

**Interdisciplinary Social Science Approaches  
to the  
Participation of Ethnic Minorities in STEM**

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In the 1990s there was great concern with the under-representation of minorities, women, and people with disabilities on the part of foundations such as NSF and Sloan who funded research in this area, including the publication of two books. The first, *The Equity Equation* (1996), dealt with women while the second, *Access Denied* (2000) addressed the under-representation of ethnic minorities. Both books were based on conferences funded by the foundations and each provided suggestions for policy. It is noteworthy that *Journal of Women and Minorities in Science and Engineering* was first published in 1994.

Each of these publications has relied heavily on the pipeline metaphor to explain the participation of minorities in STEM. However, this model puts the emphasis on pre-college factors, and thus the responsibility for fixing the problems. As such the responsibility for the problem's research has fallen to scholars in education. But, as the methodological basis of educational research is social science, The Sloan Multi-disciplinary Social Science Research Group wanted to know a) what research has been done since *Access Denied* in the social sciences and b) who are the emerging scholars in this field. The question that guided our year-long project focused on studies done in the social sciences that could focus on the experiences and participation of ethnic minorities in STEM in the United States.

1. Identification of social scientists who are focusing their work on the participation of ethnic minorities in science in the U.S.

The identification of social scientists focusing their work on the participation of ethnic minorities in science in the U.S. was achieved through four venues. Two of the venues were disciplinary based: literature searches informed by disciplinary research librarians at the Graduate library of the University of Washington, and inquiries to social scientists with disciplinary expertise. The two other venues were focused on the participation of ethnic minorities in STEM fields in the U.S.: examination of every issue of the *Journal of Women and Minorities in Science and Engineering*, and a brainstorming session with historian of science Evelyn Hammonds (Harvard) and sociologist Willie Pearson, Jr. (Georgia Tech).

Social scientists were identified as those people who either (1) self-identified in the biographical statements attached to the articles as having been trained in one of the six social science disciplines the 3SR Group was focusing on (anthropology, communications, history, sociology, philosophy, and psychology), (2) or whose work comes up when searching within a disciplinary base AND there is no other way to ascertain their disciplinary identity. In (3) some cases the disciplinary training of the social scientists was also ascertained through electronic searches based on their names and affiliations.

The literature searches focused on (1) articles written in the last ten years, (2) by social scientists, (3) focused on the participation of ethnic minorities in STEM in the U.S., and (4) published in a disciplinary journal identified through the corresponding search engine appropriate for that discipline. In those disciplines where books are the favored units of publication (Anthropology, History and Philosophy), book searches of the WorldCat database were conducted. One history of science database also listed books. These literature searches were repeated to check on procedures and reliability of search engines.

Every issue of the *Journal of Women and Minorities in Science and Engineering* (JWMSE) was also examined. Out of a total of 221 articles published from its inception until December 2006, 176 were focused only on women; of those only 10 on women of color. Fifty-five of the articles focused on ethnic minorities. In accordance with the mission, aims and scope of JWMSE many of the articles on ethnic minorities in STEM in the journal reported on intervention programs and case studies of educational achievement and/or academic experience. Given its mission and aims it is not surprising that the search of JWMSE yielded no articles that fulfilled our criteria for inclusion.

The application of the selection criteria described above yielded a surprisingly short list of social scientists as having produced any work focused on the participation of ethnic minorities in STEM since 1997. See Appendix A for a list of authors identified through one of the four venues listed above. Only one of these authors has published more than one article in that time period on this topic. It is possible that some articles or books have been missed through this process, as the codes used by libraries and search engines do not fit perfectly the topics of these searches.

2. Identification of how scholars in the social sciences have framed questions regarding the participation of ethnic minorities in STEM in the U.S.

Many of the articles selected by the process described above focused on issues that could be labeled as educational access, pipeline issues, or climate issues often in educational settings. Within the disciplines of psychology and sociology the articles examined stereotype threat, science self-efficacy, achievement, and educational outcomes. Communications scholars examined representations of gender, race, and science in the media. Philosophy and history both dealt with discrimination within the sciences. See Appendix B for a list of the topics by disciplines.

Since the literature searches initially planned under this grant did not yield a significant list of new approaches to the study of the participation of ethnic minorities in science in the U.S., members of the 3SR group conducted interviews with scholars in the social sciences and examined canonical sources in each of the disciplines. A total of eight scholars were interviewed, from the disciplines of Anthropology, Communications, History, Philosophy, and Sociology (The list of scholars interviewed, is not included in this report to protect the identity of the respondents.) The canonical sources examined were annual reviews in each of the disciplines where such volumes are published and the web pages of the professional associations identified with each of the disciplines.

The interviews with the professors in the disciplines offered useful insights of how the disciplines structure the kinds of questions about the participation of ethnic minorities in STEM in the U.S. that could be asked. Neither of these additional sources yielded a significant list of new approaches to the study of the participation of ethnic minorities in STEM in the U.S. On the contrary, such examinations provided further documentation of how materials on the participation of ethnic minorities in STEM in the U.S. are absent from the social sciences except as published in special issues or in the section of education of mainstream journals.

The preliminary answer to the question of how the social sciences frame issues pertinent to the participation of ethnic minorities in STEM fields is: as an educational access issue. We see the workshop, *Multi-Disciplinary Perspectives on Scientists of Color*, as expanding the conversation at the UW with the SSNet community about how best to “Increase social-science research on the factors that influence progress and provide barriers for *underrepresented* individuals in STEM at all levels—from learners to *leaders*” (emphasis added). That is the challenge that the congressionally mandated Committee on Equal Opportunities in Science and Engineering (CEOSE) issued to the National Science Foundation in a report in July 2005.

Social science scholars identified through the literature review who have studied the participation of ethnic minorities in STEM, 1997 – 2007.

### *Communications*

Conefrey, T. (1997). Gender, culture and authority in a university life sciences laboratory. *Discourse & Society*, 8(3), 313-340.

Long, M., et al. (2001). Gender and racial counter-stereotypes in science education television: A content analysis. *Public Understanding of Science*, 10, 255-269.

\*Steinke, J. (1999). Women scientist role modes on screen: A case study of contact. *Science Communication*, 21(2), 111-136.

\*Steinke, J. (2005). Cultural representations of gender and science: Portrayals of female scientists and engineers in popular films. *Science Communication*, 27(1), 27-63.

### *History*

Eglash, R. (1997). The African heritage of Benjamin Banneker. *Social Studies of Science*, 27(2), 307-315.

Timmermans, S. (2003). A Black technician and blue babies. *Social Studies of Science*, 33(2), 197-229.

### *Philosophy*

Cudd, A. (1998). Multiculturalism as a cognitive virtue of scientific practice. *Hypatia* 13(3), 43-61.

Harding, S. G. (1998). *Is science multicultural?: Postcolonialisms, feminisms, and epistemologies*. Bloomington, Indiana: Indiana University Press.

\*Wylie, A. (1997). The engendering of archaeology: Refiguring feminist science studies. *Osiris*, 12, 80-99.

Zack, N. (2002). *Philosophy of science and race*. New York: Routledge.

### *Psychology*

\*Aronson, E., & Patnoe, S. (1997). *The jigsaw classroom: Building cooperation in the classroom*. New York: Longman.

Gainor, K. A., & Lent, R. W. (1998). Social cognitive expectations and racial identity attitudes in predicting the math choice intentions of black college students. *Journal of Counseling Psychology*, 45(4), 403-413.

- Goode, C., Aronson, J., & Inzlicht, M. (2003). Improving adolescents' standardized test performance: An intervention to reduce the effects of stereotype threat. *Applied Developmental Psychology, 24*(6), 645-662.
- Gwilliam, L. R., & Betz, N. E. (2001). Validity of measures of math- and science-related self-efficacy for African Americans and European Americans. *Journal of Career Assessment, 9*(3), 261-281.
- Ryan, K. E., & Ryan, A. M. (2005). Psychological processes underlying stereotype threat and standardized math test performance. *Educational Psychologist, 40*(1), 53-63.
- Steele, C. M. (1997). A threat in the air: How stereotypes shape the intellectual identities and performance of women and African Americans. *American Psychologist, 52*, 613-629.
- Winston, C. E., Philip, C., & Lloyd, D. L. (2007). The identity and success life story method: A new paradigm for digital inclusion. *The Journal of Negro Education, 76*(1), 31-42.
- Sociology*
- Beoku-Betts, J. (2004). African women pursuing graduate studies in the sciences: Racism, gender bias, and third world marginality. *NWSA Journal, 16*(1), 116-135.
- Burack, C., & Franks, S. E. (2004). Telling stories about engineering: Group dynamics and resistance to diversity. *NWSA Journal, 16*(1), 79-95.
- Hanson, S. L. (2004). African American women in science: Experiences from high school through the post-secondary years and beyond. *NWSA Journal, 16*(1), 96-115.
- Johnson, A. (2005). Policy implications of supporting women of color in the sciences. *Journal of Women, Politics & Policy, 27*(3-4), 135-150.
- Miller, M. D. (2006). Science self-efficacy in tenth grade Hispanic female high school students. *Dissertation Abstract International: The Humanities and Social Sciences, 67*(3), 888.
- Ong, M. (2005). Body projects of young women of color in physics: Intersections of gender, race and science. *Social Problems, 52*(4), 593-617.
- Shih, J. (2006). Circumventing discrimination: Gender and ethnic strategies in Silicon Valley. *Gender & Society, 20*(2), 177-206.

\*Indicates that there is a mention of ethnic minorities in science or as scientists but this topic is not the focal point of the article.

## Topics

*Communications:* (1) Representations of gender and race in the media, (2) culture of a life sciences laboratory, and (3) experiential science education\*.

*History:* (1) Biography of scientists of color, (2) encyclopedias of scientists of color, and (3) discrimination in science.

*Philosophy:* (1) Critiques of scientific knowledge production and (2) methodological discrimination as gender discrimination.

*Psychology:* (1) Social cognitive career theory (2) self-efficacy for math- and science-related behaviors\*, (3) stereotype threat\*, and (4) design based research and the identity and success life story research method.

*Sociology:* (1) Science educational goals and outcomes of African women\*, (2) achievement, access, and attitudes in for science students of color\*, (3) resistance to diversity in science education\*, and (4) coping with discrimination in science (school and work)\*.

\* Denotes topic related to education