies and methodologies. While these illustrations point to strategies that are feasible and desirable for the SBE sciences, there is need for sustained investment and evaluation to determine what works well in engendering successful research careers.

Components of an Action Plan

Enhanced Funding for Critical SBE and EHR Programs

Opportunities exist within NSF for program enhancements directed to the SBE sciences. In some instances, there is a need to broaden awareness of EHR or NSF-wide programs and reduce the perception or reality that SBE scientists are not eligible. The NSF-wide Faculty Early Career Development (CAREER) Program is an example of an initiative that needs to be more accessible and visible to SBE scientists. With a focus on the integration of research and teaching for junior faculty, these five-year awards could usefully enhance the research and teaching of more SBE scholars than are currently funded under this initiative.

Other types of support in the SBE Directorate exist only as small parts of one or a few programs and require much more infusion of funds. For example, the mid-career initiatives in the Methodology, Measurement, and Statistics Program; the Cultural Anthropology Program; and the Law and Social Science Program could be structured into Directorate-wide activities and, with more resources, could make significant gains. The Postdoctoral Fellowships and Small Grants initiative within the Science and Technology Studies Program is another example of a mechanism rarely used and potentially worthy of being instituted Directorate-wide. The Minority Postdoctoral Research Fellowships and Supporting Activities Program is SBE Directorate-wide and is sufficiently important as a developmental training initiative to merit more funds.

New Opportunities and Initiatives

The absence of a tradition of postdoctoral and early career support in the SBE sciences commends it as an NSF priority. New initiatives that could make a difference include the EHR and SBE Directorates' collaborating on a Integrative Postdoctoral Research Traineeship (IPRT) Program in the SBE sciences to foster advanced scientific skills and address issues that transcend any one discipline, an SBE Postdoctoral Research Fellowships Program directed to capacity building for strong research careers, and SBE use of the NSF's Vertical Integration of Research and Education (VIGRE) Awards to encourage innovative training and integration

of postdoctoral appointments. Also, worthy of consideration is establishing an SBE Stimulus Package Partnerships Program for Professional Development with scientific societies to support small-scale innovations aimed at advancing the professional development of junior scholars.

Immediate Steps

Immediate steps to improve postdoctoral and early career education in the SBE sciences include enhancing the prominence of existing postdoctoral training opportunities; convening a meeting of key private foundations and federal agencies to identify partners to help make postdoctoral training a more integral part of SBE science education; holding a meeting of key program officers and principal investigators involved in SBE postdoctoral programs to help design an SBE postdoctoral initiative and program solicitation; urging extension of the data gathering conducted by the SBE Directorate's Division of Science Resources Statistics to include detailed information on employment choices, research activities and productivity, and career trajectories across sectors of employment of new SBE doctorates; and working with the AAAS to include the SBE sciences in the AAAS Postdoc Network and the electronic career development database.

Fostering Diversity in Education in the SBE Sciences

Current Context

Key Needs

Numerous studies demonstrate that diversity in education contributes to broadening perspectives, encouraging tolerance, and promoting the development of critical thinking and related skills. Building a scientific workforce that mirrors the U.S. population challenges all fields of science, including the social, behavioral, and economic sciences. Absent intentional efforts to alter recruitment and retention in higher education, the achievement gap between minority populations and non-Hispanic whites will persist or widen. Better recruitment and retention of women at the advanced degree level in the SBE sciences, in particular in certain disciplines and subfields, are also needed. The absolute numbers and the proportions of persons of color in the SBE sciences remain quite small, notwithstanding increases over time.

Impediments and Challenges

Currently there is a gap between aspiration and implementation in achieving more inclusive education in the SBE sciences. Despite examples of innovation, higher education in the SBE sciences requires reinvention to realize the goal of achieving excellence and inclusiveness for all. Changes that would facilitate the development and training of students and early career professionals of color are similar to those that more generally seem to engender professional growth and development (e.g., increased financial support, better mentoring and guidance, better research training and access to information and networks). Areas that warrant special emphasis include the disparities among school systems in SBE science courses, the need for improved SBE

capacity building and faculty development in Historically Black Colleges or Universities, targeted outreach at all levels of education in the SBE sciences to attract students of diverse backgrounds and aspirations, and the persistence of glass ceilings for persons of color and women in all science and engineering specialties.

Best Practices

A variety of successful programs have been established that recruit minority students; provide financial support; and enhance skills and opportunities through mentoring, direct training, and networking. Some have long and enviable records of bringing minority scholars into the SBE sciences through a variety of effective mechanisms. In addition, a few innovative programs aim at producing systemic change in academic departments and other organizational units to alter practices overall. These programs are offered through scholarly societies in many instances, by individual academic institutions in other instances, and sometimes by both, often with support from public and private foundations.

Notable examples for undergraduates include the American Economic Association's summer institute, operating for some 30 years and now at Duke University partnering with North Carolina A&T State University, and the American Political Science Association's Ralph Bunche Summer Institute also at Duke University and almost two decades old. Similarly longstanding at the graduate level are the Minority Fellowship Programs of the American Psychological Association and the American Sociological Association (ASA) providing predoctoral fellowship training in cooperation with graduate programs. Initiatives directed to systemic change are ASA's Minority Opportunities through School Transformation Program that worked with departments to enhance excellence and inclusiveness in undergraduate and graduate education, and the relatively new initiative of the History of Science Society directed to attracting faculty and students at HBCUs to the history of science as a field of inquiry.

Components of an Action Plan

Expanded SBE Access to and Support for Existing Diversity Programs

SBE participation in programs in the Human Resources Division (HRD) in EHR is critical to widening and diversifying outreach in the SBE sciences. The rarity of the SBE sciences supported by such funding initiatives as the Louis Stokes Alliance for Minority Participation (LSAMP), Centers of Research Excellence in Science and Technology (CREST), the Historically Black Colleges and Universities Undergraduate (HBCU-UP) Program and the Tribal Colleges and Universities (TCUP) Program, and the Alliance for Graduate Education and the Professorate (AGEP) Program suggests the need for explicit language in solicitations that alert applicants to the fact that STEM sciences include the SBE sciences and that the SBE sciences are encouraged to apply. NSF should consider explicit encouragement through such mechanisms as supplements for projects that include SBE science components. Additional ways to focus NSF strategies and intensify efforts include making certain that SBE scientists are eligible to participate in all HRD programs and in all programs directed to women and girls. Also, augmented financial support should be directed to programs with a track record of reaching minorities, in particular the

Research Experiences for Undergraduates (REU) Program, the Integrative Graduate Education and Research Traineeship (IGERT) Program, and the SBE Minority Postdoctoral Research Fellowships and Support Program.

New Opportunities and Initiatives

New initiatives to foster diversity in the SBE sciences could further promote a more inclusive talent pool of SBE scientists. Examples include the collaboration of the SBE and EHR Directorates on an SBE Diversity Innovations Program to foster long-term sustainable change in how academic, degree-conferring departments educate students at all levels, and an SBE Launch Awards Program (LAP) for Minority Scholars that would provide underrepresented minorities with a head start in undertaking research and building viable research programs.

Immediate Steps

High priority steps on the part of NSF to augment diversity in the SBE sciences include requesting that the NSF Committee on Equal Opportunities in Science and Engineering (CEOSE) consider this report and recommendations related to diversity; clarifying how NSF staff can address the NSF goal of *Integrating Diversity into NSF Programs, Projects, and Activities* in making funding decisions; developing an NSF incentive program that rewards academic departments, centers, and other units in the SBE sciences for achieving substantial increases in the number of underrepresented minorities; funding the compilation of a *Manual of Best Practices for Recruiting and Retaining Minority Students in the Social, Behavioral, and Economic Sciences*; issuing a solicitation for research on minority access to and participation in SBE science education and training; and urging the American Association for the Advancement of Science (AAAS) to enhance the relevance and utility of its Minority Scientists Network.

Conclusion—Pathways to Advancing SBE Science Education

In 2003, NSF embarked on a historic mission to focus attention on improving education in the social, behavioral, and economic sciences and sought guidance from leading social and behavioral scientists and educators on a plan of action that would permit the Foundation to take concrete steps at all education levels. The aim of this report is to provide a plan that is practical, feasible, and desirable within the context of NSF's structure, programs, and how the agency works. The report recognizes that strategic actions and implementation take time, but offers guidance on changes that can be introduced in the short- and longer-term.

A number of issues critical to effective implementation are presented, including attention to the language used in extant programs and outreach, the commitment of new resources and the reallocation of funds to stimulate and support SBE science education enhancements, and assessment of which new initiatives should have the highest priority for adoption. Also, the report recommends attention to the structural arrangements at NSF to manage and monitor this strategic commitment and calls for immediate and demonstrable progress.

Salient cross cutting themes that emerged from the Planning Meeting and the National Workshop and are evident in the report include:

- the need for improved SBE science education at all levels of education. Despite increasing awareness of the importance of social and behavioral science knowledge, the gaps in SBE education remain large—especially at the earlier stages of science learning;
- greater public understanding of the SBE sciences as integral parts of the STEM (science, technology, engineering, and mathematics) sciences. Public comprehension of the SBE sciences would be greatly advanced by inclusion of the SBE sciences at early stages of science learning;
- the critical leadership role of the National Science Foundation in advancing SBE science education. The National Science Foundation is the sole federal agency charged with advancing the health and well-being of science, including the SBE sciences. Beyond its internal resources, NSF is particularly well situated to support and encourage *systemic* improvement in SBE science education at all levels of education;
- the need for culture change at NSF regarding SBE science education. Joint support from the SBE and EHR Directorates for a strategic plan for education and training in the SBE sciences can help to ensure that the SBE sciences gain the same level of access, intentional programming, and support as do the other fields of science and engineering;
- the value of continuing to strengthen collaboration between the SBE and EHR Directorates. Institutional mechanisms should be devised independent of the rapport that exists between particular incumbent Assistant Directors; for example, cross-appointments to Advisory Committees or the inclusion of SBE scientists on the EHR Advisory Committee and science education experts on the SBE Advisory Committee;
- the need to strengthen communications between NSF and the SBE science community on funding mechanisms to support SBE science education and on relevant NSF's funded projects, and the need also for NSF to facilitate the dissemination of information on best practices;
- the advantages of collaboration between NSF and scientific societies and organizations on SBE science education issues. The SBE science societies and general science organizations (e.g., AAAS) offer opportunities for synergy in improving SBE science education;
- the need to improve knowledge regarding education, training, and career trajectories. Research could provide the foundation for crafting strong programs to improve SBE science education; systematic study and evaluation of SBE science education and training programs are also essential;

Education and Training

- increased investments in the social science of science, including research on SBE science education and professional development. Scientific research on the practices of science and on science education is essential. Consideration should be given to funding an NSF Center for Research on Innovation and Organizational Change in Academic and Scientific Settings.

The National Science Foundation's commitment to devise a strategic plan to improve education and training at all education levels in the social, behavioral, and economic sciences is a major step in articulating and emphasizing the need for a cohesive human resource policy. Appropriately implemented, a priority emphasis on SBE science education can contribute substantially to public understanding of these sciences and their capacity to make important new discoveries.

Action Plan Summary Table: Training and Education in the SBE Sciences By Education Level, Strategic Stage, and Priority			
Ed Level	Expand/Alter Existing Programs	New Initiatives	Immediate Steps
K-12	<ul style="list-style-type: none"> SBE Center for Learning and Teaching (EHR) Instructional Materials Development Program (EHR) Teacher Professional Continuum Program (EHR) Informal Science Education Program (EHR) 	<ul style="list-style-type: none"> SBE Science in High School Initiative (SBE/EHR) Teacher Training Initiative (SBE/EHR) “Bridges to SBE Science Education” Program (SBE/EHR) Research Experiences for High Schoolers (REHS) Program (SBE) 	<ul style="list-style-type: none"> Place high profile NSF articles (e.g., in <i>Education Week, Science</i>) on the importance of SBE education in K-12 Urge NRC to include SBE sciences in Committee on Science Education K-12 (COSE K-12) Urge AAAS to integrate SBE sciences into project 2061
Under-Graduate	<ul style="list-style-type: none"> Underrepresented Minorities Programs (EHR): <ul style="list-style-type: none"> Lewis Stokes Alliance for Minority Participation (LSAMP) Alliance for Graduate Education and the Professorate (AGEP) Centers of Research Excellence in Science and Technology (CREST) Historically Black Colleges and Universities Undergraduate Program (HBCU-UP) Tribal College Undergraduate Program (TCUP) Research Experiences for Undergraduates (REU) Program (SBE) Course, Curriculum, & Laboratory Improvement (CCLI) Program (EHR) Science, Technology, Engineering, & Mathematics Expansion (STEP) Program (EHR) 	<ul style="list-style-type: none"> Systemic Reform of SBE Undergraduate Education Initiative (SBE/EHR) SBE Educational Innovation Program (SBE/EHR) Undergraduate Faculty Enhancement Initiative (SBE/EHR) 	<ul style="list-style-type: none"> Publicize NSF Director’s Award for Distinguished Teaching Scholars (DTS) in SBE community Convene workshop of REU site grantees and SBE-CCLI grantees to identify and disseminate promising practices Urge NRC to include SBE sciences in Committee on Undergraduate Science Education

<p>Graduate</p>	<ul style="list-style-type: none"> • Integrative Graduate Education & Research Traineeship (IGERT) Program (NSF-wide) • Graduate Teaching Fellows in K-12 Education (GK-12) Program (EHR) • Research Experiences for Graduates (REG) Supplements (SBE) 	<ul style="list-style-type: none"> • Transformed SBE Doctoral Dissertation Improvement Program (SBE/EHR) • Transition & Early Career Initiative for Graduate Students (SBE/EHR) • Graduate Education Reinvention Program (SBE/EHR) • Preparing Future SBE Scientists Program (SBE/EHR) 	<ul style="list-style-type: none"> • Modify NSF review criteria to include proposal's effectiveness in graduate student training • Convene SBE leadership conference on 1995 NAS Graduate Education Report • Convene leadership of programs directed to rethinking graduate education • Commission or partner on study of SBE graduate education
<p>Postdoc & Early Career</p>	<ul style="list-style-type: none"> • Postdoctoral Fellowships & Small Grants for Training/ Research Fellowships (SGTRF) in STS Program (SBE) • Minority Postdoctoral Research Fellowships & Supporting Activities Program (SBE) • Mid-Career support mechanisms for professional development in various programs (SBE) • Faculty Early Career Development (CAREER) Program (NSF-wide) • Research Opportunity Awards (ROAs) for faculty at predominately undergraduate institutions (NSF-wide) 	<ul style="list-style-type: none"> • Integrative Postdoctoral Research Traineeship (IPRT) Program (SBE/EHR) • Postdoctoral Research Fellowships Program (SBE) • Vertical Integration of Research and Education (VIGRE) Awards (SBE/EHR) • Stimulus Package Partnerships for Professional Development (SBE) 	<ul style="list-style-type: none"> • Promote SBE postdoctoral and early career opportunities • Allocate EHR evaluation funds for evaluations as part of postdoctoral training in evaluation research • Convene federal and private funders of SBE postdoctoral training programs • Convene leadership of postdoctoral programs to help design SBE postdoctoral initiative and solicitations • Extend statistical data collection in SBE/SRS to SBE postdoctoral and early career stages • Urge AAAS to include SBE sciences in postdoctoral networks
<p>Diversity</p>	<ul style="list-style-type: none"> • Explicit access/inclusion of SBE sciences in underrepresented minorities programs in Division of Human Resource Development (EHR) <ul style="list-style-type: none"> • LSAMP • AGEP • CREST • HBCU-UP • TCUP • Programs Directed to Women and Girls <ul style="list-style-type: none"> • HRD Program in Gender Diversity in Science, Technology, Engineering, & Mathematics Education (EHR) • Advance Program (NSF-wide) • Research Experiences for Undergraduates (REU) Program (SBE) • Integrative Graduate Education & Research Traineeship (IGERT) Program (NSF-wide) • SBE Minority Postdoctoral Research Fellowships & Support Program (SBE) 	<ul style="list-style-type: none"> • SBE Diversity Innovations Program (SBE/EHR) • Launch Awards Program (LAP) for SBE Minority Scholars (SBE) 	<ul style="list-style-type: none"> • Request CEOSE to review report and diversity recommendations therein • Clarify to staff NSF goal of <i>Integrating Diversity into NSF Program Projects and Activities</i> • Develop NSF incentive program to reward departments enhancing diversity • Support preparation of best practices manual for recruiting and retaining SBE minority students • Support research on diversity in SBE sciences • Urge AAAS to enhance relevance of Minority Scientists Networks to SBE sciences