More Than The Sum Of Its Parts: 
Advancing Women at NJIT through Collaborative Research Networks

A. Project outcomes that address intellectual merit criteria

“To know who we are, we must understand how we are connected,” write Christakis and Fowler in their 2009 book on the power of social networks. The NSF-funded ADVANCE Program at the New Jersey Institute of Technology (NJIT) puts this insight into action, pioneering the use of social network analysis to affect institutional change and ensure the full participation of women in academic science and engineering.

Organizational networks supply the social capital that powers career success, allowing young professionals to convert their human capital into status. Understanding network structure is especially important for women in technological organizations, who can easily spend their entire careers on the periphery, far from the flow of information at the core. NJIT ADVANCE addresses this problem by proactively linking women researchers to each other and to male peers; by supporting women-led collaborative research projects; and by mapping research network structure to help faculty assess and manage their careers.

Accomplishments of the project include: 1) construction of an interactive database containing over 7200 NJIT faculty publications (2000-2008); and 2) statistical modeling and visual mapping of this data to analyze gender patterns in network centrality, establishing correlations between collaboration, productivity, retention, and career advancement.

The NJIT study is extremely important for institutional change efforts across the country because it demonstrates that social network analysis can be used effectively to measure the impact of isolation on women’s careers. The correlation that the study has established between increase in network centrality and female faculty retention allows us to map career landscapes in meaningful ways—and to predict who will advance in academia and who is in danger of dropping out.

The ability to visualize individual networks in dynamic organizational context is significant for program assessment as well. The NJIT study suggests that bibliometric data—more and more easily accessible on a national scale—is a valid proxy for real-world faculty networks. Drawing on such bibliometric data, in the future NSF ADVANCE will be able to use social network analysis to track changes in organizational health, to identify emerging leaders or isolated backwaters, or to compare the relative advancement of selected groups/individuals. In combination with metrics such as the NSF 12, the ability to map changes in faculty networks over time provides a powerful holistic method of seeing institutional transformation as it unfolds.

B. Project outcomes that address broader impact

The 2009 National Academy of Sciences report Gender Differences at Critical Transitions in the Careers of Science, Engineering and Mathematics Faculty expresses concern about female faculty isolation and excess attrition of women assistant professors. (“In every field, women were underrepresented among candidates for tenure relative to the number of women assistant professors.”) The NAS report observes
that women faculty members in the study “were less likely to engage in conversation with their colleagues on a wide range of professional topics, including research….This distance may prevent women from accessing important information and make them feel less included and more marginalized in their professional lives.” The report concludes by calling for future research to explore “the causes for the attrition of women… prior to tenure decisions” and to explain why “female faculty, compared to their male counterparts, appear to continue to experience some sense of isolation.” The work done by NJIT ADVANCE on network mapping and retention responds directly to NAS concerns, demonstrating that SNA methods can be used effectively and efficiently by gender and technology researchers to measure relative network isolation and its impact on female faculty careers—and can be used to mitigate that impact by giving junior faculty access to the kind of aerial view of the organizational landscape normally available only to strategically positioned “boundary spanners.”

The ability to visualize individual networks in dynamic organizational context has the potential to transform the ways in which STEM faculty researchers—especially women and underrepresented males--assess and manage their careers. Network mapping also gives academic administrators a more effective means of identifying problematic characteristics of the units they manage and brings added value to the task of program assessment, allowing governmental funding agencies such as NSF to track the effectiveness of the institutional change projects they support.

In 2008, President Obama expressed concern that “women are significantly underrepresented in the STEM workforce, and especially in the leadership positions in research and academia. We need women in leadership roles both for their contribution and for the message of encouragement and opportunity that their presence sends…” (2008). In November 2009, in launching the "Educate to Innovate" Campaign for Excellence in Science, Technology, Engineering & Math (STEM) Education, the president reiterated this message: “America needs a world-class STEM workforce to address the grand challenges of the 21st century,” he said, emphasizing that success in this effort requires “a greater focus on opportunities and access for groups such as women and underrepresented minorities.”

Like NSF ADVANCE as a whole, the NJIT ADVANCE project responds directly to the president’s call to action. Our effort to support women science and engineering faculty, and thus the young people they inspire, is an important part of the larger effort to create a more representative, and therefore more robust, US technological workforce for the future.
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Map of NJIT Faculty Co-Authorship Network, Color-Coded by Department
(Powered by ORA, Casos Center @CMU)

Principal Investigator:

Dr. Nancy Steffen-Fluhr,
Director, Murray Center for Women in Technology

Research Team:
Information Systems Doctoral Students, NJIT
Babajide Osatuyi
Regina Collins
Yiran Wang
Consultant on Social Network Analysis, Dalhousie University, Canada
Dr. Anatoliy Gruzd
Interdisciplinary Research Supported in Part by a Grant from NJIT ADVANCE:

Rapid Research Platform Device to Provoke Neuroplasticity in Traumatic Brain Injury, as Measured Using Functional MRI

Why is this research important?

It could offer a new approach to restoring visual function in soldiers and others who have suffered traumatic brain injury

Principal Investigator:

Dr. Tara Alvarez,
Associate Professor of Biomedical Engineering
New Jersey Institute of Technology

NSF Career Award winner
Named one of 12 Outstanding Women of Science by the New Jersey Association for Biomedical Research (NJABR)
Interdisciplinary Research Supported in Part by a Grant from NJIT ADVANCE:

A novel Maximum A Posteriori Gibbs Sampling approach for estimation of phytoplankton absorption/concentration in coastal waters

Why is this research important?

It could provide a cheaper and more accurate method of assessing the impact of climate change on the waters off our coasts

Remote Sensing Images of the Hudson/Raritan Estuary of New York–New Jersey

Principal Investigators:

Remote Sensing Expert Dr. Sima Bagheri
Environmental Engineer Dr. Lisa Axe
Mathematician & Signal Processing Expert Dr. Eliza Michalopoulou
New Jersey Institute of Technology