

**Institutional Capacity-Building to Enhance Science, Technology, Engineering, and Mathematics
(STEM) Education and Research:
The Historically Black Colleges and Universities Undergraduate Program (HBCU-UP)**

Beatriz Chu Clewell and Clemencia Cosentino de Cohen
The Urban Institute¹, 2010

Program Overview

The Historically Black Colleges and Universities Undergraduate Program (HBCU-UP) administered by the National Science Foundation (NSF) Division of Human Resource Development, Directorate for Education and Human Resources, began in 1998. The goal of HBCU-UP is to enhance the quality of undergraduate science, technology, engineering, and mathematics (STEM) education and research at HBCUs as a means to broaden participation in the Nation's STEM workforce. Between 1998 and 2009, the program made 139 institutional awards for a total of over \$200 million. The external evaluation, commissioned by NSF in 2006, focused on the Implementation Projects funded under the HBCU-UP program, which are five-year, institution-wide STEM education and research capacity-building projects. Given great flexibility to design and implement strategies that address each institution's STEM needs and long-term goals, projects tended to focus on institutional capacity-building activities such as curriculum development and faculty professional development. NSF expected projects to produce "significant improvements in undergraduate STEM education and research programs" (NSF Program Solicitation 07-585). The evaluation of HBCU-UP measured changes grantees made and whether those changes were associated with the ultimate program outcome of contributing to the education and retention of minority students in STEM.

Evaluation Design

The evaluation of the HBCU-UP program included process and summative components. The process component relied on qualitative methods (interviews and case studies) to study the characteristics of funded projects as well as the factors that promoted or inhibited the attainment of project goals. Results guided the definition of the HBCU-UP model of institutional capacity-building and informed the thrust of this evaluation: the summative component. The summative evaluation relied on qualitative and quantitative methods to analyze the course revisions carried out by institutions, the experiences and opinions of participating faculty, the educational progression and career outcomes of graduates of HBCU-UP projects and, most importantly, the efficacy of the HBCU-UP model. Through a quasi-experimental design that compared HBCU-UP faculty and graduates to nationally representative samples of each—the analysis led to five conclusions and recommendations.²

Conclusions

- HBCU-UP grantees succeeded in building an institutional infrastructure that supports the education of STEM majors.*** Institutions carried out curricular and instructional reforms, provided faculty professional development, established academic support services for students, engaged in collaborative relationships with other institutions and entities, upgraded their laboratory and STEM instructional equipment, and some succeeded in institutionalizing key project components.
- The HBCU-UP program yielded an intervention model characterized by a core set of strategies associated with successful student outcomes.*** Core strategies include curricular reform, faculty professional development, and summer bridge programs. Alumni from institutions that employed all core strategies were more likely to stay in the STEM education pipeline, and those employed in STEM were more likely to have earned a graduate degree.

¹ The Urban Institute is a nonprofit, nonpartisan policy research and educational organization that examines the social, economic, and governance problems facing the nation. The National Science Foundation funded the Urban Institute evaluation of the HBCU-UP program under contract HRD GS-23F-8198H D050597 and OMB cleared the collections under Control No. 3145-0204. A more detailed report is available at <http://www.urban.org>. *The views expressed are those of the authors and do not necessarily reflect the views of the National Science Foundation or the Urban Institute. Beatriz Chu Clewell is a Senior Fellow and Clemencia Cosentino is the Director of the Program for Evaluation and Equity Research (PEER).*

² The evaluation collected data through (response rates in parentheses): interviews with 29 project directors (97 percent), surveys of 2,030 graduates (65 percent) and 451 faculty (80 percent) keyed to national data from the Scientists and Engineers Statistical Data System (SESTAT, NSF) and the National Survey of Post Secondary Faculty (NSOPF, NCES), a survey of curricular revisions at 18 institutions (72 percent), and case studies at 4 institutions.

3. ***Successful HBCU-UP projects shared elements that suggest that effective projects*** (a) design interventions to address well-defined problems; (b) provide a comprehensive array of strategies that span institutional infrastructure improvement, faculty development, and student support services; (c) tailor strategies and activities to their institutional mission and characteristics; and (d) institutionalize key project components.
4. ***HBCU-UP graduates outperform national samples of STEM baccalaureate degree holders in graduate degree completion and participation in the STEM workforce with a graduate degree.*** Compared with STEM graduates nationally, HBCU-UP alumni were more likely to have sought and obtained graduate degrees (overall and in STEM), equally likely to be in STEM jobs, and more likely to hold a graduate degree while employed in STEM. Compared with African-American STEM graduates nationally, HBCU-UP graduates (mostly African-Americans) were *more likely to be employed in STEM*, and more likely to be employed in STEM and hold a graduate degree in any field and in STEM. This suggests that HBCU-UP graduates are making a double contribution to the STEM workforce: they are more likely to enter the STEM workforce than African-Americans nationally, and they are also more likely to bring more academic training than STEM baccalaureate degree holders nationally.
5. ***The HBCU-UP program contributed to the education and retention of women, and minority women, in STEM.*** Women HBCU-UP graduates outperform women nationally in educational attainment, overall and in STEM, and in STEM employment outcomes. These results also hold when restricting the comparison by ethnicity. HBCU-UP African-American female graduates outpace a national comparison of African-American women with STEM bachelor degrees. In addition, women HBCU-UP alumni have higher predicted probabilities of graduate degree completion (marginal and cumulative) than men and national benchmarks.

Recommendations

1. ***Encourage the inclusion of core model components in proposals from HBCU-UP grant applicants.*** Core model components (e.g., curricular reform, faculty professional development, and student research) are associated with successful student outcomes and seem crucial to transform grantee institutions by enhancing their capacity to produce STEM graduates who go on to complete STEM graduate programs and enter the STEM workforce.
2. ***Emphasize the inclusion of project components that strengthen the link to graduate studies, particularly in the early post-undergraduate years.*** A higher share of HBCU-UP alumni completed graduate programs than national comparison students, particularly in the first two years after graduating with a bachelor's degree. Because this advantage declines with time, projects should emphasize activities that strengthen an early transition to graduate school.
3. ***Consider characteristics of successful projects in selecting sites for grant awards under the HBCU-UP program.*** Reviewers should look for the following characteristics in grant applications to make award recommendations: (a) a clear identification of problems to be addressed; (b) a comprehensive approach that encompasses student support, faculty support, and institutional infrastructure change; (c) an intervention tailored to the needs and context of the institution and its students; and (d) plans to institutionalize major project components.
4. ***Encourage dissemination of findings and lessons learned to the HBCU community.*** The evaluation identified critical components of an intervention model that is associated with successful STEM outcomes at HBCUs, and grantees possess a wealth of knowledge and experience in implementing model components that other institutions can replicate. Successful grantees should be encouraged and funded to share their experiences and assist in replicating the HBCU-UP core model.
5. ***Use the knowledge gained through the HBCU-UP program regarding the production of African-American STEM workforce talent to inform the policies and practices of predominantly white institutions (PWIs).*** Successful HBCU-UP grantees can provide model policies and practices that can be adapted for use by PWIs, where the majority of African-Americans are educated.