



U.S. National Science Foundation
WHERE DISCOVERIES BEGIN

2012

CISE
STRATEGIC PLAN
FOR BROADENING
PARTICIPATION

EXECUTIVE SUMMARY

NOVEMBER 18, 2012

BACKGROUND

The National Science Foundation includes broadening participation in its core values, as it seeks and accommodates “contributions from all sources while reaching out especially to groups that have been underrepresented.” Nowhere at the Foundation is the need for inclusion more pressing than in the CISE community, where the longstanding underrepresentation of many demographic groups coincides with the increasingly pervasive role of computing in our society, the importance of IT innovation in driving our economy, and the growing demand for IT specialists at all levels of the workforce.

With respect to the CISE community, the groups designated as underrepresented are women, African Americans, Hispanics, Native Americans and indigenous peoples, and persons with disabilities. Their underrepresentation begins early, probably in middle school though much of our data starts in high school. In 2012, the CS Advanced Placement (AP) Exam, for example, had the largest gender gap of any of the exams the College Board administers: only 18.7% of the AP CS test takers were female, as compared to 46.3% for the Calculus AB and BC exams, 50.6% for Statistics, and 58.3% for Biology¹. The numbers for minorities were even more alarming: in 2011 only 29 African Americans took the AP CS test in the entire state of California; in the last 6 years, not a single Hispanic female has scored a passing grade (3, 4, or 5) on the AP CS test in Georgia, Michigan, Indiana, South Carolina, or Alabama². Significant underrepresentation continues at the postsecondary level. 2013 IPEDS data (for school year ending 2011) has women receiving only 16.2% of the undergraduate degrees, 27.6% of the Masters and 20.0% of the Ph.D.s³. The same IPEDS data shows underrepresented minorities receiving 16.6% of the undergraduate degrees, 8.0% of masters degrees and 3.3% of the Ph.D. degrees. This IPEDS data includes all public and private non-profit institutions. If we look at the comparable data from the CRA Taulbee departments which includes only departments with Ph.D. programs the numbers are much lower: there underrepresented minorities receive just 11.9% of the undergraduates degrees, 5.9% of the Masters, and 3.5% of the Ph.D.s⁴. (Data is more difficult to get for persons with disabilities but anecdotal evidence does appear to indicate that they are not well-represented among our postsecondary graduates.)

Together the underrepresented groups in computing make up roughly 70% of our population. Especially in light of the demographic changes that are happening across our country, we cannot hope to meet projected workforce demands without their participation. But the argument for broadening participation is more than just numbers. It is also an issue of the loss opportunity for individuals and the loss of their potential contributions for our field. To lead the world in innovation, our Nation needs the talents, creativity and perspectives of all our citizens. We need to give all students the opportunity to participate in computing, regardless of their eventual career choice, regardless of their gender, race, ethnicity, or income. Thus,

In order to ensure a robust computing research community, a globally competitive IT workforce, and a computationally savvy citizenry, CISE is committed to broadening the participation of underrepresented groups in computing.

It will take more than good intentions or business as usual, however, to reverse longstanding underrepresentation. It will take committed, focused, and sustained efforts on the part of many in the computing community. CISE will need to take a leadership role.

To date, the CISE efforts to broaden participation have fallen into three categories: the integration of broadening participation into the CISE research programs through its inclusion under Broader Impacts; the funding of efforts focused specifically on underrepresented groups, particularly the BPC Alliances; and structural changes within the Education and Workforce Cluster that better integrate education and broadening participation efforts across the Directorate. With this Strategic Plan, CISE aims to provide an overall framework for strengthening its efforts and impact. The Plan itself grew out of a meeting of an ad hoc subcommittee of the CISE Advisory Committee; members of that subcommittee are listed in [Appendix A](#).

STAKEHOLDERS & GUIDING PRINCIPLES

There is a broad group of stakeholders for the CISE efforts to broaden participation:

- Institutions including academic institutions (middle and high schools, community colleges, undergraduate institutions, and universities), computing and information sciences and engineering departments, schools, and colleges, as well as the related professional and student-focused societies, and the broader national community (industry, community groups, etc.);
- Individuals from underrepresented groups throughout the pipeline, that is, from middle school through high school, community college, undergraduate programs, graduate programs, and the faculty ranks; and
- CISE directorate and its staff, as well as CISE reviewers, panelists, awardees and potential awardees.

Two principles guided the formulation of strategies for achieving the goals of this plan.

The first principle is that the CISE effort to broaden participation will take sustained commitment. The causes of longstanding underrepresentation are complex and deeply rooted in the cultures of different demographic groups as well as in our society, in our educational institutions, and in our popular media. They will not be easily or quickly changed. The overall CISE commitment to broadening participation will need to be sustained for a considerable period of time. In addition, CISE must be prepared to support the deployment of successful interventions beyond the typical three to five year funding cycle of its research programs.

The second principle is that CISE must weave feedback and accountability into all of its broadening participation efforts. This includes not only the requirement that funded projects have appropriate evaluations but also that CISE develop and monitor metrics for both formative and summative assessments of its own efforts.

These two principles infuse the Strategic Plan.

GOALS & STRATEGIES

Here, we present the three goals for this Strategic Plan along with strategies for achieving them. The goals and strategies would admit a range of implementations.

GOAL 1

CISE will take a leadership role in calling the computing community to action on issues of underrepresentation.

Strategy 1 | CISE will keep the computing community informed on issues of underrepresentation.

Strategy 2 | CISE will promote institutional transformation that increases the participation of all underrepresented groups.

Strategy 3 | CISE will build a national community focused on BPC.

GOAL 2

CISE will raise the awareness of issues of underrepresentation among and diversity of its staff, reviewers, panelists, and awardees.

This goal emphasizes the essential role played by CISE staff, program officers, reviewers and panelists, who together serve as gatekeepers to CISEs research funding. It is important that they are sensitive to issues of underrepresentation, that they themselves represent a diverse set of perspectives, and that they create a level playing field for prospective PIs.

Strategy 4 | CISE will provide periodic training for staff, reviewers, and panelists on BP issues, including implicit bias.

Strategy 5 | CISE will take steps to improve representation among its awardees, reviewers, panelists, and scientific staff.

GOAL 3

CISE will address BP programmatically both through focused activities and through the inclusion of BP efforts as an accepted and expected part of its research and education award portfolios.

This goal emphasizes the importance of continuing and strengthening the range of CISE efforts that integrate broadening participation into the CISE research and education programs, including support for efforts focused specifically on access for underrepresented groups.

Strategy 6 | CISE will increase its programmatic emphasis on, and commitment to, broadening participation.

Strategy 7 | CISE will continue to support focused broadening participation programs aimed at students and faculty across the entire academic pipeline.

Strategy 8 | CISE will support institutional transformations of academic and professional organizations that make the computing discipline more inclusive.

Strategy 9 | CISE will be proactive in ensuring that its programs and awards are inclusive of and responsive to the needs of persons with disabilities.

STRATEGIC PLAN FOR BROADENING PARTICIPATION

SUCCESS INDICATORS

Change particularly institutional change does not happen without metrics and accountability. To guide the effective implementation of this Strategic Plan, CISE will need to develop and monitor a set of metrics that will provide feedback for ongoing efforts. Both short and long-term indicators are needed as the basis for these metrics.

Short Term Indicators would measure the success of the efforts to mobilize the CISE community. A baseline for these indicators would be established immediately after the adoption of this report and the changes measured would be reported at 5-year intervals.

Strategy 1, 9	If successful, these strategies would lead to an increase in the availability and dissemination of CISE and CISE- funded information on broadening participation that appears in public venues, including the NSF website, webinars, presentations, journals, professional magazines/newsletters, and communication directly distributed to academic departments nationally.
Strategy 2, 8, 9	If successful, these strategies would lead to an increase in institutional transformation among academic computing departments which could be measured by activities that focus on broadening participation, including the development of broadening participation strategic plans, or other changes reported in responses to a survey administered, for example, during the fifth year after the adoption of this report.
Strategy 3, 9	If successful, these strategies would lead to an increase in participation in a national community focused on broadening participation as measured by attendance at annual meetings and workshops (disaggregated by stakeholder type), the growth of related communities of practice, the availability of web resources, newsletters, etc. and progress towards establishing the community within a professional organization(s).
Strategy 4, 5, 9	If successful, these strategies would lead to an increase in participation by members of underrepresented groups as panelists, reviewers, and awardees as well as among CISE scientific and administrative staff as tracked by disaggregated demographic data. The target goal will have participation at the same levels of representation in the available pool.
Strategy 6, 7, 9	If successful, these strategies would lead to an increase in CISE-funded BP efforts, both through focused efforts and through integration with the research and education portfolios, as cited in annual and final reports and reported in the divisions annual reports and COVs.

Long Term Indicators will measure the impact of CISE efforts on the ultimate goal: to increase the number of students receiving undergraduate or graduate degrees in computing while removing, or at least significantly reducing, underrepresentation. These indicators will be more difficult to measure and will require national comparators. It is expected that an independent evaluation will be needed.

If successful, we would expect the entire portfolio of CISE activities to lead to an increase of underrepresented groups in:

- i. the number of middle school children exposed to computing;
- iii. the number of students arriving at college with the intention of majoring in computing;
- v. the number of graduate degrees awarded in computing; and
- ii. the number of high school students taking courses in computing;
- iv. the number of undergraduate degrees awarded in computing;
- vi. the number of computing faculty at all ranks.

To assess progress with either the short or long term indicators, CISE will have to be much more proactive in terms of collecting data both internally and from its PIs.

FUTURE DIRECTIONS & IMPLEMENTATION

It is the responsibility of CISE to safeguard the U.S. leadership in computing research and innovation and to ensure the development of a computationally savvy 21st Century workforce. To do that, we will need to call upon the creativity, talents, and skills of all of our diverse citizenry. The Goals and Strategies outlined here will guide CISE in using its resources and leadership in rallying the computing research community to more comprehensively and effectively address its longstanding issues of underrepresentation.

Implementation of the goals and strategies will require that CISE undertake specific activities. Possible activities are listed by Goal in **Appendix B**, but they are just examples. We intend to implement the Strategic Plan in a series of yearly steps. The Plan will be amended annually with the addition of an implementation agenda for the upcoming year that is consistent with its goals and strategies but also takes into consideration the successes and lessons learned as we monitor our ongoing progress. The yearly implementation plans will be developed by the Education Workforce Cluster in consultation with the CISE Management Group and the Education Workforce Subcommittee of the CISE Advisory Committee.

APPENDIX A

EXTERNAL SUBCOMMITTEE MEMBERS

Active in the Development of the CISE Strategic Plan for Broadening Participation

SHAWN BLANTON,
Carnegie Mellon University

RICHARD LADNER,
University of Washington

LORI CLARKE,
University of Massachusetts

BOB MEGGINSON,
University of Michigan

JEANINE COOK,
New Mexico State University

MELISSA ONEILL,
Harvey Mudd College

JORGE DÍAZ-HERRERA,
Rochester Institute of Technology

ROBERT SCHNABEL,
Indiana University

JOSÉ FORTES,
University of Florida

MARY LOU SOFFA,
University of Virginia

SAM KAMIN,
University of Illinois

RICHARD TAPIA,
Rice University

VALERIE TAYLOR,
Texas A&M

APPENDIX B

POSSIBLE ACTIVITIES FOR IMPLEMENTATION OF THE STRATEGIC PLAN

These activities are presented just as examples of possible actions. It is likely that the implementation will involve just a few activities each year and lessons learned from early experiences may well dictate entirely different approaches in ensuing years.

POSSIBLE ACTIONS TO IMPLEMENT GOAL 1

- Provide online information on issues of underrepresentation, best practices, and tips for individuals, departments, and institutions wishing to get involved in the effort.
- Create more visible output from CISE broadening participation activities in a variety of venues, including, but not limited to, presentations, webinars, features in publications focused on particular underrepresented groups, and columns specifically focused on broadening participation appearing in Computing Research News and the Communications of the ACM.
- Provide and maintain a standard set of broadening participation slides for POs to use when visiting departments. Ensure that all PI Meetings and Site Visits address broadening participation, perhaps with presentations, posters, or booths that report on funded broadening participation activities, raise awareness, convey best practices, or disseminate materials.
- Promote awareness of the issues surrounding the inclusion of persons with disabilities in all of the information that CISE disseminates on behalf of broadening participation.
- Engage key professional groups such as CRA, IEEE, ACM, and CCC in discussions and efforts on broadening participation.
- Make contacts and maintain relationships with professional and student-centered organizations such as SACNAS, AISES, BDPA, AIHEC, SHPE, GEM, RESNA, and NSBE etc.
- Encourage collaborations with K-12 informal education organizations, such as the Girl Scouts, the Boys and Girls Club, 4H, the National Girls Collaborative Project, and Girls, Inc. etc. that have a national reach.
- Pursue cooperative relationships with other government agencies that address STEM education, such as NASA, DOD, DOE, DOI, ED, and DLS.
- Develop language to be added to all CISE solicitations that highlights the importance of broadening participation. As part of the larger effort to increase the Broader Impacts of CISE research efforts, provide a clearinghouse of opportunities for getting involved in broadening participation efforts, and encourage departments (or colleges or schools where appropriate) to create a plan for broadening participation.
- Sponsor a series of workshops for department heads to raise awareness and promote institutional change. Continue to support the national community focused on broadening participation that was built under the BPC program by supporting annual meetings and workshops.

POSSIBLE ACTIONS TO IMPLEMENT GOAL 2

- Require that all staff and program officers participate in biennial diversity training.
- Include a report on broadening participation efforts and issues in division and all-hands meetings on a regular basis.
- Ask the divisions to report on the broadening participation activities undertaken by their PIs as part of the Broader Impacts of their work.
- Encourage MSIs to participate in broadening participation efforts and build capacity.

- Encourage the Program Officers to provide training on implicit bias and the importance of BP to all panels, and written information to all ad hoc reviewers.
- Encourage CISE awardees to partner with community colleges and Minority Serving Institutions (MSIs) in order to provide increased research opportunities and pathways for a broad range of students.
- Bring new researchers to NSF to attend proposal-writing workshops that include information about Broader Impacts and broader participation.
- Explore additional ways to increase awareness of NSF funding opportunities in students, faculty and researchers from underrepresented groups.
- Expand the pool of potential panelists from the underrepresented groups using the new Reviewer System. Devise new practices to encourage better representation on panels and monitor their success.
- Encourage a broad range of reviewers who are sensitive to national issues of underrepresentation. Report demographic data on PIs, CoPIs, awardees, and panelists disaggregated by gender and ethnicity. Review hiring practices with the goal of increasing the number of scientific staff who are members of underrepresented groups.
- Review workplace practices in order to recruit and retain a more diverse group of program officers.

POSSIBLE ACTIONS TO IMPLEMENT GOAL 3

- Give awards with strong broadening participation components special recognition, perhaps additional or supplemental funding.
- Develop an additional review criterion that addresses expectations for broadening participation for all new solicitations for large awards (over \$2M).
- Add reporting requirements for broadening participation activities to all annual and final reports.
- Provide mechanisms for awards that demonstrate success in broadening participation to be considered for additional funding subject to merit review.
- Develop a postdoc program for underrepresented minorities and persons with disabilities to provide students with high quality postdocs to increase their chances of getting and successfully navigating a faculty position at a top institution.
- Develop a new Minority Research Initiation Award (MRIA) for underrepresented minorities and persons with disabilities that supports young faculty.
- Support sessions on the issues for persons with disabilities at CISE-funded workshops, conferences, and PI meetings.
- Continue to fund efforts at systemic change through programmatic efforts and direct support to individuals through CISE research and education portfolios.
- Require that all conferences and workshops supported by CISE have a BP component. This could include, for example, having speakers from the underrepresented groups, disseminating information on best practices, or providing scholarships and mentoring for students from the underrepresented groups.
- Fund small ADVANCE-like awards (\$50K) for departmental transformation that aims to improve recruitment and retention of members of underrepresented groups.
- Within programmatic efforts, emphasize interventions that are scalable and replicable and lead to widespread systemic change.
- Remind PIs that all NSF-funded workshops and conferences must be accessible. Provide a checklist to assist PIs in determining whether a facility is accessible.
- Encourage CISE-funded institutions and departments to be in compliance with the ADA in having their computing facilities accessible to people with disabilities; provide information on how to accomplish facility accessibility.
- Engage with people doing accessibility research, perhaps by holding workshops that include assistive technology researchers along with consumers and people who run broadening participation projects.

FOOTNOTES

¹ College Board Advanced Placement Program Participation and Performance Data 2012, <http://research.collegeboard.org/programs/ap/data/participation/2012>

² How White and Male the AP CS Really Is: Measuring Quality as well as Quantity, Mark Guzdial, Computing Education Blog, 8/21/12, <http://computinged.wordpress.com/2012/08/21/how-white-and-male-the-ap-cs-really-is-measuring-quality-as-well-as-quantity/> <<http://computinged.wordpress.com/2012/08/21/how-white-and-male-the-ap-cs-really-is-measuring-quality-as-well-as-quantity/>> .

³ IPEDS Completion Survey, 2011, <https://webcaspar.nsf.gov> <<https://webcaspar.nsf.gov>> . Data used: IPEDS Completions Survey by Race, NCES Population of Institutions. Year 2011, Year: 2011 Level of Degree or Other Award: Doctorate Degree-Research/Scholarship, Master's Degrees, Bachelor's Degrees Academic Discipline, Detailed (standardized): Computer Science Race & Ethnicity (standardized): Black, Non-Hispanic, American Indian or Alaska Native, Hispanic; Institutional Control (survey-specific): Public Institutions, Private Institutions: Nonprofit

⁴ Taulbee Survey, 2009-10, <http://cra.org/resources/taulbee/> <<http://cra.org/resources/taulbee/>>.