Annual Report for Period:10/2011 - 09/2012   **Submitted on:** 06/01/2012

Principal Investigator: Steffen-Fluhr, Nancy .   **Award ID:** 1008549

Organization: NJIT

Submitted By:

Steffen-Fluhr, Nancy - Principal Investigator

Title:

More than the Sum of Its Parts:Advancing Women at NJIT through Collaborative Research Networks

Project Participants

Senior Personnel

> **Name:** Steffen-Fluhr, Nancy
>
> **Worked for more than 160 Hours:**   Yes
>
> **Contribution to Project:**
>
> **Name:** Wu, Yi-Fang
>
> **Worked for more than 160 Hours:**   Yes
>
> **Contribution to Project:**
>
> **Name:** Friedman, Robert
>
> **Worked for more than 160 Hours:**   No
>
> **Contribution to Project:**
>
> Friedman left the employ of NJIT in July 2011 and is no longer co-PI on this grant. His functions in the project are being assumed by CSLA Dean Fadi Deek. (See annual report.)
>
> **Name:** Passerini, Katia
>
> **Worked for more than 160 Hours:**   Yes
>
> **Contribution to Project:**
>
> **Name:** Hiltz, Starr
>
> **Worked for more than 160 Hours:**   No
>
> **Contribution to Project:**
>
> Consultant on self-reported social network data collection and analysis and on faculty mentoring.
>
> **Name:** Gruzd, Anatoliy
>
> **Worked for more than 160 Hours:**   Yes
>
> **Contribution to Project:**
>
> Consultant on social network data collection and analysis

Post-doc

Graduate Student

> **Name:** Wang, Yiran
>
> **Worked for more than 160 Hours:**   No
>
> **Contribution to Project:**
>
> RA focusing on self-reported data collection and SNA analysis
>
> Yiran Wang left NJIT in June to continue her graduate studies at the University of California. She continues to collaborate informally with NJIT Advance team members but is no longer officially working on the project.
>
> **Name:** Zhu, Mingzhu
>
> **Worked for more than 160 Hours:**   Yes

Contribution to Project:

RA focusing on database construction and automated bibilographic data collection

Name: Collins, Regina

Worked for more than 160 Hours: Yes

Contribution to Project:

Replaces RA Yiran Wang. Conducts social network analysis of faculty publications data and maintains the Research Map tool.

Name: Ahmed, Azhar

Worked for more than 160 Hours: No

Contribution to Project:

As of 17 November 2011, Azhar Ahmed is no longer employed by the project. He has been replaced by Prem Kumar Narayanappa Venkatesh.

Name: Venkatesh, Prem

Worked for more than 160 Hours: No

Contribution to Project:

Prem (full name: rem Kumar Narayanappa Venkatesh) briefly replaced Azhar Ahmed as the project's webmaster, who also assisted with data cleaning and validation. However, Prem worked only briefly before resigning to take an internship.

Undergraduate Student

Name: Vo, Jonathan

Worked for more than 160 Hours: No

Contribution to Project:

Designed new NJIT ADVANCE brochure.

Jonathan Vo graduated in June and has gone on to graduate school at the University of Pennsylvania but still serves as an occasionaly media consultant.

Name: Dave, Vaidehi

Worked for more than 160 Hours: No

Contribution to Project:

Redesigned and maintained NJIT ADVANCE website.

Vaidehi Dave graduated in June and has accepted a job in industry. She is no longer employed by the project.

Name: Spinelli, Lara

Worked for more than 160 Hours: No

Contribution to Project:

Lara Spinelli is an undergraduate work-student hired to help with data cleaning and our db information retrieval coverage check,

Technician, Programmer

Name: Sears, Mary

Worked for more than 160 Hours: No

Contribution to Project:

Helps with administrative tasks, including brochure design and event logistics

Name: Avalani, Pawna

Worked for more than 160 Hours: Yes

Contribution to Project:

Pawna Avalani, an NJIT graduate, is the project's current webmaster and database technician.

Other Participant

Research Experience for Undergraduates

Organizational Partners

New Jersey Technology Council

The NJ Technology Council co-sponsored the NJIT ADVANCE April 20 Innovation and Collaboration Research Showcase and publicized the event to its members.

UMDNJ - School of Health Related Professions

NJIT ADVANCE collaborates with UMDNJ Professor Ellen Townes Anderson, Department of Neurosciences, UMDNJ-New Jersey Medical School and director of the UMDNJ Faculty Mentoring Program. We share best practice in mentoring and are exploring the possibility of using our new Research Map tool to foster cross-institutional collaboration among NJIT and UMDNJ faculty. (See ACTIVITIES report.)Townes-Anderson serves on the NJIT ADVANCE External Advisory Committee.

Other Collaborators or Contacts

Dr. Laura Kramer, Montclair University (Emerita)/ Former NSF ADVANCE Program Director: ADVISORY BOARD MEMBER

Susan Metz, Co-Founder, WEPAN: ADVISORY BOARD MEMBER & CONSULTANT

Dr. Ellen Townes-Anderson, Professor, Department of Neurosciences, UMDNJ-New Jersey Medical School and director of the UMDNJ Faculty Mentoring Program: ADVISORY BOARD MEMBER

Dr. Caroline Haythornthwaite, Director and Professor, School of Library, Archival & Information Studies, University of British Columbia: ADVISORY BOARD MEMBER

Activities and Findings

Research and Education Activities: (See PDF version submitted by PI at the end of the report)

See attached Activities and Findings File.

Findings:

See attached Activities and Findings File

Training and Development:

RESEARCH TRAINING OVERVIEW: Grounded in the belief that increasing interconnectivity is essential to the transformation of organizational culture, NJIT ADVANCE relies on each-one-teach-one strategies to create bridging ties across disciplines, sectors, and hierarchies. Virtually all of the activities described in the Activities Section involve some form of research training, both teacher-to-student and peer-to-peer. During 2011-12, consultant Anatoliy Gruzd continued to provide ongoing training in social network analysis to RA Regina Collins and the Co-PIs. Collins, who served as an RA on the previous NJIT ADVANCE grant from 2009-2010, already had experience with social network analysis tools and techniques; however, she was able to increase her expertise much further in early July 2011 by participating in a week-long one-on-one training session with Gruzd at his home campus, Dalhousie University in Halifax, NS. Training focused on the use of ORA and UCINET for analysis and hypothesis testing and an overview of the new Research Map tool. Collins received additional training at the INSNA Sunbelt conference in March 2012 where she not only presented a paper but also attended a series of hands-on workshops covering new SNA tools and methodologies. Co-PI Brook Wu has trained RA Mingzhu Zhu in the text-mining techniques that are central to the project's data collection strategies. Mingzhu, in turn, has been an invaluable informant to the rest of the project team. Katia Passerini has shared her expertise in knowledge management, and PI Steffen-Fluhr has made sure that the project remains grounded in the work of gender equity research.

Outreach Activities:

STIMULATING CROSS-SECTOR SYNERGY: NJIT ADVANCE has matched its efforts to increase interconnection among women faculty

with an effort to forge cross-sector connections, linking women researchers in academia with women researchers in New Jersey industry. In Year Two, this effort was best expressed in the highly successful March 7 Innovation and Collaboration Showcase. NJIT ADVANCE reached out to the Office of Technology Development, which co-sponsored the event and has helped to publicize ADVANCE activities.

FORMING LOCAL ALLIANCES: Demos of the ADVANCE Research Map tool have sparked considerable interest from faculty at other universities and are helping to foster collaboration among NJIT and UMDNJ faculty. (See Activities Section A4.1.)

PUBLICIZING ADVANCE ACTIVITIES: Throughout the year, ADVANCE has worked to ensure that its efforts are visible to the larger community. Webmaster Pawna Avalani has updated our website and seeded it with interactive products, including our handsome E-brochure, professionally-produced video clips, and a demo of our Research Map tool, as well as links to new gender equity research and IT resources. In addition, In addition information about the NJIT ADVANCE project is disseminated via a monthly E-newsletter published by the Murray Center for Women in Technology, of which Steffen-Fluhr serves as director. The newsletter, which uses Constant Contact as its vehicle, contains interactive multimedia content, including a hyperlink to previous issues, and has proved be an especially effective and efficient means of communication.

Journal Publications

Books or Other One-time Publications

Web/Internet Site

URL(s):
http://advance.njit.edu/
Description:
NJIT ADVANCE Website

Other Specific Products

Product Type:
Research Poster
Product Description:
A research poster describing how ADVANCE uses social network analysis to drive institutional transformation.
Sharing Information:
The poster was presented by PI Steffen-Fluhr at the November ADVANCE NSF PIs meeting in Alexandria, VA.

Product Type:
Press Release/News Story
Product Description:
Steffen-Fluhr co-wrote a press release/ news story that NJIT Communications used to officially announce the new grant.
Sharing Information:
The story was released to media on 14 December and was picked up fairly widely on the Web and re-disseminated: http://www.njit.edu/news/2010/2010-521.php (8,620 hits on Google).

Product Type:
Conference Presentation
Product Description:
ADVANCE RA Yiran Wang wrote a conference paper describing the NJIT ADVANCE self-reported network study and successfully submitted it to peer review for the INSNA Subbelt Conference.
Sharing Information:
Wang presented the paper on 10 February 2011 at the Sunbelt XXXI Conference (International Network for Social Network Analysis) in St. Pete Beach, Florida ("Increasing the Reliability, Sustainability and Scalability of Social Network Data Collection")

Product Type:

Data or databases

Product Description:

NJIT ADVANCE has created a database of all publications authored by NJIT faculty between 2000 and 2011. A subset of this DB contains 1,533 publications co-authored by at least two NJIT faculty.

Sharing Information:

Analysis of the DB and dissemination of the results is the core work of the NJIT ADVANCE project and will be disseminated in journal articles and conference papers, along with discussion of innovative network data collection methods. Preliminary results are presented in this annual report.

Product Type:

Audio or video products

Product Description:

Co-PI Katia Passerini used an NJIT "Stories of Innovation" video shoot as an occasion to talk about the work of our ADVANCE project. Nancy Steffen-Fluhr also appears in the video.

Sharing Information:

The video is available on the NJIT main website at http://www.njit.edu/edge/#Innovations14 and on the NJIT Advance website.

Product Type:

Audio or video products

Product Description:

An archived WIMBA audio/slide version of ADVANCE consultant Anatoliy Gruzd's February 24 workshop presentation "Emerging Trends in Online Research Dissemination and Collaboration"

Sharing Information:

The Wimba audio recording of the ADVANCE February 24 colloquium, plus Gruzd's PowerPoint slides, can be accessed on the NJIT ADVANCE website by clicking Gruzd's photo.

Product Type:

Brochure

Product Description:

A new NJIT ADVANCE color brochure: 4 sides, 8.5" by 11" each.

Sharing Information:

The brochure was distributed at the ADVANCE April 20 Showcase and is available in digital form on the ADVANCE website.

Product Type:

Audio or video products

Product Description:

In April, research assistant Yiran Wang created a Camtasia Studio demonstration showing how our Research Map tool can help faculty identify potential collaborators.

Sharing Information:

Wang's Camtasia demo was rolled out at the April 20 Advance Research Showcase and is now available on the NJIT ADVANCE website

Product Type:

Research Poster

Product Description:

ADVANCE RA Mingzhu Zhu created a research poster describing ADVANCE data collection methods.

Sharing Information:

The poster was presented at the ADVANCE April 20 Showcase and is now available on the ADVANCE website.

Product Type:

Research posters

Product Description:

Digital copies of the April 20 Showcase research posters are available.

Sharing Information:

The posters can be accessed from a virtual archive on the ADVANCE website, along with a video of the panel discussion

Product Type:

Instruments or equipment developed

Product Description:

ADVANCE researchers have created and fielded a new seven page survey instrument and protocol designed to collect network data from human subjects.

Sharing Information:

Other ADVANCE projects and SNA researchers can use the NJIT ADVANCE survey and data collection methods to collect faculty network data at their home institutions.

Product Type:

Conference Paper

Product Description:

Ye, Lingun and Anatoliy Gruzd. "Studying research collaborations in GRAND via coauthorship networks." GRAND 211 Conference. May 12-14. Vancouver, BC, Canada

Sharing Information:

This paper will be published in conference proceedings.

Product Type:

Research Poster

Product Description:

A poster that summarized NJIT ADVANCE activities, methods, and outcomes, plus a live demonstration of the Research Interests Map tool.

Sharing Information:

The poster and demo were presented on 14 November at the annual NSF ADVANCE PIs meeting in Alexandria, Virginia, by PI Steffen-Fluhr and RA Regina Collins.

Product Type:

Mentoring Guide

Product Description:

Mentoring Program Guide
New Jersey Institute of Technology
Pilot Program Sponsored by the ADVANCE Project
2011-2012

Sharing Information:

Disseminated internally during the 2012 NJIT Faculty Career Advancement Mentoring pilot program. Will be disseminated externally via the NJIT ADVANCE website.

Product Type:

Research Poster

Product Description:

Research Poster: "More Than the Sum of Its Parts: Advancing Women at NJIT Through Collaborative Research Networks"

Sharing Information:

Presented by Nancy Steffen-Fluhr and Regina Collins at the annual ADVANCE PIs meeting, November, 2011, Alexandria, VA,

Product Type:

Conference Presentation

Product Description:

Conference Presentation (PPT) describing the NJIT ADVANCE "Department X" study. Title: "Talking Through the Noise: Methodological Issues in Collecting Faculty Network Data"

Sharing Information:

Presented by ADVANCE RA Regina Collins at the the March 2012 INSNA "Sunbelt XXXII" conference in Redondo Beach, California.

Product Type:

Research Poster

Product Description:

Research Poster describing NJIT ADVANCE 2012 network data analysis.

Sharing Information:

Presented by Regina Collins at the March 7 Research and Collaboration Showcase (at NJIT) and again at the April 4 Dana Knox Student Research Showcase (at NJIT).

Product Type:

Research Poster

Product Description:

Research poster describing NJIT ADVANCE data collection and data visualization methodology. Title: "Collecting and Mapping Faculty Collaboration Data"

Sharing Information:

Presented by Mingzhu Zhu at the March 7 Research and Collaboration Showcase (NJIT) and again at the April 4 Dana Knox Student Research Showcase (NJIT).

Product Type:

Audio or video products

Product Description:

Internet Podcast providing an overview of the NJIT ADVANCE project for a general audience. Audio voiceover with PPT slides.

Sharing Information:

The podcast, created by Steffen-Fluhr, is available off the NJIT website at http://www.njit.edu/middlestates/Podcasts.php and directly at this YouTube link: http://www.youtube.com/watch?v=DIYNScMskEE

Product Type:

Conference Presentation

Product Description:

A Powerpoint presentation of the latest results of NJIT ADVANCE network research and its application to faculty mentoring. Title: "Leveraging Social Network Data to Support Faculty Mentoring: Best Practices from NJIT Advance"

Sharing Information:

Steffen-Fluhr will make the presentation at the annual WEPAN conference in Columbus, Ohio, on 25 June 2012. The full paper has been peer-reviewed and accepted for subsequent publication in conference proceedings.

Contributions

Contributions within Discipline:

Women STEM faculty are frequently relegated to the periphery of the collegial networks that pass along information critical to career success. Marginalization makes it more difficult for these women to acquire tacit knowledge, find support for risk-taking, signal the value of their work, and accumulate social capital--deficits that add up to greater difficulty in P&T. 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 may 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.'
 The ADVANCE Project at the New Jersey Institute of Technology responds directly to the NAS call for new research on faculty retention.

Over the last two years, NJIT ADVANCE has made an important contribution to institutional change efforts across the country by demonstrating that social network analysis can be used effectively to measure the impact of isolation on women's career trajectories. The project's longitudinal analysis of faculty co-authorship patterns has produced a much clearer understanding of the relationship among collaboration, productivity, and advancement in rank. The NJIT ADVANCE methodology, involving text-mining of widely accessible publication databases, is both sustainable and scalable. Following the NJIT ADVANCE lead, in the future universities across the country will be able to use network data to construct predictive models of faculty career success that can be deployed in mentoring programs.

 NJIT ADVANCE research has demonstrated that collaboration drives faculty advancement, especially networks that contain 'bridging ties.' ADVANCE researchers have developed a tool (the Faculty Research Interests Map) to help faculty form such ties and reduce the transaction costs involved in collaboration. A Beta version of the tool is available to the public on the NJIT ADVANCE website. NJIT ADVANCE has also developed an interface for its co-authorship database that, in its final form, will give faculty members the ability to visualize their professional networks in dynamic organizational context and track their career advancement in real time. In the future, the network mapping approach pioneered by NJIT ADVANCE will also give academic administrators a more effective means of identifying problematic characteristics of the units they manage and will bring added value to the task of program assessment, providing another way for governmental funding agencies such as NSF to track the effectiveness of the institutional change projects they support.

Contributions to Other Disciplines:

See 'Contributions within the Discipline' section.

Contributions to Human Resource Development:

See 'Contributions within the Discipline Section.'

Contributions to Resources for Research and Education:

See 'Contributions within the Discipline' section.

Contributions Beyond Science and Engineering:

See 'Contributions within the Discipline' section.

Conference Proceedings

Special Requirements

Special reporting requirements: None

Change in Objectives or Scope: None

Animal, Human Subjects, Biohazards: None

Categories for which nothing is reported:

Any Journal

Any Book

Any Conference

NJIT ADVANCE Institutional Transformation Project
An Accomplishment-Based Renewal Grant

Annual Report for 2011-2012

ACTIVITIES & FINDINGS SECTION

Principal Investigator: Steffen-Fluhr, Nancy   **Award ID: HRD- 1008549**
Organization: New Jersey Institute of Technology (NJIT)

Title: *More Than the Sum of Its Parts: Advancing Women at NJIT through Collaborative Research Networks*

Capsule Description: The NSF-funded ADVANCE Program at NJIT pioneers the use of social network analysis to affect institutional change and ensure the full participation of women in academic science and engineering.

II. A. MAJOR RESEARCH AND EDUCATION ACTIVITIES

Overview of Project Background, Goals and Methodology: The roots of this project go back to 2005 when research for our *Status of Women Faculty Report* made it clear that at NJIT, as at other similar institutions, women felt isolated and *were* isolated, outside the information loop. In our initial proof-of-concept grant, we addressed this issue by stimulating greater interconnectivity among researchers and, simultaneously, studying existing patterns of interconnectivity. The concept at issue was whether or not supporting collaboration supports women faculty. Our initial research suggested that it does, especially when collaboration occurs across lines of discipline and gender and is informed by data from social network analysis. We found significant correlations between collaboration, network structure, and career advancement. Our 2011-2012 accomplishment-based renewal grant builds on that work, moving from concept to application and institutionalization. In particular, it focuses on the use of social network analysis to create a data-driven approach to faculty mentoring.

In this annual report, following the structure of our management plan, we document our Year Two activities and preliminary findings in three broad categories:

1. Collecting and Mapping Network Data
2. Supporting Research Collaboration
3. Disseminating Best Practices in Retention

A1. YEAR TWO LAUNCH:
NJIT ADVANCE began the 2011-2012 academic year by hosting an all-day event on September 20 that brought together our External Advisory Committee and Internal Steering Committees for a joint planning session. In the morning session, ADVANCE Team members (Steffen-Fluhr, Wu, Hiltz, Collins, and Zhu) and Provost Gatley met with three of the four External Advisory Committee Members: Dr. Laura Kramer, Montclair University (Emerita)/ Former NSF ADVANCE Program Director**;** Susan Metz, Co-Founder, WEPAN; and Dr. Ellen Townes-Anderson, Professor, Department of Neurosciences, UMDNJ-New Jersey Medical School and director of the UMDNJ Faculty Mentoring Program. Co-PI Katia Passerini could not attend because of a family medical emergency. (See section A6.0 below.) The fourth member of the Advisory Committee, Dr. Caroline Haythornthwaite, Director and Professor, School of Library, Archival & Information Studies, University of British Columbia, was also unable to attend because of a

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commitment in Europe; however, the Advance Team met with her earlier in the month in an extremely valuable two-hour virtual conference. Haythornthwaite reviewed the project's network data and analytical methodology, suggesting that we contextualize our network mapping project as part of the exciting new field of Learning Analytics, a suggestion we embraced.

The discussion at the September 20 External Advisory Committee meeting focused on the mentorship/career advancement pilot program that NJIT ADVANCE had launched on September 16: the Faculty Career Advancement Network (Faculty CAN). Issues discussed included the pros and cons of matching mentors and mentees in complimentary (rather than identical) disciplines; the importance of providing training for mentors (under the umbrella of "professional development"), even for faculty who have considerable seniority; the wisdom of asking mentees upfront what they want to get out of mentoring; the importance of soliciting formal program feedback from both mentors and mentees; the problematic nature of same sex mentoring; the value of having multiple mentors. The Committee's advice in each of these areas was incorporated into the Faculty CAN pilot program.

The External Advisory Committee, Provost Gatley, and the ADVANCE Team subsequently adjourned to a working lunch, where they were joined by all nine members of the NJIT ADVANCE Internal Steering Committee: Lisa Axe, Associate Dean, Newark College of Engineering; Fadi Deek, Dean, College of Science & Liberal Arts; Eugene P. Deess, Director, Institutional Research and Planning; Norbert Elliot, Chair, NJIT Middle States Self-Study Team; Rose Federici, Assistant to the Provost/ co-chair, Committee on Women's Issues; Judith Redling, Associate Provost; Judith Sheft, Associate VP, Technology Development; Richard Sweeney, University Librarian; David Ullman, Associate Provost for Information Services & Technology/ CIO. External Evaluator, Dr. Katherine Mayberry, Vice President for Special Projects at the Rochester Institute of Technology, also sat in on the meeting. Steffen-Fluhr presented an overview of the ADVANCE plan for 2011-2012, including quotes from assistant professors on the need for mentoring, culled from the September 16 Faculty Career Advancement Network surveys. An extremely lively and frank discussion ensued, from which the ADVANCE Team was able to garner many new ideas. (See Appendix 1 for a summary of issues discussed.) After lunch, the External Advisory Committee met briefly, then rejoined Provost Gatley and the ADVANCE Team for additional discussion of mentoring best practices.

A2.   EXTERNAL EVALUATION:

The NJIT ADVANCE Project's external evaluator, Dr. Katherine Mayberry, Vice President for Special Projects at the Rochester Institute of Technology, is an experienced evaluator and a strong advocate for diversity in higher education. She has served as a Periodic Report Review reviewer for the Middle States Commission for Higher Education and was the first reviewer in the Middle States analysis of the 2007 NJIT accreditation self-study. The key questions included in the NJIT ADVANCE Evaluation Plan, approved by Program Directors Mack and Rogers, were incorporated into the language of the contract used to hire Mayberry. The Co-PIs subsequently provided Mayberry with materials detailing NJIT ADVANCE Year One activities and findings, including our annual report, and arranged for her to visit campus and meet with various faculty and administrators. In late September 2011, Mayberry submitted her Year One NJIT ADVANCE evaluation, which was subsequently reviewed by the Advance Team. A copy of the evaluation is attached to this report. (See Appendix 2.)

A3.0 COLLECTING AND MAPPING NETWORK DATA:

NJIT Advance is essentially a proof-of-concept grant. The concept at issue is whether or not supporting collaboration supports women STEM faculty--at NJIT and, potentially, at other, similar institutions as well. To answer this question, we needed to know more about the relationship among four broad variables: *collaboration, productivity, retention*, and *advancement in rank*. To make our work useful to others, we also needed to choose a methodology that could

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be sustained at NJIT and replicated elsewhere on a large scale. The sections below describe the work we did in 2011-2012 to collect, validate, and analyze NJIT faculty collaboration data-- part of our ongoing effort to develop predictive models of faculty career success.

A3.1 Background: Although we experimented with several forms of social network data collection, including surveys and interviews, fairly early on in our project we settled on bibliometric data-mining as our primary method. The advantages of this approach are fairly obvious: faculty publication data are free, verifiable, and can be scraped off of individuals without their active participation. Moreover, publications are invariably time-stamped. This means that when bibliometric data is combined with Human Resources data (hire dates, rank, tenure status, etc.) and with Research Office data (grant proposals submitted and funded), we can track the evolution of the faculty network over time, noting when and how new nodes (people), new ties, and new resources are added to the system.

In order for co-authorship network mapping to be a sustainable, scalable practice in mentoring and institutional transformation, data collection needs to be automated and accurate. NJIT Advance used a two-stage approach to achieve this goal efficiently. We began with Google Scholar, a meta-search engine that retrieves results from many digital libraries and databases. Human Resources provided Advance with a spreadsheet containing the names of all NJIT faculty (2000-2010) by gender and rank. Our data-miners (Co-PI Brook Wu and RA Mingzhu Zhu) wrote a program that sends each faculty name to Google Scholar's author search function. A parser program was then used to process each paper in the search results. Parsed raw data from Google Scholar for each paper consists of a title link, author names, a short snippet of content, the name of the source digital library or database, a citation count, etc. The title link leads to a web page dynamically generated by the source database using a unique pattern and display format. Using the pattern, the parser program extracts bibliographic information on that web page.

In the initial run, a Google Scholar meta search returned 63,937 raw search hits matching the names of NJIT faculty. These hits came from more than 2,500 separate source databases. Predictably, the raw data included many duplicates, different versions of the same work, incorrectly parsed bibliographic data, missing affiliations, as well as common name problems. In order to provide the level of accuracy needed for subsequent network analysis, this noise had to be removed. The "common name problem" was especially troublesome--i.e., distinguishing the work of an NJIT faculty member from the work of non-NJIT authors who have the exact same name. The academic practice of using first initials exacerbated this problem. Luckily, however, there are no NJIT faculty who have an identical full name, and we were able to use institutional affiliation information to remove publications of same-name authors who are not from NJIT. NJIT students and NJIT faculty who have identical names were distinguished by their departmental affiliation. Searching a list of NJIT student names identified the rare instances where students have identical names with faculty in the same department. They were then distinguished semi-automatically.

A3.2 Year Two Co-authorship Data Collection Method: Although cleaning the data was laborious, the more serious time constraint came from the structure of Google Scholar: we would need to create a dedicated parser for each digital library or database that Google Scholar searches--and periodically update those parsers in response to format changes in the libraries/DBs. By the spring of 2011, we had decided that this method was not sustainable and switched to Elsevier's large publication database (Scopus) as our primary source. We were able to design a new data collection plan that involved only one-layer crawling because of the more unified search result pages Scopus provides, as opposed to the two-layer crawling needed for Google Scholar.

Over the summer of 2011, Wu and Zhu used this new approach to mine NJIT publications data from Scopus, complete initial data cleaning, and merge the results with the data they had collected before. By fall 2011, they had constructed a database that contains

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8395 NJIT faculty publications, 3608 of which were co-authored by NJIT faculty during the period 2000-2010. (These co-authored publications are our "network.") We were also able to identify a subset of publications in which one of the collaborators was a faculty member from another university and another subset of publications in which NJIT graduate students were one or more of the co-authors. From September through November, Wu and Zhu worked on fine tuning the data, preparing it for network analysis by project consultant Anatoliy Gruzd and RA Regina Collins.

A3.3 Data Collection Validation: In December 2011, we began a tedious but important task: conducting a coverage check to ensure that our data was as accurate as possible, especially for STEM faculty. After consulting with a Math Department expert in statistical sampling, we collected a set of online and paper resumes from faculty in each of the STEM academic units and began comparing the list of publications in each CV to the data in our database, to Google Scholar, and to the current version of Scopus, our primary source database. (The Scopus staff continually updates their db, retroactively correcting old errors as well as adding new publications.) As we discovered discrepancies, we noted their source and calculated our recall rate. Thus far, our search algorithm seems to have worked well. Most of the issues we have uncovered are the result of 1) the "common name problem"; 2) incorrect affiliation tags in Scopus; and 3) gaps in Scopus' coverage (e.g., Scopus does not index many small, international conference proceedings). All of us have helped with the coverage check in various ways, but most of the initial work was done by work-study graduate students, supervised by RA Mingzhu Zhu.

The work-study students turned out to be a major problem, unfortunately, delaying the work of the project considerably. In the fall of 2011, we hired a masters student, Azhar Ahmed, as our new webmaster, replacing undergraduate webmaster Vaidehi Dave who had graduated. Ahmed also had some knowledge of databases, so Mingzhu Zhu subsequently trained him to conduct the coverage check and assist in building the DB interface (Faculty Connections Visualizer). However, not long after being trained, Ahmed left suddenly to take another job. We subsequently hired another masters student, P.K.N. Venkatesh ("Prem"), to replace Ahmed; however, the ink was barely dry on Prem's personnel action form when he, too, left, to take an internship. It was not until late February that we were able to identify an appropriate replacement, NJIT alumna Pawna Avalani, who has expertise in both website development and database management and, more importantly, who seems to care about ADVANCE program goals. We hired her, along with an undergraduate work-study student, Lara Spinelli, to help with the coverage check. Since Avalani took charge, the coverage check has proceeded smoothly, but it is inherently laborious and will not be fully completed until the summer--at which time we will finally be ready to do a fresh round of network analysis, incorporating new hypotheses.

A3.4 Research Proposal Data: In addition to the co-authorship data discussed above, in the fall of 2011 the ADVANCE project acquired a database containing all research proposals submitted by NJIT to external funding agencies from 2000-2010, over 3700 proposals in total. Although the data on co-PIs is spotty for the first five years of the dataset, all the PIs are listed from 2000-2010 and all the CO-PIs from 2005-2010. Since the research db contains *all* submitted proposals, however--including many in which the PI is an administrator, not a faculty member-- we had to spend some time sorting out those submitted by tenure-track faculty, identifying the co-PIs, and ascertaining the status of each proposal. This effort, led by RA Regina Collins, was completed by the end of March. In May, Collins did a preliminary comparative analysis of the faculty co-authorship network and the research proposal network. This data has given us another important faculty attribute to analyze, as well as additional evidence of faculty collaboration that may not always be reflected in joint publication counts. (See Findings Section B1.3 for a preliminary analysis of this dataset.)

A3.5 Preparing for a New Round of Network Analysis: While the final processing of the co-authorship data was taking place, project RA Regina Collins combined the publication

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counts supplied by Wu and Zhu with personnel data obtained from HR to create an attribute file (Excel spreadsheet) that contains the names of the 514 faculty members who worked at NJIT from 2000-2012, their department, gender, rank progression, tenure status, hire date, separation date (if any), retention status (left/stayed), years at NJIT, and years in the study. We performed standard statistical tests on this data using SAS. To analyze the structure of the faculty co-authorship network and calculate centrality measures, we used the Organizational Risk Analyzer (ORA) software package and UCINET, a social network analysis program distributed by Analytic Technologies. The entire team participated in developing an expanded set of research hypotheses to be tested against the data. The primary work of social network analysis took place from January through March, led by Gruzd and Collins. (See Findings Sections B1.4-B1.6.)

   A3.6 The Faculty Connections Visualizer: During the spring semester 2012, RA Zhu began work on a user-friendly web interface (dubbed the "Faculty Connections Visualizer") for the project's database that will allow faculty to access publications data directly and see data visualizations (maps) of network ties. The Visualizer is designed to work in tandem with the Research Interests Map tool (RIMap) described in section A4.1 below. The RIMap shows connections among faculty who are interested the same research areas but who may not know each other at all. i.e., It identifies people with whom you might want to collaborate. The Faculty Connections Visualizer shows actual network connections (collaborative research ties) among faculty—ties between co-authors or co-PIs on grants, etc. That is, Faculty Connections Visualizer identifies people with whom you already collaborate.

   The tool is basically a user interface on top of our faculty co-authors database. Figure 1 shows a prototype of the interface that was demonstrated at the March 7 ADVANCE Research Showcase. The interface demo was built using Prefuse (http://prefuse.org/). Each node is labeled with a faculty name. When a node is double clicked, a small panel appears to show the detailed information for that faculty member. Each edge (line) represents a co-authorship tie between two faculty members. The number on an edge denotes the number of coauthored papers between the two faculty members. The corresponding coauthored papers will be shown in a small panel when the edge is double clicked. In the summer of 2011, we will complete our data coverage checks, update the DB, and configure the interface for general users. We will pilot test the new Faculty Connections Visualizer in our AY 2012-13 Faculty CAN follow-up..
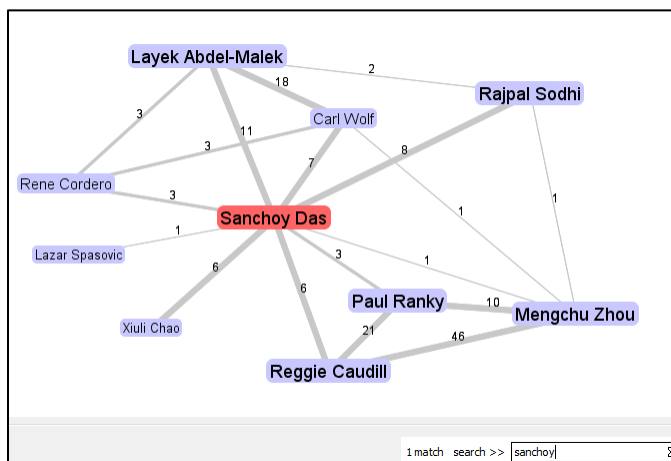

Figure 1 (Screen Shot of Faculty Connections Visualizer)

   A3.7 Automating and Sustaining the Collection of Faculty Collaboration Data: In order to increase the ease and accuracy with which faculty publication and collaboration data are collected and to sustain this data collection beyond the life of the grant, the ADVANCE team

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has developed a plan for updating our existing DB by acquiring new data directly from Digital Measures, the software package used by NJIT faculty to make their annual reports. The NJIT CIO, Dave Ullman, has agreed to support this effort; however, the staff at Digital Measures has not yet given our team the required access to the system. We expect this access to be given by June, but our RA, Mingzhu Zhu, may not be able to finish building the Web Service before he goes to China for two months, and we will need much of the fall semester to field test the system and develop a functional interface (the Faculty Connections Visualizer) that can be deployed in mentoring. This is one of several reasons we have requested a no-cost extension until September 2013.

   A3.8 Collecting Self-Reported Network Data: In addition to the main data-mining effort by Wu and Zhu, in the fall of 2010, PI Steffen-Fluhr, then research assistant Yiran Wang, and consultants Roxanne Hiltz and Anatoliy Gruzd designed a multi-modal network study to collect self-reported data about many forms of collegial interaction, including advice networks. In the spring of 2011, after obtaining IRB approval, Steffen-Fluhr and Wang conducted a series of structured one-hour interviews with 12 of the 15 STEM faculty members in NJIT "Department X." In the summer of 2011, new ADVANCE RA Regina Collins replaced Wang, who had transferred to another university. Collins, with assistance from Gruzd, analyzed the Department X results, using both symmetrized and non-symmetrized data to examine reciprocity and over- and under-reporting of connections. She compared self-reported data to bibliometric data and measured the accuracy of each faculty member's perception of the departmental research network. After conducting a thorough literature review, Collins began writing up the study. In the fall of 2011, Collins and Steffen-Fluhr submitted an abstract of the study to the conference peer review panel of the International Network for Social Network Analysis (INSNA). The paper ("*Talking Through the Noise: Methodological Issues in Collecting Faculty Network Data*") was subsequently accepted and presented by Collins at the March 2012 INSNA "Sunbelt XXXII" conference in Redondo Beach, California. (See Findings Section B.2 for a discussion of the Department X study results. See Appendix 3 for a copy of Collins' Sunbelt presentation.)

   A3.9 Analyzing Co-Authorship Network Data: Although it has necessarily consumed much of the project team's time and energy, collecting network data is a means to an end: the ongoing effort to better understand how information and influence are being shared at NJIT, knowledge that is essential to institutional transformation. Consultant Anatoliy Gruzd, an expert in social network analysis, is central to that effort. Throughout the year, he worked closely with Co-PI Brook Wu and RA Regina Collins on co-authorship network data collection. In March 2011, he and Collins began to examine the enlarged and cleaned co-authorship dataset, using Organizational Risk Analyzer (ORA) software and other tools to analyze and visualize network connections. Gruzd and Collins were able to test most of the key hypotheses about career advancement developed by the project team in the fall of 2011. (See **Findings Section B1.4-B1.6** for a detailed discussion of the results thus far.)

   A4. SUPPORTING RESEARCH COLLABORATION (BUILDING NETWORKS):
The second of NJIT Advance's core strategies involves three principal tactics: **a)** developing an effective tool that NJIT faculty can use to find potential collaborators who have similar or complimentary research interests; **b)** hosting workshops and interdisciplinary research colloquia in order to increase information flow and opportunities for collaboration; and **c)** hosting cross-sector research showcases designed to stimulate translational research and academic entrepreneurship among NJIT women faculty and to provide opportunities for them to present their work to a wider audience. During the Year One of our grant, we have used all three tactics, as follows:

   A.4.1 SNA Data and Tools for Effective Faculty Mentoring: A growing body of literature attests to the impact of collaboration and network structure on the retention and promotion of junior STEM faculty. Advocacy groups are beginning to join forces with social

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network analysts in an effort to explore how strategically designed mentoring programs can leverage the power of bridging social capital on behalf of women and underrepresented minorities. Studies stress the importance of reaching outward, across boundaries, for both individual advancement and societal knowledge creation. Although bridging is clearly the most productive strategy, it is also the most difficult to use because of the high transaction costs involved in identifying, assessing, and establishing contact with potential collaborators who are located beyond the immediate radius of a faculty member's departmental office.

At NJIT ADVANCE, we have tried to increase the benefits of collaboration by reducing the transaction costs, especially the cost of finding potential collaborators. We have done this in a number of fairly traditional ways. e.g., We have hosted interdisciplinary research colloquia and cross-sector showcases. (See sections A2.3 and A2.4 below.) Our approach to mentoring reaches across boundaries as well. In our 2011-2012 Faculty Career Advancement Network pilot program (Faculty CAN), we used teaming, endeavoring to connect mentees to mentors who have similar research interests and complimentary skill sets. We began this process by using a survey instrument to collect data about new faculty member's goals, preferences, and research areas. To help them find appropriate mentors, we plugged their data into our new Research Interests Map tool (RIMap) and created a pool of possible choices.

Developed by NJIT Advance consultant Dr. Anatoliy Gruzd, the Research Interests Map is a web-based tool that visualizes existing and potential research connections among faculty members. Each faculty member is a named node on the map. Lines connect the node to her/his research topics. These connections are based on keywords that we have entered, taken largely from the data in the "Faculty Academic Interests" website (http://people.njit.edu/) developed by former NJIT webmaster Jim Robertson. Unfortunately, many of the current keywords (culled by Robertson's work-study students from faculty homepages) are too general (e.g. "chemistry") or too narrow (e.g." single-walled carbon nanotubes in aqueous environments"). To increase the functionality of the RIMap tool, over the summer of 2012, the ADVANCE team, working with NJIT CIO Dave Ullman, will develop an interdisciplinary research term thesaurus and arrange for it to be uploaded to Digital Measures, the system through which faculty submit their annual summaries. If all goes well, in AY 2011-12 faculty using Digital Measures will be asked to add their research interests to a DM database that ADVANCE can tap directly. (Mingzhu Zhu and Wu are in the process of building a Webservice to DM.) Faculty will be prompted to select three terms from a drop-down list and then allowed to add two terms of their choosing.

Even without the refined keyword list, the RIMap tool is fully functional. Users can search the Research Interests Map either by faculty name or by research topic. A topic search generates a map of faculty who work in that area. For example, a search for "computer networking" produces the following map.

Figure 2. Research Interests Map Topic Search

An animation function allows the user to arrange the nodes on the map, a useful feature when there are many connections. The user can disclose additional research areas for each faculty member by double clicking on the person's node. (See Figure 3 for a level 2 expanded view of the computer networking map above.) The network can be expanded further, level by level, by clicking on each of the new research topics and new faculty nodes that appear, until the structure looks like a ball of yarn. Single-clicking on a faculty node produces a pop-up box containing the faculty member's name, email address, and a link to the person's full profile on the NJIT Website, which contains much additional information, including a list of publications. (See Figures 4 and 5 below.)

In addition to deploying the Research Interests Map in our Faculty CAN mentoring program, we have also used the tool to facilitate research collaboration directly--e.g., to generate a list of possible participants in a new, interdisciplinary research center. Demonstrations of the tool at our research showcases have sparked interest from industry partners who are looking for cross-sector research collaborators and from neighboring universities looking to stimulate greater research synergies and economies across institutional boundaries. Undergraduate and graduate students also find the tool helpful in identifying potential supervisors for their thesis work and independent study projects. A beta version of the tool is now available to the public on the NJIT ADVANCE website at **http://advance.njit.edu/**.

Once the keyword issue is resolved, the RIMap will be even more useful, not only for junior faculty and doctoral students but for faculty from other universities in the region looking for new collaborators. This possibility was the focus of several discussions that took place in the spring of 2012 involving Gruzd, Steffen-Fluhr, and Collins from ADVANCE; NJIT senior VP for research, Dr. Donald Sebastian; ADVANCE Advisory Board member Dr. Ellen Townes-Anderson, a professor in the Department of Neurosciences, UMDNJ-New Jersey Medical School; and UMDNJ dean Bill Gause. The State of New Jersey is encouraging closer collaboration between NJIT and UMDNJ, both located in Newark, and the ADVANCE RIMap tool may "help to set the table" for that interaction.
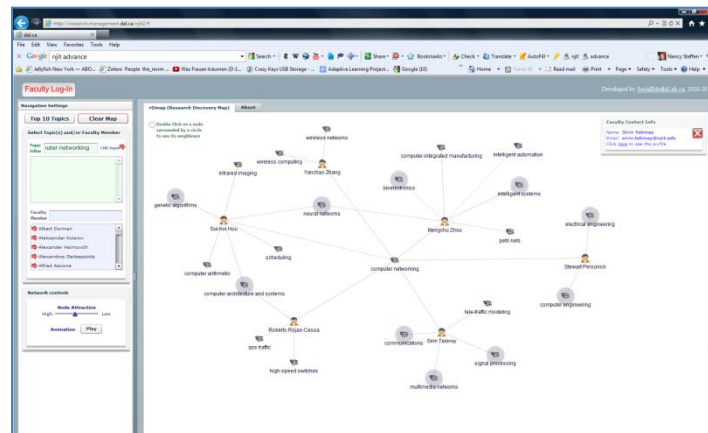
Figure 3. Expanded Research Interests Map
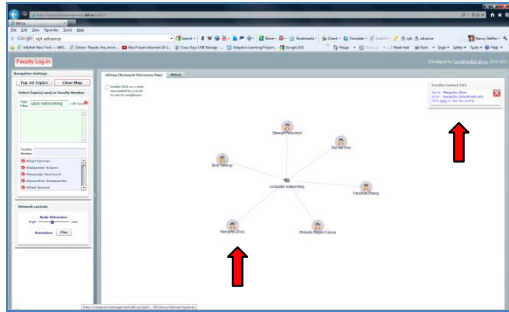
| Figure 4. Faculty Information Box | Figure 5. Faculty Profile Page |
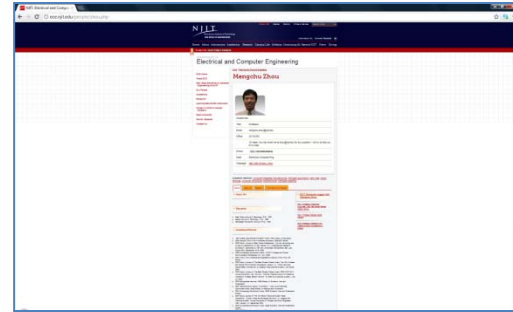
A4.2 Research Showcase: As we stressed in the section above, the benefits of collaboration--now clearly identified by our data analysis--can be increased by reducing the transaction costs associated with collaboration, especially the cost of finding potential partners. In addition to developing the RIMap for this purpose, NJIT ADVANCE has also worked to decrease transaction costs by increasing face-to-face information flow across departments and sectors. As part of this effort, during the spring semester, PI Steffen-Fluhr partnered with Judith Sheft, NJIT VP for Technology Development, to plan and host the 2012 ADVANCE Innovation and Collaboration Research Showcase, held on 7 March from 11:30am to 3:30pm on the NJIT campus (Eberhardt Hall). The showcase featured a panel discussion among representatives from industry and academia about how researchers and entrepreneurs can use new social media tools to more efficiently exchange ideas, map the assets of potential collaborators, and signal the value of their work/products to the larger community. Moderated by NJIT Professor of Management and Associate Dean at the NJIT School of Management Dr. Shanthi Gopalakrishnan, the panel included:

- *Lindsey C. Holmes,* **a** graduate of Sarah Lawrence College and head of LCH Business Social Media, a digital marketing/PR and mobile application development agency whose clients include the NAACP, BET and The Minority Media & Telecom Council (MMTC).
- *Caren Martineau,* a partner in H M E Brand Management, who has been recognized for her work as an art director/graphic designer, executive producer, writer and entrepreneur.
- *Peggy McHale*, MBA, the founder of Consultants2Go, LLC (C2G), a consulting firm that provides marketing solutions to Fortune 500 companies in the financial services, telecom, and life sciences industries.
- *Jeanne Sullivan*, JD, a founding principal of StarVest and member of the founding group for the New York New Media Association Angel Investors Program.
- *Nancy Steffen-Fluhr*, Ph.D., NJIT ADVANCE PI and Director of NJIT's Murray Center for Women in Technology.

As part of the panel discussion, Steffen-Fluhr presented the results of a study by NJIT ADVANCE consultant Dr. Anatoliy Gruzd of how and why faculty use (and don't use) social media tools. (See summary table in Appendix 4.) The panel discussion was followed by a cross-sector networking session featuring research posters presented by 20 NJIT junior faculty members (12 of them women) assisted by eight STEM doctoral students (five of them women). Over the course of the day, nearly 100 faculty members, administrators, and representatives from business and industry participated in the 2012 ADVANCE Research Showcase.

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A4.3 Interdisciplinary Research Colloquium: In addition to the Research Showcase, on March 28, ADVANCE co-hosted the 2012 Gilbreth Colloquium, featuring a presentation entitled "Paving the Way to a Smarter World: Creativity in Engineering Education" by Dr. Santosh Kurinec from the Rochester Institute of Technology. The Gilbreth Colloquium is held each year during Women's History Month in honor of pioneering industrial engineer Dr. Lillian Moller Gilbreth (1878-1972), the first female professor to teach at NJIT's Newark College of Engineering. Kurinec, a microelectronics engineer, teaches in an engineering school named for a Gilbreth contemporary, Kate Gleason, one of the first female engineers and engineering entrepreneurs in the nation. Kurinec, who is also a visiting scholar at IBM's T.J. Watson Research Center, spoke at length about the history of women in engineering as well as about interdisciplinary research opportunities for faculty of the future. The colloquium drew a faculty and student audience of over 150. ADVANCE co-hosted a smaller pre-event luncheon to give women faculty and administrators an opportunity to interact closely with Dr. Kurinec. The colloquium was co-sponsored by the Murray Center for Women in Technology, the Technology and Society Forum, and the Albert Dorman Honors College. (A video of Dr. Kurinec's presentation is available to faculty and students on NJIT i-Tunes.) In addition to the university-wide Gilbreth research colloquium, ADVANCE also created opportunities for cross-departmental networking as part of its Faculty CAN brown-bag series for junior faculty mentees. (See section A5 below.)

A5. DISSEMINATING BEST PRACTICES IN RETENTION:

A5.1 Overview of Faculty CAN Mentoring Pilot: During summer 2011, the ADVANCE team moved from data gathering and benchmarking of mentoring programs nationally to planning the structure of the Spring 2012 NJIT mentoring pilot. Feedback from senior administrators and project sponsors prompted us to rethink our original approach, as outlined in the ADVANCE work plan of February 2011. We had initially considered using top-down planning involving a selected group of faculty who already support ADVANCE goals. However, we ultimately decided to follow a suggestion from Provost Ian Gatley that we adopt a bottom-up approach, collecting needs, interests and goals directly from the assistant professors who would be involved in the program. At the same time, the provost challenged us to reconsider the notion of traditional senior-to-junior mentoring as the center-piece of the pilot. In response, we moved to a more holistic approach that mixes traditional senior-junior mentoring with other, related learning and knowledge sharing interventions.

We decided to broaden the horizon and pilot test a "Faculty Career Advancement Network" (Faculty CAN), using what we had learned about mentoring best practices but focusing on career networking and bringing faculty together rather than on one-to-one mentoring relationships exclusively. We also enlarged the scope of the program. Initially, we planned to target only selected faculty in CSLA. In actual practice, we targeted the entire pool of junior faculty at NJIT (currently N=33). The result was a nine-part program that ran from 16 September 2011 through 23 April 2012, with follow-up program assessment to be conducted from June through August 2012. (See Table 1 below for an overview of the Faculty CAN agenda.)

September 16, 2011	**Introductory meeting** Mentees were provided with an overview of the program and an application form and were surveyed in face-to-face focus groups about their mentoring needs
September 28, 2011	**University P&T Committee Information Session** Members of the current Institute P&T Committee discussed university-level

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	considerations in the promotion and tenure process at NJIT. Faculty CAN colleagues were invited, with ADVANCE co-sponsoring an informal Q&A after the event.
December 5, 2011	**Meet the Mentor event** Mentees and Mentors met for the first time and received materials to get them started (a mentoring guide, a mentoring needs summary, a pilot activities agenda, and an overview of mentor/mentee responsibilities)
Jan 27, 2012	**Mentors Workshop & Luncheon** Mentors met to discuss best practices and to share personal experiences as both mentors and mentees. Training materials and a summary of needs were distributed, including a Mentoring Worksheet of goals to track during the pilot. MODERATOR: *Susan Staffin Metz, Principal Investigator, ENGAGE* *smetz@stevens.edu*
Feb 3, 2012	**Mentees' Event -- Your Research Pitch** Mentees were trained to present their research effectively in posters and "elevator speeches." MODERATOR: *Steve Bowman ("The Pitch Doctor"), President of BizClarity*
March 7, 2012	**Research Showcase** Mentees presented posters describing their current research to a cross-sector audience of colleagues from various disciplines and representatives from business and industry.
March 27, 2012	**Brownbag 1** (GRANT WRITING/ FUNDING) – Mentees discussed strategies to identify research funding sources. MODERATOR: *Donald H. Sebastian, Senior Vice President for Research and Development*, NJIT
April 11, 2012	**Brownbag 2** (PROMOTION & TENURE PROCESS) –Mentees met with three members of the current P&T committee for a thorough Q&A about the promotion and tenure review process. MODERATORS: *Drs. Mili, Schachter, and Siegel.*
April 23, 2012	**Brownbag 3** (PUBLISHING/ TEACHING) –Mentees met with two members of the current and prior Institute P&T Committee to discuss teaching and publication requirements for P&T. MODERATORS: *Drs. Das and Somers.*

Table 1 (Faculty CAN Pilot Overview)

A5.2 Additional Discussion of Faculty CAN Pilot: Early in the fall, Passerini created a Faculty CAN website on Moodle and sent invitations to all 33 of NJIT's untenured assistant professors to attend a September 16 information session. Twenty-three (70%) of the eligible faculty attended the meeting, which was hosted by Gatley and Steffen-Fluhr, taking over for Passerini who had a serious family emergency. (See section A6.0 below.) Sixteen of the attendees (70%) eventually applied to be mentored, plus one additional woman faculty member who had been unable to attend the information session. In all, 52% of the untenured faculty cohort participated in the Spring 2012 Faculty CAN pilot. (Mentee participation was incentivized by the promise of a $500 travel grant to each junior faculty member who completed the program and the assessment interview/survey.)

At the September 16 event, Steffen-Fluhr presented an overview of the NJIT ADVANCE Program, outlined the Faculty CAN pilot, and distributed a survey designed to collect data about each participant, including research interests, existing or desired mentoring relationships, pressing career issues, and key mentoring needs. Aggregate survey results were posted on the

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Moodle website, and individual survey data was later used, in combination with the RIMap tool, to identify potential mentors for the seventeen assistant professors. (See Appendix 5 for Application Form and Appendix 6 for the aggregate survey results).

In the weeks following the workshop, the data collected was reviewed to inform planning and finalize mentor-mentee pairing. Potential mentors (tenured full and associate professors) were invited to participate. The response was strong, despite the fact that we had offered no special incentives. Indeed, so many faculty volunteered that many of the mentees were able to be assigned two mentors, one senior and one junior. For the spring pilot, 26 of the volunteers were selected to be mentors and (with their consent) were matched with specific mentees. Each mentee was asked to consent to the pairing(s). All agreed. Thus, in the spring pilot, every mentee had at least one mentor, and some had two mentors, often from different departments.

The ADVANCE Team hosted a kick-off event on December 5 to introduce mentors to their mentees and to establish ground rules for the spring pilot. Steffen-Fluhr, Passerini, and ADVANCE consultant Starr Roxanne Hiltz met briefly with the mentees before the event to tell them a little about the matches and to give them tips about how to get the most out of the program. The mentors and the provost subsequently joined the event, which combined a brief information session with an extended opportunity for peer networking as well as interaction between mentor(s) and mentee. The information packet given to each participant included a schedule of Spring 2012 Faculty CAN events (a January mentor training session, brownbag lunch Q&A sessions, and a research Showcase) and a detailed Mentoring Guide. (See Appendix 7 for the Mentoring Guide.)

The Mentoring Guide was prepared by consultant Roxanne Hiltz, a Distinguished Professor Emerita in Information Systems, who reviewed materials from ADVANCE mentoring programs at universities across the country and wove best practices into a document appropriate for the NJIT pilot. Other members of the ADVANCE Mentoring Team (Steffen-Fluhr, Passerini, and Wu) contributed language to the document as well. Hiltz introduced the Guide at the December 5 kick-off event and is helping Passerini design the evaluation feedback procedures and survey to be fielded during the summer of 2012 to assess the initial Faculty CAN pilot. Based on participant feedback, the ADVANCE team will provide suggested changes in the university's approach to mentoring to the Provost's Office, which will be responsible for sustaining the mentoring program in the future.

On 27 January, ADVANCE ran a Best Practices for Mentors Workshop designed to help the mentors develop specific strategies for interacting with their mentees that allow both partners to use their time together efficiently and effectively. The workshop was facilitated by WEPAN co-founder Susan Metz, who led the participants in identifying best practices by recalling their own experiences as young faculty. Steffen-Fluhr asked the mentors (and, later, the mentees as well) to document in real time each of their interactions by texting a brief message to her. Initially, this seemed to be an effective way of collecting contact data, but compliance tailed off later in the spring, perhaps because there was no immediate "reward" for contributing data. (A large body of literature suggests that, in online communication, lack of immediate feedback prompts disengagement.) The summer 2012 pilot assessment effort will attempt to collect contact data retroactively and to develop suggestions for more effective real-time tracking methods in the future.

On 3 February, ADVANCE ran the first of its spring workshops for the Faculty CAN mentees, co-sponsored by the Office of Technology development. The workshop, built around a famous quip attributed to Albert Einstein--" If you can't explain it simply, you don't understand it well enough"--was designed to help the young faculty members learn how to maximize clarity and impact when presenting their research to colleagues, industry, and funding agencies. Workshop presenter Steve Bowman (a Harvard-educated professional "pitch doctor") worked with the Faculty CAN participants, both as a group and individually, to help them refine their

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research posters and "elevator speeches." As an immediate incentive, ADVANCE promised to feature the mentees' new posters at the March 7 Research Showcase.

In addition to encouraging ongoing interaction between the mentors and mentees, ADVANCE ran three more events exclusively for the mentees during the remainder of the spring semester (March 27, April 11, April 23). These informal "brownbag" Q&A sessions with senior faculty leaders were designed to help the mentees better understand and more successfully navigate the NJIT promotion and tenure process. The topics for the brownbags were drawn from the mentoring priorities data collected from the mentees in September (e.g. acquiring research funds, maximizing the P&T impact of research publications, etc.) The faculty informants included senior administrators and faculty who had served on the institute P&T committee.

A5.3 Faculty Leadership Advancement Group: The original 2009 NJIT ADVANCE ABR proposal and subsequent management plans included a component in addition to Faculty CAN: the Faculty Leadership Advancement Group (FLAG) workshop initiative. FLAG was designed "to assist faculty and academic administrators in achieving greater excellence/diversity in their units by familiarizing them with best practices in faculty recruitment and retention, including strategies for recognizing and combating unconscious bias in evaluative processes." Unfortunately, unanticipated personnel issues, described in Section A6.0 below, forced a delay in the FLAG launch, as did events in the university at large--especially the sudden resignation of NJIT President Altenkirch in September 2011 and its aftermath. Because it explicitly involves buy-in from the senior administration, FLAG had to be postponed until the new NJIT senior administrative leadership team, under President Joel Bloom, was firmly in place. The need for FLAG is greater than ever, however. After years of drought, the NJIT Board of Trustees is poised to approve 18 new faculty hires, with many more hires to come in the near future as senior faculty accept the university's new buy-out offer and retire. In response, NJIT ADVANCE will focus its efforts during the AY 2012-2013 no-cost extension on designing, planning, and co-hosting a FLAG pilot workshop, laying the groundwork for ongoing best practices training for administrators, search committees, and P&T committees.

A6.0 NOTE ON PERSONNEL ISSUES AND MANAGEMENT CHALLENGES:
Although the ADVANCE team has achieved most of the central objectives described in our official two-year work plan, a number of factors beyond our control have slowed our progress in several important areas critical to the long-term sustainability of the ADVANCE initiatives at NJIT and their dissemination to other campuses. Those factors include, first and foremost, the traumatic brain injury sustained by co-PI Katia Passerini's mother in September 2011, requiring Katia, who gave birth to her third child last year, to assume additional care-giving functions, including serving as a translator during rehabilitation. (Her mother speaks only Italian.) ADVANCE Co-PI Rob Friedman left the university in September, as did ADVANCE Coordinating Committee member Jim Robertson. In addition, during the winter, both of the project's consultants, Roxanne Hiltz and Anatoliy Gruzd, were sidelined by surgery for a time. Work on the database was slowed by the sudden departure, one after the other, of two graduate students we had hired to help with the text mining recall rate check and the DB interface design. Events in the university at large also had an effect on our work, especially the unanticipated resignation of NJIT President Altenkirch and an intensified period of preparation for the Middle States accreditation visit, in which both Katia Passerini and Nancy Steffen-Fluhr were involved. In addition, the Board of Trustees' surprise decision to authorize 26 faculty searches, while most welcome, involved both Passerini and co-PI Brook Wu in additional departmental work, complicating our project schedule further. For these reasons, NJIT ADVANCE has applied for a one year no-cost extension until 30 September 2013 in order to complete several important components of the project.

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On the Bright Side: Both Anatoliy Gruzd and Roxanne Hiltz have now recovered from their surgeries and are actively participating in the work of the ADVANCE project. Katia Passerini's mother, though not fully recovered from her injuries, is making progress and has returned to Italy. Although 2011-12 was an *Annus Horribilis* for Katia, it also brought a renewed sense of accomplishment. She was honored with both the NJIT Master teacher designation and the prestigious Van Houten Teaching Excellence Award (only the second NJIT woman faculty member to receive this award)--and in the spring she saw the long-awaited publication of her new book, *Information Technology for Small Business: Managing the Digital Enterprise*.

See the following websites for more information:
http://www.njit.edu/news/2011/2011-308.php
http://www.njit.edu/alumni/awards/vanhouten/index.php
http://www.amazon.com/Information-Technology-Small-Business-Enterprise/dp/1461430399

II.B.   Major Findings

B. SOCIAL NETWORK ANALYSIS OF THE UPDATED NJIT CO-AUTHORSHIP NETWORK:

B1.1. Data Collection Overview: An initial test comparison of six faculty member's publications indicated that the NJIT Advance faculty database was very accurate--i.e., purged of duplications and false attributions. However, because publication counts are a critical variable in many of the hypotheses being tested, in early 2012, we began a laborious but important coverage check to ensure that our data is as complete as possible, especially for STEM faculty. (See discussion in Activities Section A3.3 above.) Thus far, our search algorithm seems to have worked well. Most of the issues we have uncovered are the result of 1) the "common name problem"; 2) incorrect affiliation tags in Scopus; and 3) gaps in Scopus' coverage. Despite various issues with the number of publications captured through our data mining, we are confident that most of the connections between faculty members are represented. Because social network analysis can be performed on binarized networks (where a connection either exists or does not exist and the number of publications is not factored into the results), social network analysis metrics may prove to be more meaningful in our subsequent hypothesis testing.

Our coverage/recall rate check demonstrates that neither the Google Scholar nor the Scopus database--or any other single online source, for that matter--is 100% correct in its search results, and we have no ability to improve source accuracy. These findings support our previous decision to make a transition in our data collection approach in year 2 of our project. To augment our faculty publication database in the future, we will draw directly from Digital Measures, a faculty annual report system implemented in 2010. (See Year One annual report.)

B1.2 Preparation for Hypothesis Testing: In the early spring of 2012, while our co-authorship data was being validated, Collins, with assistance from Zhu and Steffen-Fluhr, generated attribute data for each tenure-track faculty member from the project's NJIT publication database. Based on personnel data obtained from HR, our attribute spreadsheet now contains the names of the 514 faculty members who worked at NJIT from 2000-2010, their department, gender, rank progression, tenure status, hire date, separation date (if any), retention status (left/stayed), years at NJIT, and years in the study. The spreadsheet includes four additional attributes as well, based on 2000-2010 data extracted from our publications db: 1) total number of publications; 2) number of publications co-authored with one or more NJIT faculty colleagues; 3) number of publications in which one of the collaborators was a faculty member from another university; and 4) number of publications in which NJIT graduate students were one or more of the co-authors. To adjust publication counts for each faculty member to reflect their number of years included in the study, we also calculated publication *rates*, dividing each of the publication counts by the number of years in the study.

B1.3 Grant Proposals DB: In addition to the co-authorship data discussed above, the project recently acquired a database containing all research proposals submitted by NJIT faculty to external funding agencies from 2000-2010, over 3700 proposals in total. **(**See Activities section A3.4 for more detail.) This network was imported into the ORA dynamic meta-network assessment and analysis tool (developed by Carnegie Mellon); the correlation procedure was used to compare the CO-PI network to the faculty co-authorship network. The results of this analysis returned a moderate correlation ($r = 0.315$, $p = 0.000$), suggesting that collaborating on grant proposals is important in increasing faculty co-authorship.

Degree centrality is a social network measure indicating the number of ties that a node has. When we compared the degree centrality of faculty in the co-authorship network and in the grant CO-PI network, five of the top ten faculty members appeared in both lists, again indicating that collaboration on grant proposals has a positive impact on publication co-authorship. The

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following table lists the faculty who consistently rank in the top 10 for degree centrality in both co-authorship and grant collaboration.

Faculty member	Degree Centrality Rank (Co-authorship)	Degree Centrality Rank (Grant Collaboration)
Faculty member A	1	1
Faculty member B	2	7
Faculty member C	3	6
Faculty member D	4	2
Faculty member E	6	8

Table 2 (Comparison of Co-Authorship and Co-PI Networks)

B1.4 Overview of 2011 Network Analysis: In addition to our core list of 514 tenured/tenure track faculty from 2000-2010, we created various subsets of faculty for the purposes of hypothesis testing. There are several reasons for subdividing the data into cohorts. For example, although we collected data for faculty in the department of Humanities, we excluded them from much of our hypothesis testing because: 1) Scopus does not index publications in this discipline; 2) many of the publications in the Humanities are single-authored books (reducing the opportunities for collaboration); and 3) our ADVANCE grant focuses on faculty in STEM disciplines in which women are traditionally less well represented. Another consideration was varying opportunity for advancement: full professors maintain their rank for longer periods of time than Assistant Professors, who must achieve tenure and promotion within their first seven years at the university; therefore, comparing rank changes for these two groups does not provide meaningful information.

Analysis of our co-authorship data involved two distinct methodologies. Attribute values collected from HR (gender, department, tenure status, rank, hire and separation dates), along with publication counts and rates (calculated from our co-authorship database), were analyzed using standard statistical procedures including correlations, t-tests, ANOVA, and regression analysis. Social network analysis methods were used to calculate SNA measures based upon our co-authorship network data. The variables identified as success indicators included retention, publication rates, and increase in rank during the study period. The results of our hypothesis testing are described below. In all cases, the particular cohort upon which the hypothesis was tested is clearly indicated, along with gender breakdowns.

H1. *STEM Faculty members who publish more are more successful in terms of rank increase.* [SUPPORTED]

This hypothesis was tested on two data sets by comparing total publication counts and number of rank increases over our 10 year study period. Results are shown in the table below.

Table 2.1

Data Set	N / Gender	Correlation	ANOVA
H1: STEM faculty members who publish more are more successful in terms of rank increase (using total publication *count* for each faculty member).			
All tenured/tenure track STEM faculty 2000-2010	N = 327 F = 38, M = 289	r = 0.38988, p < .0001	F = 31.92, p < .0001 (df = 2)
STEM tenure track Assistant Professors hired between 2000 and 2003	N = 40 F = 6, M = 34	r = 0.64695, p < .0001	F = 27.35, p < .0001 (df = 1)

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We first tested H1 on the full set of tenured/tenure track STEM faculty at NJIT between 2000 and 2010. Results (shown in Table 2.1) indicate that higher publication counts are associated with increase in rank. However, because full Professors, and to a lesser extent Associate Professors, tend to remain at a single rank for longer periods of time, we also tested H1 on a data set that included only STEM tenure track Assistant Professors hired between 2000 and 2003. We selected this cohort because they would all have been at the university long enough to have the opportunity to attain promotion and tenure. For this cohort, the number of publications was even more strongly associated with rank increases.

Although these results were not surprising, we were nevertheless concerned that our analysis might be skewed because our dataset does not count publications of people who left NJIT during the study period, and it is to be expected that somebody with rank change of 0 who left NJIT will have fewer publications. To correct for this problem, we redid the assistant professor cohort study a slightly different way: dividing the total number of publications by the number of years in our study. Once again, *H1 was strongly supported,* as shown in Table 2.2*.*

Table 2.2

Data Set	N / Gender	Means	t-test	Corr.
H1: STEM faculty members who publish more are more successful in terms of rank increase (using total publication *rate* for each faculty member).				
STEM tenure track Assistant Professors hired between 2000 and 2003	N = 40 F = 6, M = 34	μ1 = 5.73, SD = 3.36 μ2 = 8.67, SD = 0.91	t = 3.60, p = 0.0009	r = 0.505, p = .0009

In Table 2.2, μ1 represents the average (mean) total publication rate of Assistant Professors hired between 2000 and 2003 who did not move up in rank, while μ2 reflects the mean total publication rate of Assistant Professors hired during that same period who were promoted to Associate Professor. A t-test indicates that the difference in mean publication rates between these two groups is statistically significant, and a correlation suggests a relationship between publication rate and rank increase. There was a weaker but nevertheless positive correlation (0.220, p=0.0122) between publication rate and rank change for all STEM faculty who had an initial rank of Assistant Professor at any point during our study period (2000 – 2010).

H2. *STEM Faculty who left the university during the study period had fewer total publications than faculty who were retained.* [SUPPORTED]

Table 2.3

Data Set	N / Gender	Means	t-test	Correlation	ANOVA
H2: STEM faculty members who left the university during the study period had a lower total publication rate than faculty who were retained.					
STEM tenure track Assistant Professors hired between 2000 and 2003	N = 40 F = 6, M = 34	μ1 = 8.78, SD = 0.94 μ2 = 3.46, SD = 2.33	t = 10.35, p < .0001	r = -0.859, p < .0001	F =107.22 p < .0001 (df = 1)

In Table 2.3, μ1 represents the average (mean) total publication rate of Assistant Professors hired between 2000 and 2003 who stayed at the university during our study period, while μ2 reflects the mean total publication rate of Assistant Professors hired between 2000 and 2003 who left the university. Results (shown in Table 2.3) suggest a strong (negative) correlation

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between publication rate and leaving the university, so that faculty with higher publication rates were significantly less likely to leave.

H3. *Female STEM Faculty publish less than their male counterparts.* [SUPPORTED]

Table 2.4

Data Set	N / Gender	Means	t-test	Correlation	ANOVA
H3 Female STEM faculty publish less than their male counterparts.					
All tenured/tenure track STEM faculty 2000-2010	N = 327 F = 38, M = 289	μF = 12.08, SD = 8.83 μM = 19.19, SD = 13.34	t = 3.28, p = .0011	r = -0.174, p = .0011	F =10.75 p = .0011 (df = 1)

Even though our other hypothesis tests suggest that gender is no longer an overt factor in career advancement at NJIT, the results of H3 (shown in Table 2.4) indicate that women in the STEM fields (μF) publish less than their male counterparts (μM). These results raise a red flag, spurring us to re-examine our earlier studies and obtain additional quantitative and qualitative data.

B1.5 The Impact of Co-authorship on Productivity & Advancement--NJIT Advance Data: We began by trying to establish that our assumptions were true and that collaboration (specifically, co-authoring) was in fact positively correlated with productivity (measured as publication count) and a predictor of faculty career advancement. This hypothesis is tested in H4 below.

H4. *STEM Faculty who coauthor more will publish more than faculty who coauthor less.* [SUPPORTED]

Table 2.5

Data Set	N / Gender	Correlation	ANOVA
H4: STEM faculty who coauthor more will publish more than faculty who coauthor less.			
All tenured/tenure track STEM faculty 2000-2010	N = 327 F = 38, M = 289	r = 0.79180, p < .0001	F = 611.18, p < .0001 (df = 1)
STEM tenure track Assistant Professors hired between 2000 and 2003	N = 40 F = 6, M = 34	r = 0.74069, p < .0001	F = 46.19, p < .0001 (df = 1)

The results shown in Table 2.5 support H4, suggesting that co-authorship does indeed positively affect productivity as measured by total publication rate. This was supported for both cohorts: all tenured/tenure track STEM faculty (2000 to 2010) and STEM Assistant Professors hired between 2000 and 2003.

H5. *STEM Faculty members who co-author more are more successful in terms of rank increase.* **[**MODERATELY SUPPORTED]

We tested the relationship between co-authorship and rank change (retention/advancement) directly as well. The correlations (Table 5 below) were less strong but still statistically significant. In short, co-authorship does seem to be a behavior positively correlated with productivity and advancement. Although this is a work in progress and we are continuing to expand and refine our dataset, these initial results encourage us in the NJIT ADVANCE Project to continue our

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efforts to diminish the isolation of female faculty by stimulating and supporting interdisciplinary research collaboration.

Table 3. (Co-Authorship & Rank Change)

Measure	STEM TT faculty who had an initial rank of Assistant or Associate Professor during our study N=230 F=29 M=201	STEM TT faculty who had an initial rank of Assistant Professor during our study N=129 F=21 M=108	STEM TT faculty hired between 2000-2003 as Assistant Professors: N = 40 F = 6 M = 34	All STEM TT faculty, excluding Dist. Professors N=310 F=35 M=275	All STEM T/TT faculty 2000-2010 N = 327 F = 38 M = 289
Co-authorship Publication Rate					
Rank Changes (corr.)	0.429, p<.0001	0.288, p=0.0013		0.387, p<.0001	
Rank Changes (ANOVA)	25.01, p<.0001	5.53, p=0.0050		27.33, p<.0001	
Rank changes					
Correlation with Total Co-authored publications	0.462, p<.0001	0.368, p<.0001	0.34195, p = 0.0308	0.424, p<.0001	0.35927, p < .0001
ANOVA: Rank Change & Total Co-authored publications			F=5.03, p=0.0308 (df = 1)		F=36.72, p < .0001 (df = 2)

We used SSPS to re-run our co-authorship and productivity tests on all 371 NJIT faculty members, STEM and non-STEM, who published at least one co-authored article from 2000-2010 (i.e., the faculty population in our network). This time we looked at another variable as well: the number of graduate students with whom each faculty member had collaborated on a paper. Our results confirmed that the number of co-authored publications positively influences the total number of publications (and hence, indirectly, career advancement); however, the number of publications co-authored with *students* is actually twice as influential as the number of publication co-authored with other NJIT faculty. (See the Standardized Coefficients Beta in the "Coefficients" table below.) Both of these factors together (the number of co-authored publications + the number of student co-authored publications) explained 84% of the variance in the total number of publications. (See Adjusted R Square in the "Model Summary" table below).

Table. 4a Co-Authorship & Productivity

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.919a	.844	.843	12.642

a. Predictors: (Constant), totstudnt, totalcopubs

Table. 4b Co-Authorship & Productivity

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	317866.396	2	158933.198	994.483	.000a
	Residual	58652.080	367	159.815		
	Total	376518.476	369			

a. Predictors: (Constant), totstudnt, totalcopubs

b. Dependent Variable: totalpubs

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Table. 4c Co-Authorship & Productivity

Coefficientsª

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5.443	.766		7.105	.000
	totalcopubs	.592	.054	.314	11.064	.000
	totstudnt	1.158	.049	.674	23.744	.000

a. Dependent Variable: totalpubs

This analysis, in turn, lends support to what we have learned informally from focus groups with younger faculty: that in starting up their labs, the resource they most desire, and have the greatest difficulty acquiring, is graduate students whom they can train to help them.

This kind of mentoring collaboration has long been the fundamental building block of the Old Boy's Club, and it is still very much in place, at NJIT and elsewhere. One piece of data in our set illustrates the extraordinary competitive advantage that a senior researcher with many doctoral students can confer on a junior colleague. In our study of the faculty cohort hired as assistant professors from 2000-2003, we noted that those who did not move up in rank from assistant to associate had an average (mean) publication rate of 5.73 publications per year, while those who were promoted from assistant to associate had an average (mean) publication rate of 8.67 publications per year. Compare these norms to the publication record for one assistant professor ("Professor Y") in STEM Department Q. In the first three years of his career, he produced a total of 117 publications--a rate of 39 papers a year! Eighty-eight of those publications had at least one non-NJIT faculty co-author, in many cases his thesis advisor at another university. However, 54 of his papers had NJIT faculty co-authors, and he co-authored 43 times with NJIT graduate students. What is his secret? Aside from talent, drive, and expertise in an extremely hot research area, Professor Y has a crucial network edge. He began his career at NJIT as a post-doc to one of the university's most prolific and well-funded researchers, Professor Z, a man who from 2000-2010 produced over 150 publications, including more than 100 co-authored with one or more of his large stable of graduate students. Professor Y now works as a junior colleague to Professor Z, part of a successful research team.

B1.6 The Impact of Network Centrality on Productivity & Advancement: In addition to these fairly straightforward modes of analysis, we wanted to use the more subtle tools available in SNA to explore the core concepts that shape our project: that network *structure* is positively correlated with faculty career success and that we can leverage SNA data to give women faculty a network edge. We had a special interest in *Betweenness centrality, which indicates how likely a node is to occur on the shortest path between two other nodes.* Our original NSF proposal was designed to exploit what sociologist Mark Granovetter (1973, 1982) has called "the strength of weak ties"--that is, the advantages of being a bridge between people otherwise disconnected in the social structure (Burt, 1998). As it turns out, at NJIT *Betweenness Centrality* does indeed give faculty a small but crucial network edge. We established this by testing another hypothesis, first against the attribute data for all NJIT STEM faculty in our study (2000-2010)

H6. *In the NJIT STEM faculty co-authorship network, faculty with higher Betweenness Centrality will publish more than faculty with lower Betweenness Centrality.*
[SUPPORTED]

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Our initial results using SAS confirmed that *Betweenness Centrality,* calculated as an attribute for each individual faculty member using ORA, was strongly correlated with productivity in publishing, across all four modes of co-authorship that we studied.

Table 5.
[Correlation Between *Betweenness Centrality* and Publication (Productivity)]

Betweenness and external publications	0.49192	p < .0001
Betweenness and coauthored publications	0.65450	p < .0001
Betweenness and total publications	0.63380	p < .0001
Betweenness and student co-authored publications	0.54355	p < .0001

A regression analysis with Betweenness as the independent variable and total publications as the dependent variable indicated that Betweenness is a strong predictor of publication productivity (F=233.65, p < .0001). This result was confirmed, albeit less strongly, when we ran a similar test on the dataset of 371 faculty members (Non-STEM and STEM combined) who had co-authored at least one article with another NJIT faculty member from 2000-2010. (See SPSS tables below.)

Table 6a. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.951[a]	.904	.903	9.940

a. Predictors: (Constant), Between, extpubs, totalcopubs, totstudnt

Table 6b. Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	3.652	.614		5.944	.000
	totalcopubs	.382	.047	.203	8.082	.000
	totstudnt	.712	.049	.414	14.610	.000
	extpubs	.770	.055	.365	13.958	.000
	Between	627.040	128.607	.103	4.876	.000

a. Dependent Variable: totalpubs

In studies we conducted some years ago, at the beginning of our Advance project, the mean difference in Eigenvector values for female and male faculty was statistically significant (3.249, p = 0.05). This seemed to confirm that, before our project, female faculty members were less likely than their male peers to be connected to well-connected individuals and that having such connections gave women a crucial edge. In recent years, however—i.e. after the inception of the ADVANCE project—the Eigenvector centrality of women faculty has increased relative to their male peers, an indicator that women are becoming more important players at NJIT. In our

most recent tests, there is no statistically significant gender difference in Eigenvector values, and Eigenvector Centrality is no longer correlated with productivity or retention. At NJIT today, the most important predictors of productivity are, in rank order: co-authoring with non-NJIT researchers ("cosmopolitan collaboration"); co-authoring with NJIT graduate students (the "worker bee connection"); co-authoring with NJIT colleagues; and last, but not least, Betweenness Centrality. For STEM faculty who had an initial rank of Assistant or Associate Professor during our study (n=230—f29, m201), both Betweenness (0.323, p<.0001) and cosmopolitan collaboration (0.400, p<.0001) were positively correlated with rank change (career advancement).

B2. COLLECTING AND ANALYZING SELF-REPORTED NETWORK DATA:
In the spring of 2011, PI Steffen-Fluhr and research assistant Yiran Wang conducted a multi-modal network study of tenure track faculty in one NJIT STEM department ("Department X"). The aim of the study was not merely to supplement our co-authorship data but to validate our primary methodology, demonstrating that mining bibliometric data, a sustainable and scalable process, produces salient network maps.

　　　The study utilized semi-structured interviews to solicit self-reported data about many forms of collegial interaction, including collaboration and advice networks. It also employed a network visualization tool called Vennmaker, developed and marketed by Michael Kronenwett and his partners in Germany (http://www.vennmaker.com/en/). After first pre-populating the tool with nodes representing each faculty member in Department X, Steffen-Fluhr and Wang asked the study subjects to draw connections between nodes based on their perception of which Department X faculty were engaged in intra-departmental research collaborations.

　　　One of the key purposes in performing the Department X study was to compare the effort required to collect self-reported data and the accuracy of the data obtained to the effort and accuracy of collecting objective, bibliometric data using automated tools. To assess the accuracy of the Department X data, we first calculated reciprocity measures, indicating how many of the ties provided by the reporting faculty member were reciprocated by the reported faculty member. The results are shown in Table 7 below. In general, we observed that the more verifiable the connection (i.e. co-authorship and committee membership as opposed to socializing), the higher the reciprocity.

Connection Type	Reciprocity
Co-authorship	0.667
Collaboration	0.115
Committee membership	0.311
Discuss research	0.217
Socialize	0.222

Table 7 (Department X Reciprocity Values)

The results of the Vennmaker perception data study are similar, indicating that the faculty members of Department X did not have consistent views of the connections within their department. Correlations between each faculty member's perceived network and the bibliometric co-authorship network revealed that only three (out of 12) faculty members'

perceptions of their departmental connections were strongly correlated with the objective bibliometric data ($r > 0.600$, $p = 0.000$).

Conclusion: The low reciprocities in the self-reported data, along with the overall low correlations between faculty perceptions and objective realities, confirmed that the effort to collect self-reported data (where each faculty member interview took between 45 and 90 minutes) results in high effort for low accuracy, making the collection of bibliometric data more reliable, sustainable and scalable.

B. 3. NJIT ADVANCE Products and Dissemination:

The most writing-intensive phase of our grant will not begin until July 2012, after the final data validation is complete, and will continue into the next academic year (assuming a no-cost extension) during which we will complete and submit three related journal articles (one each on network data collection methods, network perception, and network data analysis and mapping as a tool in mentoring). Even before this work is complete, however, we have already succeeded in creating a number of products and resources that allow us to disseminate our activities and findings. The bulleted list below briefly describes these products, many of which are collected in the appendices to this report and/or are available on our updated website: **http://advance.njit.edu/**--designed and maintained by our new NJIT ADVANCE webmaster, Pawna Avalani.

- A research poster describing how ADVANCE uses social network analysis to drive institutional transformation was presented by PI Steffen-Fluhr at the November 2011 ADVANCE NSF PIs meeting in Alexandria, VA. (Appendix 8.)
- RA Regina Collins presented an overview of the NJIT ADVANCE "Department X" study at the March 2012 INSNA "Sunbelt XXXII" conference in Redondo Beach, California. ("Talking Through the Noise: Methodological Issues in Collecting Faculty Network Data") (Appendix 3)
- Regina Collins and Mingzhu Zhu each presented a poster describing NJIT ADVANCE data collection and data analyses at the March 7 Research and Collaboration Showcase and again at the April 4 Dana Knox Student Research Showcase. (Appendices 9 and 10.)
- In March 2012, Steffen-Fluhr created a "podcast" describing the NJIT ADVANCE project for a general audience which was subsequently posted on the NJIT website. [http://www.youtube.com/watch?v=DIYNScMskEE]
- In June 2012, Steffen-Fluhr will present results from the NJIT ADVANCE project at the annual WEPAN conference in Columbus, Ohio. The paper ("Leveraging Social Network Data to Support Faculty Mentoring: Best Practices from NJIT Advance") will subsequently be published in conference proceedings. (Appendix 11)

NSF Data Indicators for 2011

New Jersey Institute of Technology
ADVANCE Institutional Transformation Project

NSF ADVANCE
Indicators of Institutional Progress

Basic Questions:
(1) What is the distribution of faculty by gender, ethnicity, rank and department?
(2a) What are the outcomes of institutional processes of recruitment and advancement for men and women?
(3a) What is the gender distribution of faculty in leadership positions at NJIT?
(4a) What is the allocation of resources for faculty by gender at NJIT?

NSF 12 Indicators
1. Number of men and women tenured and tenure-track faculty by department, rank and gender

2. Number of non-tenured men and women faculty (e.g., Instructional, Research, Clinical, Postdoctoral)

3. Number of faculty who submit tenure packets, and number awarded tenure, by gender and department

4. Number of faculty who apply for promotion, and number promoted, by gender, department, and promotion transition (assistant to associate; associate to full)

5. Number of tenured associate professors by department and gender with years-in-rank (in 6, 3-year categories)

6. Number of faculty who leave their departments, excluding those who died or retired, by rank, gender, and department

7. Number of faculty hired by rank, gender, and department

8. Cohort analyses of tenure and promotion, including to full professor

9. Number of men and women scientists and engineers in leadership positions

10. Study of salaries of men and women faculty (with additional controls such as department, rank, years in rank)

11. Study of space allocation of STEM faculty by gender (with additional controls such as department, etc.)

12. Study of start-up packages of newly hired faculty by gender (with additional controls such as field/department, rank, etc.)

INDICATOR #1

Fall 2011 Data

Number of men and women tenured and tenure-track faculty by department, rank and gender

Table 1a

2011 Tenured/Tenure-Track Faculty by Division, Department, Rank, and Gender						
Division	**Department**	**Rank**	**F**	**M**	**Total**	**% F**
College of Computing Sciences	Computer Science	Assoc Prof	1	11	12	8
		Asst Prof		2	2	0.00
		Dist Prof		1	1	0
		Prof		9	9	0
	Computer Science Total		1	23	24	4
	Information Systems	Assoc Prof	1	4	5	20
		Asst Prof				0
		Prof		1	1	0
	Information Systems Total		1	5	6	17
College of Computing Sciences Total			2	28	30	7
	Δ 2010 to 2011		same	-4	-4	+1

INDICATOR #1
Fall 2011 Data
Number of men and women tenured and tenure-track faculty by department, rank and gender
Table 1b

Division	Department	Rank	F	M	Total	% F
College of Science and Liberal Arts (CSLA)	Biological Sciences	Assoc Prof		2	2	0
		Asst Prof		2	2	0
		Dist Prof	1		1	100
	Biological Sciences Total		**1**	**4**	**5**	**20**
	Chemistry & Environmental Science	Assoc Prof		4	4	0
		Asst Prof	1	1	2	50
		Dist Prof	1	2	3	33
		Prof	2	1	3	67
	Chemistry & Environmental Science Total		**4**	**8**	**12**	**33**
	Mathematical Sciences	Assoc Prof	2	19	21	10.00
		Asst Prof		4	4	0
		Dist Prof		1	1	0
		Prof	1	14	15	7.00
	Mathematical Sciences Total		**3**	**38**	**41**	**7**
	Physics	Assoc Prof	1	4	5	20.00
		Asst Prof		2	2	0
		Dist Prof		6	6	0
		Prof		5	5	0
	Physics Total		**1**	**17**	**18**	**6**
CSLA Total (STEM ONLY)			**9**	**67**	**76**	**12**
	Δ 2010 to 2011		**-6**	**-16**	**-22**	**-3**

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INDICATOR #1
Fall 2011 Data
Number of men and women tenured and tenure-track faculty by department, rank and gender
Table 1c

Division	Department	Rank	F	M	Total	% F
Newark College of Engineering (NCE)	Bio Medical Engineering	Assoc Prof	1	4	5	20
		Asst Prof	2	1	3	67
		Dist Prof		1	1	0
		Prof	1	1	2	50
	Bio Medical Engineering Total		**4**	**7**	**11**	**36**
	Chemical, Biological and Pharmaceutical Engineering	Assoc Prof		1	1	0
		Asst Prof	1	1	2	50
		Dist Prof		3	3	0
		Prof		9	9	0
	Chemical, Biological and Pharmaceutical Engineering Total		**1**	**14**	**15**	**7**
	Civil & Environmental Engineering	Assoc Prof	3	2	5	60
		Dist Prof				
		Prof	3	15	18	17.00
	Civil & Environmental Engineering Total		**6**	**17**	**23**	**26**
	Electrical & Computer Engineering	Assoc Prof	1	4	5	20.00
		Asst Prof		1	1	0.00
		Dist Prof		3	3	0
		Prof		15	15	9
	Electrical & Computer Engineering Total		**1**	**23**	**24**	**4**
	Engineering Technology	Assoc Prof		6	6	0
		Asst Prof		2	2	0
		Prof		2	2	0
	Engineering Technology Total			**10**	**10**	**0**
	Mechanical & Industrial Engineering	Assoc Prof	1	7	8	13.00
		Dist Prof				
		Prof		15	15	0
	Mechanical & Industrial Engineering Total		**1**	**22**	**23**	**4**
NCE Total			**9**	**93**	**106**	**8.50**
	Δ 2010 to 2011		**-3**	**-11**	**-10**	**-1.5**

<mark>Comparative Data (Fall 2010)</mark>
Number of men and women tenured and tenure-track faculty by department, rank and gender

Table 1d

2010 Tenured/Tenure-Track Faculty by Division, Department, Rank, and Gender						
Division	**Department**	**Rank**	**F**	**M**	**Total**	**F**
College of Architecture and Design	NJ School Of Architecture	Assoc Prof	2	5	7	
		Asst Prof	1	5	6	
		Dist Prof	1	1	2	
		Prof	1	4	5	
	NJ School Of Architecture Total		5	15	20	
	School of Art and Design	Asst Prof		1	1	
	School of Art and Design Total			1	1	
College of Architecture and Design Total			5	16	21	
College of Computing Sciences	Computer Science	Assoc Prof		11	11	0
		Asst Prof	1	2	3	33.
		Dist Prof		1	1	0
		Prof		11	11	0
	Computer Science Total		1	25	26	4
	Information Systems	Assoc Prof	1	4	5	20
		Asst Prof		1	1	0
		Prof		2	2	0
	Information Systems Total		1	7	8	13
College of Computing Sciences Total			2	32	34	**6**

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INDICATOR #1

Number of men and women tenured and tenure-track faculty by department, rank and gender

Table 1e

College of Science and Liberal Arts	Biological Sciences	Assoc Prof		2	2	0
		Asst Prof		2	2	0
		Dist Prof	1		1	100
	Biological Sciences Total		**1**	**4**	**5**	**20**
	Chemistry & Environmental Science	Assoc Prof		5	5	0
		Asst Prof	1	1	2	50
		Dist Prof	1	1	2	50
		Prof	2	2	4	50
	Chemistry & Environmental Science Total		**4**	**9**	**13**	**31**
	Federated History	Assoc Prof		3	3	
		Asst Prof	1	1	2	
		Dist Prof		1	1	
		Prof		1	1	
	Federated History Total		1	6	7	
	Humanities	Assoc Prof	3	2	5	
		Asst Prof		2	2	
		Prof	1	5	6	
	Humanities Total		4	9	13	
	Mathematical Sciences	Assoc Prof	2	16	18	11.10
		Asst Prof		6	6	0
		Dist Prof		2	2	0
		Prof	2	14	16	12.50
	Mathematical Sciences Total		**4**	**38**	**42**	**10**
	Physics	Assoc Prof	1	5	6	17
		Asst Prof		2	2	0
		Dist Prof		6	6	0
		Prof		4	4	0
	Physics Total		**1**	**17**	**18**	**6**
College of Science and Liberal Arts Total			**15**	**83**	**98**	**15**

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==Comparative Data (Fall 2010)==
Number of men and women tenured and tenure-track faculty by department, rank and gender
Table 1f

Newark College of Engineering	Bio Medical Engineering	Assoc Prof	**2**	3	5	**40**
		Asst Prof		2	2	**0**
		Dist Prof		1	1	**0**
		Prof		2	2	**0**
	Bio Medical Engineering Total		**2**	**8**	**10**	
	Chemical, Biological and Pharmaceutical Engineering	Assoc Prof		1	1	**0**
		Asst Prof	**1**	1	2	**50**
		Dist Prof		3	3	**0**
		Prof		12	12	**0**
	Chemical, Biological and Pharmaceutical Engineering Total		**1**	**17**	**18**	
	Civil & Environmental Engineering	Assoc Prof	**3**	2	5	**60**
		Dist Prof		1	1	**0**
		Prof	**3**	15	18	**17**
	Civil & Environmental Engineering Total		**6**	**18**	**24**	
	Electrical & Computer Engineering	Assoc Prof	**1**	4	5	**17**
		Asst Prof	**1**	2	3	**33**
		Dist Prof		4	4	**0**
		Prof		18	18	**0**
	Electrical & Computer Engineering Total		**2**	**28**	**30**	
	Engineering Technology	Assoc Prof		5	5	**0**
		Asst Prof		3	3	**0**
		Prof		2	2	**0**
	Engineering Technology Total			**10**	**10**	
	Mechanical & Industrial Engineering	Assoc Prof	**1**	7	8	**13**
		Dist Prof		1	1	**0**
		Prof		15	15	**0**
	Mechanical & Industrial Engineering Total			**1**	**23**	**24**
Newark College of Engineering Total			**12**	**104**	**116**	**10**

INDICATOR #2
Table 2
Number of non-tenure track men and women faculty

Fall 2011 Full-Time Non-Tenured Faculty by School, Department, and Gender					
School	**Department**	**F**	**M**	**Grand Total**	**% Female**
CCS	Computer Science	1	7	8	12.5
	Information Systems	1	2	3	33
	Information Technology	3	3	6	50
CCS Total		**5**	**12**	**17**	**29**
CSLA (STEM ONLY)	Biological Sciences	2	3	5	40
	Chemistry and Environmental Science	3	4	7	43
	Mathematics	2	6	8	25
	Center for Solar Research	**2**	**8**	**10**	**20**
	Physics	1	9	10	10
CSLA (STEM) Total		**10**	**30**	**40**	**25**
NCE	Bio-Medical Engineering		6	6	0
	Chemical, Biological and Pharm Engr	1	3	4	25
	Civil & Environmental Engineering	1		1	100
	Electrical and Computer Engineering		4	4	100
	Engineering Technology		3	3	0
	Mechanical and Industrial Engr		4	4	0
NCE Total		**2**	**20**	**22**	**9**
Grand Total (STEM)		**17**	**62**	**69**	**25**

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INDICATOR #3
Table 3
2011-2012
Number of faculty who submit tenure packets, and number awarded tenure, by gender and department

Gender	Dept		Final recommendation of University P&T Committee
M	ECE	Promotion to Associate Professor & tenure	YES
M	Physics	Promotion to Associate Professor & tenure	NO
M	Physics	Promotion to Associate Professor & tenure	YES
M	Math	Promotion to Associate Professor & tenure	YES
F	Math	Tenure only	YES

The Board of Trustees will review/approve these recommendations at its June 7, 2012 meeting.

INDICATOR #4
Table 4
2011-2012

Number of faculty who apply for promotion, and number promoted,
by gender, department, and promotion transition (assistant to associate; associate to full)

Gender	Dept	Current Rank	Promotion to	University P&T Committee Recommendation
M	Biological Sciences	Associate Professor	Full Professor	YES
F	CEE	Associate Professor	Full Professor	NO
M	MIE	Associate Professor	Full Professor	YES
M	Eng Tech	Associate Professor	Full Professor	NO
M	SoM	Associate Professor	Full Professor	YES
M	ECE	Assistant Professor	Associate Professor	YES
M	Physics	Assistant Professor	Associate Professor	NO
M	Physics	Assistant Professor	Associate Professor	YES
M	Math	Assistant Professor	Associate Professor	YES

The Board of Trustees will review/approve these recommendations at its June 7, 2012 meeting.

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INDICATOR #5

Table 5a

Fall 2011

Number of tenured associate professors by department and gender
with years-in-rank (in 6, 3-year categories)

Summary: T/TT Associate Professors 3 Years in Rank by Gender

Division	Department	F	M	Total
College of Computing Sciences	Computer Science		9	9
	Information Systems	1	2	3
College of Computing Sciences Total		**1**	**11**	**12**
College of Science and Liberal Arts	Biological Sciences		1	1
	Chemistry & Environmental Science		2	2
	Mathematical Sciences	2	12	14
	Physics		2	2
College of Science and Liberal Arts (STEM) Total		**4**	**21**	**25**
Newark College of Engineering	Bio Medical Engineering	1	1	2
	Chemical, Biological and Pharmaceutical Engineering		1	1
	Civil & Environmental Engineering	3	3	6
	Electrical & Computer Engineering	1	4	5
	Engineering Technology		5	5
	Mechanical & Industrial Engineering	1	7	8
Newark College of Engineering Total		**6**	**21**	**27**
Grand Total (STEM)		**11**	**53**	**64**

INDICATOR #5

Table 5b

Fall 2011

Number of tenured associate professors by department and gender
with years-in-rank (in 6, 3-year categories)

Summary: T/TT Associate Professors 6 Years in Rank by Gender

Division	Department	F	M	Total
College of Computing Sciences	Computer Science		7	7
	Information Systems		2	2
College of Computing Sciences Total			**9**	**9**
College of Science and Liberal Arts	Biological Sciences		1	1
	Chemistry & Environmental Science		1	1
	Mathematical Sciences	1	8	9
	Physics		2	2
College of Science and Liberal Arts (STEM) Total		**1**	**12**	**13**
Newark College of Engineering	Bio Medical Engineering		1	1
	Civil & Environmental Engineering	2	1	3
	Electrical & Computer Engineering	1	2	3
	Engineering Technology		5	5
	Mechanical & Industrial Engineering	1	5	6
Newark College of Engineering Total		**4**	**14**	**18**
Grand Total		**5**	**35**	**40**

INDICATOR #6
Table 6
AY 2011-2012

Number of faculty who leave their departments,
excluding those who died or retired, by rank, gender, and department

In AY 2011-2012, no tenured/tenure-tracked faculty left NJIT, excluding those who died or retired.

INDICATOR #7
Table 7

2011-2012

Number of faculty hired by rank, gender, and department

DEPARTMENT	RANK	GENDER
Biomedical Engineering	Assistant Professor	Female

INDICATOR #8

Table 8a

2011

Cohort analyses of tenure and promotion, including to full professor

ASSISTANT PROFESSOR TO ASSOCIATE PROFESSOR

Division	Department	Sex	Rank	ID	2010-2011	2009	2008	2007	2006	2005	2004
College of	Computer	M	Assoc Prof	21374627		Asst Prof	Asst Prof	Asst Prof	Asst Prof	Asst Prof	Asst Prof
College of	Computer	F	Asst Prof	21484141		Asst Prof	Asst Prof	Asst Prof	Asst Prof		
College of	Computer	M	Asst Prof	21484554		Asst Prof	Asst Prof				
College of	Computer	M	Asst Prof	21484576		Asst Prof	Asst Prof				
College of	Information	M	Asst Prof	21484051		Asst Prof	Asst Prof	Asst Prof	Asst Prof		
College of	Biological	M	Assoc Prof	21455010		Asst Prof	Asst Prof	Asst Prof	Asst Prof	Asst Prof	
College of	Biological	M	Asst Prof	21484325		Asst Prof	Asst Prof	Asst Prof			
College of	Biological	M	Asst Prof	21484551		Asst Prof	Asst Prof				
College of	Chemistry	M	Assoc Prof	21374832		Asst Prof	Asst Prof	Asst Prof	Asst Prof	Asst Prof	Asst Prof
College of	Chemistry	F	Asst Prof	21484013		Asst Prof	Asst Prof	Asst Prof	Asst Prof		
College of	Chemistry	M	Asst Prof	21838113		Asst Prof					
College of	Mathemati	M	Assoc Prof	21367602		Asst Prof	Asst Prof	Asst Prof	Asst Prof	Asst Prof	Asst Prof
College of	Mathemati	M	Assoc Prof	21368684		Asst Prof	Asst Prof	Asst Prof	Asst Prof	Asst Prof	Asst Prof
College of	Mathemati	M	Asst Prof	21455158		Asst Prof	Asst Prof	Asst Prof	Asst Prof	Asst Prof	
College of	Mathemati	M	Asst Prof	21484175		Asst Prof	Asst Prof	Asst Prof	Asst Prof		
College of	Mathemati	M	Asst Prof	21484811		Asst Prof					
College of	Mathemati	M	Asst Prof	21639563		Asst Prof	Asst Prof	Asst Prof			
College of	Mathemati	M	Asst Prof	21746125		Asst Prof	Asst Prof				
College of	Mathemati	M	Asst Prof	21846793		Asst Prof					
College of	Physics	M	Assoc Prof	21374668		Asst Prof	Asst Prof	Asst Prof	Asst Prof	Asst Prof	Asst Prof
College of	Physics	F	Assoc Prof	21454957		Asst Prof	Asst Prof	Asst Prof	Asst Prof	Asst Prof	
College of	Physics	M	Asst Prof	21474664		Asst Prof	Asst Prof	Asst Prof			
College of	Physics	M	Asst Prof	21552527		Asst Prof	Asst Prof	Asst Prof			
Newark Co	Bio Medica	M	Asst Prof	21467896		Asst Prof	Asst Prof	Asst Prof	Asst Prof		
Newark Co	Bio Medica	M	Asst Prof	21484376		Asst Prof	Asst Prof	Asst Prof			
Newark Co	Chemical,	F	Asst Prof	21484357		Asst Prof	Asst Prof	Asst Prof			
Newark Co	Chemical,	M	Asst Prof	21484776		Asst Prof					
Newark Co	Electrical &	M	Asst Prof	21369178		Asst Prof	Asst Prof	Asst Prof	Asst Prof	Asst Prof	Asst Prof
Newark Co	Electrical &	M	Asst Prof	21454923		Asst Prof	Asst Prof	Asst Prof			
Newark Co	Electrical &	F	Asst Prof	21484586		Asst Prof	Asst Prof				
Newark Co	Engineerin	M	Asst Prof	21484151		Asst Prof	Asst Prof	Asst Prof	Asst Prof		
Newark Co	Engineerin	M	Asst Prof	21844528		Asst Prof					

Table 8b

2011

Cohort analyses of tenure and promotion, including to full professor

ASSOCIATE PROFESSOR TO FULL PROFESSOR

Division	Department	Sex	Rank	ID	2010-2012	2009	2008	2007	2006	2005	2004
College of	Computer	M	Assoc Prof	21367251		Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof
College of	Computer	M	Assoc Prof	21367324		Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof
College of	Computer	M	Assoc Prof	21368091		Assoc Prof	Asst Prof	Asst Prof	Asst Prof	Asst Prof	Asst Prof
College of	Computer	M	Assoc Prof	21368166		Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Asst Prof	Asst Prof
College of	Computer	M	Assoc Prof	21368341		Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof
College of	Computer	M	Assoc Prof	21368535		Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof
College of	Computer	M	Assoc Prof	21368536		Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Asst Prof	Asst Prof
College of	Computer	M	Assoc Prof	21368823		Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof
College of	Computer	M	Assoc Prof	21368853		Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof
College of	Computer	M	Assoc Prof	21368964		Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof
College of	Computer	M	Prof	21368913	Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof
College of	Computer	M	Prof	21368967	Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof
College of	Information	M	Assoc Prof	21203626		Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof
College of	Information	F	Assoc Prof	21367740		Assoc Prof	Assoc Prof	Assoc Prof	Asst Prof	Asst Prof	Asst Prof
College of	Information	M	Assoc Prof	21367979		Assoc Prof	Assoc Prof	Asst Prof	Asst Prof	Asst Prof	Asst Prof
College of	Information	M	Assoc Prof	21368604		Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof
College of	Information	M	Assoc Prof	21368958		Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof
College of	Biological	M	Assoc Prof	21367260		Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof
College of	Chemistry	M	Assoc Prof	21367696		Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof
College of	Chemistry	M	Assoc Prof	21368229		Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Asst Prof	Asst Prof
College of	Chemistry	M	Assoc Prof	21368872		Assoc Prof	Assoc Prof	Asst Prof	Asst Prof	Asst Prof	Asst Prof
College of	Chemistry	M	Assoc Prof	21374833		Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof
College of	Mathemati	M	Assoc Prof	21189515		Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof
College of	Mathemati	M	Assoc Prof	21192078		Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof
College of	Mathemati	M	Assoc Prof	21357518		Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof
College of	Mathemati	M	Assoc Prof	21367293		Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Asst Prof	Asst Prof
College of	Mathemati	M	Assoc Prof	21367687		Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof
College of	Mathemati	M	Assoc Prof	21367764		Assoc Prof	Asst Prof	Asst Prof	Asst Prof	Asst Prof	Asst Prof
College of	Mathemati	M	Assoc Prof	21367994		Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof
College of	Mathemati	F	Assoc Prof	21368302		Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof
College of	Mathemati	M	Assoc Prof	21368373		Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof	Assoc Prof
College of	Mathemati	M	Assoc Prof	21368480		Assoc Prof	Assoc Prof	Asst Prof	Asst Prof	Asst Prof	Asst Prof
College of	Mathemati	M	Assoc Prof	21368703		Assoc Prof	Asst Prof	Asst Prof	Asst Prof	Asst Prof	Asst Prof

INDICATOR #8

Table 8c

2011

Cohort analyses of tenure and promotion, including to full professor

FULL PROFESSOR TO DISTINGUISHED PROFESSOR

Division	Department	Sex	Rank	ID	2010-2011	2009	2008	2007	2006	2005	2004
College of Computin	Computer Sc	M	Distn Prof	21368683		Distn Prof	Distn Prof	Distn Prof	Distn Prof	Distn Prof	Distn Prof
College of Science a	Biological Sc	F	Distn Prof	21368585		Distn Prof	Distn Prof	Distn Prof	Distn Prof	Distn Prof	Distn Prof
College of Science a	Chemistry &	M	Distn Prof	21368009		Distn Prof	Distn Prof	Distn Prof	Distn Prof	Distn Prof	Distn Prof
College of Science a	Chemistry &	F	Distn Prof	21368723		Distn Prof	Distn Prof	Distn Prof	Distn Prof	Distn Prof	Distn Prof
College of Science a	Chemistry &	M	Distn Prof	21368690	Distn Prof	Prof	Prof	Prof	Prof	Prof	Prof
College of Science a	Mathematica	M	Distn Prof	21368673		Distn Prof	Distn Prof	Distn Prof	Distn Prof	Distn Prof	Distn Prof
College of Science a	Mathematica	M	Distn Prof	21368975		Distn Prof	Distn Prof	Distn Prof	Prof	Prof	Prof
College of Science a	Physics	M	Distn Prof	21367587		Distn Prof	Distn Prof	Distn Prof	Distn Prof	Distn Prof	Distn Prof
College of Science a	Physics	M	Distn Prof	21367970		Distn Prof	Distn Prof	Prof	Prof	Prof	Prof
College of Science a	Physics	M	Distn Prof	21368747		Distn Prof	Prof	Prof	Prof	Prof	Prof
College of Science a	Physics	M	Distn Prof	21368945		Distn Prof	Distn Prof	Distn Prof	Distn Prof	Distn Prof	Distn Prof
College of Science a	Physics	M	Distn Prof	21368979		Distn Prof	Distn Prof	Distn Prof	Distn Prof	Distn Prof	Distn Prof
College of Science a	Physics	M	Distn Prof	21369010	Distn Prof	Prof	Prof	Prof	Prof	Prof	Prof
Newark College of E	Bio Medical	M	Distn Prof	21369349		Distn Prof	Distn Prof	Distn Prof	Distn Prof	Distn Prof	Distn Prof
Newark College of E	Chemical, Bi	M	Distn Prof	21368543		Distn Prof	Distn Prof	Distn Prof	Distn Prof	Distn Prof	Distn Prof
Newark College of E	Chemical, Bi	M	Distn Prof	21368663		Distn Prof	Distn Prof	Distn Prof	Distn Prof	Distn Prof	Distn Prof
Newark College of E	Chemical, Bi	M	Distn Prof	21368907		Distn Prof	Distn Prof	Distn Prof	Distn Prof	Prof	Prof
Newark College of E	Civil & Envir	M	Distn Prof	21484283		Distn Prof	Distn Prof	Distn Prof			
Newark College of E	Electrical & (	M	Distn Prof	21367310		Distn Prof	Distn Prof	Distn Prof	Distn Prof	Distn Prof	Distn Prof
Newark College of E	Electrical & (	M	Distn Prof	21367439		Prof	Prof	Prof	Prof	Assoc Prof	Assoc Prof
Newark College of E	Electrical & (	M	Distn Prof	21367455		Distn Prof	Distn Prof	Distn Prof	Distn Prof	Distn Prof	Distn Prof
Newark College of E	Electrical & (	M	Distn Prof	21368973		Distn Prof	Distn Prof	Distn Prof	Distn Prof	Distn Prof	Distn Prof
Newark College of E	Mechanical &	M	Distn Prof	21368879		Distn Prof	Distn Prof	Distn Prof	Distn Prof	Distn Prof	Distn Prof

INDICATOR #9

Table 9

2011-12

Number of men and women scientists and engineers in leadership positions

LEADERSHIP UNIT	TITLE	MALE	FEMALE	
Senior Administration		3	0	
Trustees		6	2	
Overseeers		12	1	
ACADEMIC ADMIN	College/School Dean	4	0	
ACADEMIC ADMIN	Dept. Chair	10	0	
ACADEMIC ADMIN	Assoc. Provost	2	1	
ACADEMIC ADMIN	Associate Dean	4	1	
ACADEMIC ADMIN	Director	2	0	
RESEARCH ADMIN	Associate VP	0	1	
RESEARCH ADMIN	Center Director	12	1	
ACADEMIC & STUDENT SERVICES	Associate VP	0	1	
ACADEMIC & STUDENT SERVICES	Assistant VP	1	0	
TOTAL		56	8	(13%female)

INDICATOR #10
Table 10a

Study of salaries of men and women faculty
(with additional controls such as department, rank, years in rank)

Table 10a
Spring 2011

| | | | Sex Data | | | | | |
| | | | F | | | M | | |
Division	Department	Rank	#	Avg Years in Rank	Avg Salary	#	Avg Years in Rank	Avg Salary
College of Computing Sciences	Computer Science	Assoc Prof				11	6	121,376
		Asst Prof	1	4	103,483	2	2	95,024
		Distn Prof				1	6	199,894
		Lect	1	4	53,791	7	6	69,644
		Prof				11	5	163,723
	Information Systems	Assoc Prof	1	5	131,800	4	6	130,730
		Asst Prof				1	4	95,727
		Lect	1	2	54,947	1	6	66,804
		Prof				2	6	199,507
	Information Technology	Lect	3	3	59,339	3	5	68,782
College of Science and Liberal Arts	Biological Sciences	Assoc Prof				2	5	97,066
		Asst Prof				2	3	74,578
		Distn Prof	1	6	174,547			
		Lect	2	1	53,019	1	0	52,076
	Chemistry & Environmental Science	Assoc Prof				5	5	97,802
		Asst Prof	1	4	79,512	1	1	70,000
		Distn Prof	1	6	177,081	1	6	171,067
		Lect	3	2	58,216	3	4	54,352
		Prof	2	6	136,398	2	6	152,917
		Profess/Inst				1	5	70,000
		Asst Prof				2	2	65,911
		Lect	7	4	44,360	8	5	45,959
		Prof	1	5	130,391	5	6	136,798
		Profess/Inst	2	6	76,969	3	6	88,964
	Mathematical Sciences	Assoc Prof	2	4	120,230	16	5	104,462
		Asst Prof				6	3	73,298
		Distn Prof				2	6	174,201
		Lect	2	4	44,937	7	5	44,000
		Prof	2	6	146,409	14	5	145,204
	Physics	Assoc	1	4	93,813	5	5	104,047

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College	Department	Title						
		Prof						
		Asst Prof				2	3	86,562
		Distn Prof				6	5	190,624
		Lect	1	6	61,535	7	5	60,840
		Prof				4	6	148,661
		Profess/Inst				1	6	72,803
Newark College of Engineering	Bio Medical Engineering	Assoc Prof	2	5	118,087	3	5	120,659
		Asst Prof				2	4	91,851
		Distn Prof				1	6	202,429
		Lect				2	6	58,506
		Prof				2	6	156,921
	Chemical, Biological and Pharmaceutical Engineering	Assoc Prof				1	5	98,372
		Asst Prof	1	3	87,973	1	1	90,000
		Distn Prof				3	6	196,936
		Prof				12	6	165,184
	Civil & Environmental Engineering	Assoc Prof	3	6	116,373	2	5	124,944
		Distn Prof				1	3	264,474
		Lect	1	6	91,146			
		Prof	3	5	154,085	15	6	153,224
	Electrical & Computer Engineering	Assoc Prof	1	6	116,372	4	6	116,586
		Asst Prof	1	2	84,447	2	5	92,554
		Distn Prof				4	6	184,510
		Lect				1	6	63,222
		Prof				18	6	157,064
	Engineering Technology	Assoc Prof				5	6	123,230
		Asst Prof				3	2	81,482
		Lect				3	4	78,296
		Prof				2	6	175,194
	Mechanical & Industrial Engineering	Assoc Prof	1	6	0	7	6	128,985
		Distn Prof				1	6	387,320
		Lect				4	5	73,592
		Prof				15	6	153,150

INDICATOR #10

Table 10b

Fall 2011

(Data from 2011 AAUP Salary Study)

RANK	AVG. SALARY MALE		AVG. SALARY FEMALE
Professor	167.7		157.5
Associate Professor	119.8		121.9
Assistant Professor	83.3		97

INDICATOR #11

Study of space allocation of STEM faculty by gender (with additional controls such as department, etc.)

NJIT ADVANCE IS NOT REQUIRED TO REPORT THIS DATA.

INDICATOR #12

Tables 12a & 12b

2010 Data

Study of start-up packages of newly hired faculty by gender
(with additional controls such as field/department, rank, etc.)

DEPARMENT	RANK AT HIRE	STARTUP	GENDER
Chemistry	Asst Prof	$284,555	M
Chemical, Biological, & Pharmaceutical Engineering	Asst Prof	$179,000	M
Engineering Technology	Asst Prof	$8,330	M
Mathematical Sciences	Asst Prof	$39,555	M
Mathematical Sciences	Asst Prof	$23,883	M

Table 12a (2010 Hires & Start Up Packages)
[STEM Hires in BF]

DEPARTMENT	RANK	STARTUP	GENDER
Biomedical Engineering	Assistant Professor	$384,000	F

Table 12b (2011 Hire & Start Up Package)

[STEM Hires in BF]

APPENDICES

APPENDIX 1

JOINT MEETING OF THE NJIT ADVANCE
INTERNAL STEERING COMMITTEE & EXTERNAL ADVISORY COMMITTEE

20 September 2011

PARTICIPANTS:

ADVANCE Team:
- Dr. Nancy Steffen-Fluhr, PI
- Dr. Brook Wu, Co-PI
- Doctoral Student Regina Collins, RA
- Doctoral Student Mingzhu Zhu, RA
- Dr. S. Roxanne Hiltz, Consultant

External Advisory Committee:
- Dr. Laura Kramer, Montclair University (Emerita)/ Former NSF ADVANCE Program Director**;**
- Susan Metz, Co-Founder, WEPAN;
- Dr. Ellen Townes-Anderson, Professor, Department of Neurosciences, UMDNJ-New Jersey Medical School and director of the UMDNJ Faculty Mentoring Program.

Internal Steering Committee:
- Dr. Lisa Axe, Associate Dean, Newark College of Engineering;
- Dr. Fadi Deek, Dean. College of Science & Liberal Arts;
- Dr. Eugene P. Deess, Director, Institutional Research and Planning;
- Dr. Norbert Elliot, Chair, NJIT Middle States Self-Study Team;
- Rose Federici, Assistant to the Provost/ co-chair, Committee on Women's Issues;
- Dr. Judith Redling, Associate Provost;
- Dr. Judith Sheft, Associate VP, Technology Development;
- Dr. Richard Sweeney, University Librarian;
- Dr. David Ullman, Associate Provost for Information Services & Technology/ CIO.

External Evaluator:
- Dr. Katherine Mayberry, Vice President for Special Projects at the Rochester Institute of Technology

ISSUES DISCUSSED:

A) *Potential Uses of the New NJIT ADVANCE Research Interests Map Tool*
-The tool has already demonstrated its usefulness for NJIT faculty, why can't we collect data on research outside of NJIT?
-NSF and NIH are encouraging multi-investigator research; the Research Map tool would be helpful to locate external collaborators.
-People accessing NJIT's innovation incubation program could look for collaborators using such a tool. We could even include patent and invention disclosure information and external grant PIs in the database. ("Members of industry/academia/government are always looking for innovation, but many companies feel they don't have access to the technology or the collaboration partners in academia.")

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-Keywords will be critical to the success of the Research Map tool. Perhaps there should be a summit of organizations who will participate in the tool to decide on meaningful keywords.

B) *The Importance of Sustaining the ADVANCE Co-authorship Database*
-By evaluating co-authorship, we can measure at least a part of faculty members' social capital.

C) *The Need to Develop and Sustain a new Approach to Faculty Mentoring*
-We need to do a much better job of introducing faculty to our environment and culture;
-How can we create a go-to person for junior faculty?
-Junior faculty need to be part of a peer group, a cohort.
-Would the term *advocate* or *coach* remove some of the concerns about mentoring?
-We need to focus on faculty development throughout their career.
-Faculty members need to be more engaged with each other.

D) *The Need to Reinvigorate Search Process Best Practices:*
-How best do we ensure diverse faculty hiring in the coming years?
-We need to make mentoring and collaboration a part of faculty evaluation.
-Search committees need to be accountable as well.
-When we hire a new faculty member, we typically ask, 'How does this new hire fill a hole in this department?' That produces individualized nodes. Instead, we should look at new hires with respect to how they fit into the department and into the university. This person that does what nobody else does, who knows what nobody else knows, and can teach what no one else can teach – we should be looking at how does this person fit into the department. For example, we could include possible collaborators in the interview process to show the prospective faculty member what opportunities will be available to them. This should become part of the search process."

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APPENDIX 2

"Advancing Women at NJIT Through Collaborative Research Networks"
New Jersey Institute of Technology ADVANCE Program ABR
External Evaluation
Katherine J. Mayberry, Ph.D.

This evaluation covers the activities and findings of Year One[1] of an Accomplishment-based Renewal ADVANCE grant awarded to the New Jersey Institute of Technology for the two-year period beginning September 30, 2010 and ending September 30, 2012. The evaluation is based upon a review of the following:

- the original ABR proposal submitted to NSF in November 2009;
- the plan of work for Years One and Two of the ABR grant;
- telephone conversations with Nancy Steffen-Fluhr (February-September 2011);
- the three 2010-2011 quarterly reports for Year One;
- the Annual Report for Year One;
- the NJIT ADVANCE website;
- Power Point slides for various presentations at NJIT and elsewhere;
- the evaluator's attendance at the September 20 meeting of the External Advisory Committee, the Steering Committee, and the co-PI's ;
- participant assessments of colloquia and showcases.

This evaluation is organized in terms of the first two phases identified in the 2010-2011 work plan: 1) Collecting and Mapping Network Data; and 2) Supporting Research Collaboration. Since the majority of work to be conducted during the third phase, Disseminating Best Practices in Retention, will occur in the coming twelve months, evaluation of those subtasks will not appear here. The discussion of these two phases will include reference to progress made, quality/promise of outcomes; and current or potential impact.

Phase I: Collecting and Mapping Network Data

Co-Authorship Database

Continued refinement of the co-authorship database was necessary in order to confirm earlier hypotheses and preliminary findings—in particular, the apparent presence of collaborative homophily in both males and females at NJIT and the statistical correlation between network structure and promotion and between network structure and gender. The time spent mining, parsing, and analyzing the Google Scholar and particularly the

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[1] Because the grant under review is an ABR, I should probably refer to 2010-2011 as Year Four and to 2011-2012 as Year Five (as does the majority of the documentation I have received). If only because of my lack of familiarity with the original proof-of-concept grant, I find I am more comfortable referring to the two years covered by the ABR as Years One and Two.

SCOPUS data (as well as cleaning the database developed during the earlier ADVANCE grant) clearly paid off in providing confirmation of the gender and rank-related impediments to collaboration and productivity, but it also demonstrated the necessity of a fully automated data collector if scalability and sustainability are to be achieved.

Data Automation

The development of a fully automated method for collecting faculty research data is the necessary, if not sufficient, condition of this grant's ultimate success. Assumed within the term "fully automated" are the modifiers "sustainable" (i.e., neither time-, labor-, nor money-intensive), "reliable," and "replicable."

The team is to be congratulated for its identification of Digital Measures as a far preferable data source for identifying research connections. Not only is data from DM much easier to mine—an advantage that would by itself make it a winner—but the software is 1) already in place at NJIT; 2) likely to be widely if not universally used by the NJIT faculty; 3) deployed by more than 2000 other colleges and universities (a fact that implies rich consortial possibilities); and 4) able to capture a variety of professional data (grants, books, works in progress, service, teaching, etc.). Certainly the mentoring matchmaking process stands a better chance of success if it is based upon multiple variables. Additionally, should the mentoring program to be put in place employ a broad definition of the term "mentoring," that includes professional and personal advancement-related issues as well as research, the variety of available data will be particularly useful.

The only disadvantage to the use of Digital Measures is its lack of historical data. Presumably, the co-authorship database derived from Google Scholar, which was cleaned and supplemented early in Year One (2010-2011), provides these data, and faculty will be able to access these as well as the more current annual data provided through DM.

The potential of collaboration with Elsevier is promising in terms of scalability and sustainability of the project, but as I understand it, would not replace the DM mining method. I would suggest that in next year's quarterly reports, regular updates about the feasibility of this partnership be provided.

Collecting and Analyzing Self-Reported Network Data

While it probably came as little surprise to the investigators that the collection and analysis of self-reported network data were extremely labor-intensive tasks, the information gleaned from these surveys and interviews was critical to the progress of the work, though perhaps not in the way expected.

The team went to great lengths to ensure that the subjects had the necessary information, prompts, and visual feedback to provide thoughtful and accurate characterizations of their networking relationships, and it turned out that every bit of the prep work was necessary. Had care *not* been taken to elicit self-reports that were as accurate as possible, it might have been too easy to ascribe the inaccuracies and inconsistencies of the self-reports to the survey methodology.

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Under the circumstances, it does seem safe to conclude tentatively not only that "bibliometric networks are a valid proxy for 'real' faculty social-professional networks" (ABR Proposal, 8), but that mined network data is often less noisy than self-reported data collected in face-to-face interviews.

Assuming for the moment that further analysis and data gathering will confirm the superiority of bibliometric to self-reported networks, this strikes me as a critical finding— one with the potential of impacting mentoring programs at other universities in a profound way. Virtually all mentoring programs rely upon some form of questionnaire as the primary means of connecting mentee with mentor. Typically, these questionnaires are sketchy at best, usually including no more than two questions about research interests. In universities where advancement (promotion and tenure) depend upon research productivity, identifying strong research-based mentoring matches is critical. Thus, a tool like the Research Map holds considerable promise for increasing the individual and collaborative productivity of younger faculty by sharpening the accuracy of networking information.

While the Annual Report indicates that further analysis of the self-reported network surveys will be conducted, I could find no indication that additional departments will be studied in the same way as Department X. Ideally, the survey should be replicated in one or more additional departments. But given time constraints, it might make sense to identify an alternative method that would take you more efficiently to your goal of identifying predictive models of faculty success and failure.

The rather pronounced differences between the two groups participating in the Communication Modes survey (Department X and attendees at the February 24th workshop) does, as the Annual Report indicates, merit further analysis and wider sampling. A determination that the differing response patterns are at least partially a function of subject age (generation), could influence the shape of the mentoring program to be developed. With four generations currently in the workforce (Traditionalists, Baby Boomers, Gen-Xers, and Millennials), it is not only communication modes that will diverge, but also expectations around hiring, work-life balance, rewards, and institutional loyalty. Two excellent resources for these issues are Meister and Willyerd's *The 2020 Workplace* (2010); and Sharon Hostler, M.D. (see http://www.brown.edu/Administration/Provost/Advance/Hostler%20Generational%20Diversity.pdf.

Phase 2: Supporting Research Collaboration

Enhance the Faculty Research Tool

The mapping tool, or Research Map, as represented on the NJIT ADVANCE website, is a remarkable tool—user-friendly and graphically compelling. This last is particularly important because of the emphasis placed throughout the grant materials on "seeing" vital networking information (or non-networking information, as the case may be) that could otherwise go unidentified—trouble spots, bottle-necks, emerging leaders—and, ultimately, reflecting institutional transformation.

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It is no surprise that the Research Map tool stimulated considerable interest both within NJIT and from potential external partners. The early conversations between UMDNJ and NJIT regarding inter-institutional cooperation speak to the potential of DM and the Research Map for enabling inter-institutional cooperation. Inter-institutional diversity could well be as important to breakthrough research as we know interdisciplinary and inter-departmental research to be.

If, for example, 50 of the > 2000 schools currently using Digital Measures could follow a process similar to the data mining done at NJIT, consider the possibilities not just for setting up breakthrough research partnerships, but also for creating unique inter-institutional mentoring opportunities. When considering the scalability of this project, you should address these consortial possibilities.

Stimulate Collaboration

1. Interdisciplinary Research Colloquia

   The "Emerging Trends" presentation by Anatoliy Gruzd on February 24, 2011 provided excellent coverage of current patterns of social media technologies use by faculty. It appears to have been just the right launch pad for the survey completed by presentation attendees (I am assuming participants were given the survey *after* the presentation/discussion). (I wonder whether the variance in responses between the February 24 group and Department X may have been a function of Department X not having been exposed to the presentation and discussion at the February 24 event.)

   Dr. Gruzd's survey indicates time and again that faculty do not have the time to wend their way through blogs, list-servs, microblogs, wikis, etc. in their search relevant research and/or possible collaborators. Certainly these findings confirm the value of a tool like Research Map.

   The post-event evaluation form indicates that the event was quite effective in stimulating or capturing faculty interest in interdisciplinary research and its attendant rewards and issues. Particularly encouraging was the percentage of attendees (92.3) who indicated they were "likely to attend another workshop."

   I was not able to access the iTunes recording of Dr. Iyengar's presentation and would be grateful for an explanation of the relevance that the talk doubtless had to the goals and objectives of the grant.

2. Research Showcases

   I am impressed by the wisdom of developing the ongoing research showcase series. This is an excellent way to stimulate and capture interest in interdisciplinary research. Demonstrating that the NJIT climate encourages the kind of (interdisciplinary) research represented in these showcases cannot help but seed the ground for the mentoring program to be developed in Year Two of the grant. Again, the very positive response regarding interest in attending similar events is heartening. On the other hand, the response of presenters to the statement "the Showcase increased my interest in cross-sector collaboration" is curious and probably worth at least some informal probing.

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3. Travel grant incentives

    The team was very clever in using travel grants as participation incentives, as the currency of the incentive is a perfect match for the overall goal(s) of the grant.

Phase 3: Disseminating Best Practices in Retention

As indicated at the outset of this evaluation, review of the actual mentoring program emerging from the work of Year One will be a major focus part of the second external evaluation. Because the development of these tools was the primary focus of Year One (the timeframe under review here), it is easy for an outside reviewer focusing on the first year to lose sight of the link between these tools and the pilot mentoring program currently under development. It would make sense in a final report for the linkages to be made a bit more explicit. That said, at this juncture (end of Year One), both of the tools developed in Year One promise to play critical roles in the pilot mentoring program (Faculty CAN)—the Research Map tool for mentor-mentee matching and, later in Year Two, the GPS tool for revealing useful data about faculty's existing ego networks and their current positions in the larger institutional/college network. Of course, the Research Map does not *ensure* "matching effectiveness"—there are too many other psycho-social variables—but by anyone's measure, it has the potential of being a game-changer for mentoring programs that have as their goal the advancement and satisfaction of women in academic STEM fields.

I look forward to watching the Faculty CAN program in CSLA unfold in the next twelve months. On that subject, I was surprised to see how few female assistant professors that college includes. The absence of photographs for some faculty (on the departmental websites) and the high number of international faculty with first names that I can't readily identify as male or female may have contributed to an inaccurate count, but even taking these unknowns into account, there just doesn't seem to be a critical mass of junior tenure-track faculty who are female. It may well be that the pilot design works around this fact, and again, I look forward to watching it unfold in Year Two.

Year One Commendations

So many important things were done well during Year One of this grant that I cannot enumerate them all. I have referenced some of these commendable strategies/tactics throughout the evaluation. The following deserve special notice.

- The Office of the Provost is to be commended for the continuing provision of financial, official, and personal support. It would be hard to imagine that any faculty member or administrator at NJIT could mistake the Provost's commitment to the success of the grant. Given the culture-changing ambitions of the grant, this visible support is critical.

- In the spirit of collaboration and networking, the team has reached out to individuals from a number of different institutions—as potential partners, consultants, and informal

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advisors. This cross-pollination is nicely in keeping with the informing values of the grant itself.

The External Advisory Board also appears to have been very thoughtfully composed, with appropriate diversity of expertise and institutional affiliation.

- The care with which the colloquia and research showcases were assessed is exemplary.

- The amount of time dedicated to this grant in Year One by the PI's and others on the team is extraordinary. The commitment of hours and energy has yielded a host of promising accomplishments with real potential for improving the retention of women in STEM (and other) fields.

Recommendations:

I am limiting the following set of recommendations to those that seem to me to have the potential of being considered for and possibly applied to the activities of Year Two and the final write-up(s) of the grant.

- I look forward to reading updates regarding the possible Elsevier partnership.

- The names of the two tools developed in Year One might be re-considered. It is easy to confuse the two (particularly when both are referred to as a "faculty research network mapping tool"). Perhaps something as simple as Tool 1 and Tool 2 would solve the potential confusion.

- The written and electronic documentation made available to me provides abundant information about the background and intent of the grant and answers most of the questions that arose throughout my review. In Year Two, schedules permitting, I would be grateful for opportunities to interact in person with faculty involved in the mentoring pilot and with faculty in general. I can infer a good bit about the current NJIT climate for women in STEM from my own experience at a similar institution and from the work done in the original ADVANCE grant, but the opportunity to speak at some length with junior faculty would, I'm sure, contribute to an even greater understanding of the current climate.

- The ADVANCE website was extremely useful—in particular the Research Map demo and the audio tape of Dr. Gruzd's presentation. This coming year, I am eager for the opportunity to attend one or more of the showcases or colloquia in person.

Katherine J. Mayberry, Ph.D.

2 October 2011

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APPENDIX 3

Slide 1

Slide 2

**HISTORY OF
NJIT ADVANCE**

2006 - Present
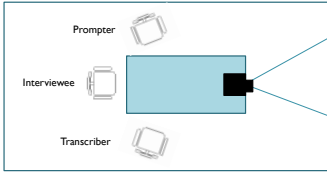
- Began in response to *Status of Women Faculty Report* conducted in 2005
- NSF Grant to support research on collaboration as a remedy to isolation
- Can we use social network analysis to predict career success and look for those in danger of failing?

Slide 3

SELF-REPORTED DATA

Pilot study: Department X

Prompter

Interviewee

Transcriber

Slide 4

INTERVIEW METHODOLOGY

Prompter was tenured Associate Professor

Transcriber was graduate student

Names of all faculty from university between 2000 and 2010 were shown (alpha or dept. order)

First pass – tell us who you know

    Transcriber entered data into MS Excel Spreadsheet

    Prompted took notes using LiveScribe recording pen

Slide 5

INTERVIEW METHODOLOGY

For each person selected in the "first pass", specify types of interactions:

- **Coauthor**
- **Collaborate**
- **Serve on committees**
- **Discuss research**
- **Give advice**
- **Receive advice**
- **Socialize**

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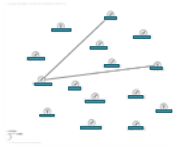
Slide 6

VENNMAKER WHOLE NETWORK PERCEPTIONS

Given nodes representing individual faculty members in Department X, tell us who are connected through research

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Slide 7

EFFORT VS. ACCURACY

Interviews were labor-intensive and time consuming:

- Length of interviews ranged from 30 to 90 minutes
- Some faculty refused to participate
- Substantial differences in reporting (what does it mean to "socialize" or "discuss research"?)

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Slide 8

VENNMAKER WHOLE NETWORK PERCEPTIONS

Whole network perceptions, even in a small department, differed substantially.

Faculty Member #1 · Faculty Member #2

Slide 9

RECIPROCITY OF REPORTED CONNECTIONS (COLLABORATION)

Slide 10

NETWORK RECIPROCITIES

Coauthorship:	0.667
Collaboration:	0.115
Committee:	0.318
Discuss:	0.217
Socialize:	0.222

(Calculated using UCINET)
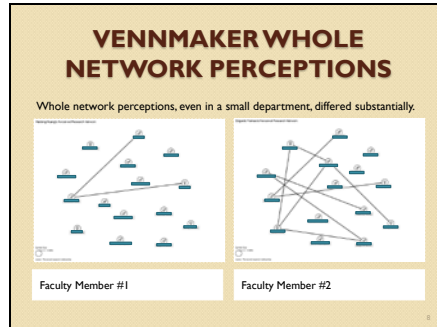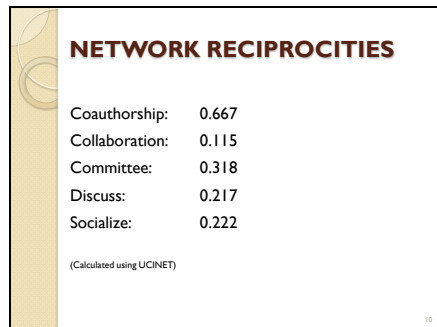
Slide 11
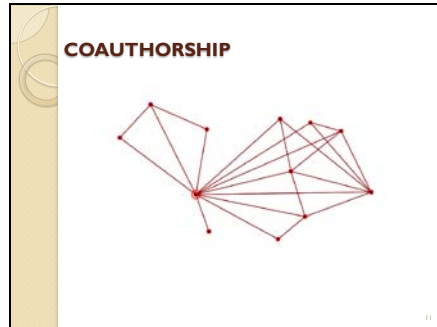
COAUTHORSHIP

Slide 12

WHY COAUTHORSHIP?

Coauthorship data is:

- Public
- Objective
- Can be scraped from the internet or captured from faculty CVs
- Coauthorship requires a working relationship, unlike citations or other publication measures

Slide 13

COLLECTING COAUTHORSHIP DATA

First Study

First data collection effort:

- Faculty were unwilling to share CVs
- Used a web crawler to search several databases (Scopus, Web of Science, IEEE) for NJIT affiliations
- Collected 7225 publications from 2208 authors (463 STEM faculty)

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COLLECTING COAUTHORSHIP DATA

First Study

Significant issues:
- NJIT faculty having same name as external faculty/grad students
- Mislabeling of affiliations
- Different databases having slightly different publication titles (e.g. using the word "beta" as opposed to "β")

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Slide 15

COLLECTING COAUTHORSHIP DATA

Second Study

Crawled Google Scholar
- Used faculty list (obtained from HR) and affiliation
- Retrieved information by following link to source database or digital library (ACM, IEEE, etc.)
- Each required a unique parser

This method was deemed unsustainable.

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COLLECTING COAUTHORSHIP DATA

Second Study

Focused on Scopus digital library to capture STEM faculty data
- Built a web crawler to search Scopus
- Retrieved 8395 faculty publications, 3608 published during 2000-2010
- Also captured counts of publications of faculty with external faculty and grad students
- Compiled attributes from HR

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Slide 17

COLLECTING COAUTHORSHIP DATA

Sustainability

○ Faculty at NJIT now required to enter yearly publications into Digital Measures

- Use collected data to populate historical publications
- Retrieve new publications from Digital Measures
- Entering this data is tied to merit-based awards for faculty

Slide 18

ANALYZING COAUTHORSHIP DATA

Data is currently being used to test hypotheses including:

- Faculty with higher Betweenness centrality publish more than faculty with lower Betweenness centrality

  (Preliminary results: strongly supported)

- Female faculty have lower Eigenvector centrality or Betweenness centrality than their male counterparts

  (Preliminary results: not supported)

- Faculty members who co-author more are more successful in terms of rank increase.

  (Preliminary results: strongly supported)

Slide 19

TOOLS USING COAUTHORSHIP DATA

Research Interests Map – developed by Advance Consultant Dr. Anatoliy Gruzd

For more information, please see:
http://socialmedialab.ca/?page_id=4847

Slide 20

TOOLS USING COAUTHORSHIP DATA

Faculty Connections Visualizer
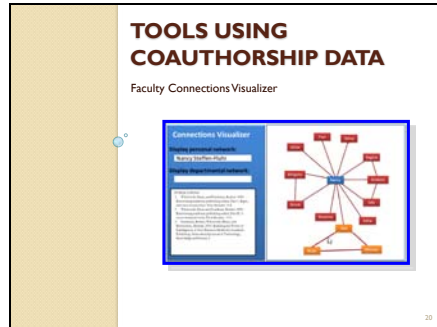
Slide 21

NJIT ADVANCE TEAM

http://advance.njit.edu

Dr. Nancy Steffen-Fluhr
Director of Murray Center for Women, Associate Professor of Humanities, NJIT

Dr. S. Roxanne Hiltz
Distinguished Professor Emerita, Information Systems, NJIT

Dr. Brook (Yi-Fang) Wu
Associate Professor of Information Systems, NJIT

Dr. Katia Passerini
Associate Professor of School of Management, NJIT

Dr. Anatoliy Gruzd
Director of Social Media Lab, Assistant Professor of Information Management, Dalhousie University, Halifax NS

Mingzhu Zhu, Doctoral Candidate in Information Systems, NJIT

Regina Collins, Doctoral Candidate in Information Systems, NJIT

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QUESTIONS

?

ACKNOWLEDGEMENTS

- We gratefully acknowledge the support of the National Science Foundation
- We also thank doctoral student Yiran Wang for her tremendous efforts in the Department X study.

APPENDIX 4

From Steffen-Fluhr Presentation on Faculty Use of Social Media

NJIT ADVANCE 2012 Collaboration and Research Showcase

7 March 2012

FACULTY RESEARCHERS & SOCIAL MEDIA: Who Uses What...and Why

SOCIAL MEDIA IN GENERAL		Find research; SHARE research; Spark new ideas; Create & maintain scholarly networks	
SOCIAL MEDIA BY CATEGORY	**TOOLS IN CATEGORY, e.g.**	**TYPICAL USES & BENEFITS**	**POPULARITY AMONG FACULTY[1 2]**
Virtual worlds	SecondLife	Create illusion of presence in virtual classrooms, conferences [avatars]	10
Presentation sharing sites	SlideShare.net, Slideboom	Locate all slides in one place; share to many sites; embed	16
Social bookmarking tools	Delicious.com	Collaborative tagging & rating of bookmarks to resources; a potential time saver for researchers	17
Academic social networking tools	Academia.edu, ResearchGATE.net	Post papers; get new papers by fellow academics to whose profiles you "subscribe"; participate in discussions; post questions; provide expertise	17
Bibliographic management sites	Citeulike, Connotea, Mendeley, Zotero	Organize your own and others' articles; generate citations easily; house your cv online. [Mendeley: network with peers]	18
Microbloging tools	Twitter, Sciencefeed.com	Allows academics to separate personal & professional microblogging; can cross-list a single post on many sites; Twitter circles tout each other onto hot new research articles	25
Media repositories	Youtube, Flikr		29
Online document management tools	Google docs, Scribd, Dropbox	Scribd: good for sharing, embedding; Google Docs/ Dropbox: facilitate group work	32
Video/teleconferencing	Skype, other IMs	Essential for long-distance collaboration [...and talking with your grandchildren]	35
Academic Blogs (writing, reading, commenting)	Researchblogging.org, BlogScholar.com	Discuss published papers with peers	35
Listserv groups		Share information; mobilize action; maintain interest-based networks	36
Non-academic social networking tools	Facebook, Linkedin	Create visibility for you & your work; find out more about people you meet at conferences; find potential sources of student internships [Linkedin]...and post pictures of your grand/children	37
Wikis	Wikipedia, Wikibooks		42

[1] Anatoliy Gruzd, Kathleen Staves, Amanda Wilk. "Tenure & Promotion in the Age of Online Social Media." ASIS&T 2011. http://www.slideshare.net/primath/tenure-and-promotion-in-the-age-of-online-social-media

[2] Gruzd, A., Goertzen, M., and Mai, P. (2012, Feb. 1). "Survey Results Highlights: Trends in Scholarly Communication and Knowledge Dissemination in the Age of Social Media." Social Media Lab Report, Dalhousie University, Halifax, NS, Canada. http://www.slideshare.net/primath/survey-results-highlights-trends-in-scholarly-communication-and-knowledge-dissemination-in-the-age-of-online-social-media

APPENDIX 5

Application Form for ADVANCE Faculty CAN Pilot

Application Form – 2011-12 Faculty CAN Pilot

SEPTEMBER 2011-SEPTEMBER 2012

RETURN APPLICATION1 TO KATIA PASSERINI, pkatia@njit.edu *NJIT ADVANCE BY SEPT 19, 2011*

1 Form adapted from UT Dallas Faculty Mentoring Program Jan 2009-Jan 2010

YOUR NAME _____

DEPARTMENT / SCHOOL _____

*PHONE*_____ *EMAIL*_____

LIST YOUR RESEARCH INTERESTS (KEYWORDS)

_____
_____
_____

LIST COMPLEMENTARY RESEARCH KEYWORDS (RESEARCH THAT MAY RELATE TO YOUR MAIN INTERESTS)

_____
_____
_____

LIST YOUR TEACHING INTERESTS / AREAS

_____
_____
_____

IDENTIFYING MENTORS

PLEASE NAME INDIVIDUALS (SENIOR AND PEERS) YOU MIGHT WANT AS MENTORS AT NJIT. ALSO SPECIFY IF YOU ALREADY HAVE A MENTORING/COLLABORATION RELATIONSHIP WITH THE LISTED INDIVIDUALS.

*NAME*_____

THIS PERSON IS: □ *SENIOR FACULTY*

□ *PEER FACULTY* □ *OTHER (SPECIFY)* _____

*NAME*_____

THIS PERSON IS: □ *SENIOR FACULTY*

□ *PEER FACULTY* □ *OTHER (SPECIFY)* _____

*NAME*_____

THIS PERSON IS: □ *SENIOR FACULTY*

□ *PEER FACULTY* □ *OTHER (SPECIFY)* _____

*NAME*_____

THIS PERSON IS: □ *SENIOR FACULTY*

□ *PEER FACULTY* □ *OTHER (SPECIFY)* _____

MENTORS SERVE MANY PURPOSES, INCLUDING OFFERING SOCIAL SUPPORT, ADVICE AND GUIDANCE ABOUT RESEARCH, TEACHING, SERVICE, SPECIFIC POLICIES, AND YOUR RESEARCH FIELD MORE GENERALLY. PLEASE ANSWER THE FOLLOWING ABOUT YOUR MENTORING RELATIONSHIP PREFERENCES. FOR EACH AREA, PLEASE MARK 0=NOT NEEDED; 1=LIMITED GUIDANCE NEEDED; 2=SOME GUIDANCE NEEDED; 3=SIGNIFICANT GUIDANCE NEEDED.

SELECT AREAS OF RESEARCH ACTIVITY ON WHICH YOU WOULD LIKE TO RECEIVE GUIDANCE (0-3) FROM A MENTOR:

___ Conducting research

___ Manuscript preparation/writing

___ Presentations

___ Publishing

___ Identifying funding opportunities

___Grant writing

___ Developing a research portfolio

___ Other _____

CHECK AREAS OF TEACHING ACTIVITY ON WHICH YOU WOULD LIKE TO RECEIVE GUIDANCE (0-3) FROM A MENTOR:

___ Developing a course

___ Delivering classes (lectures)

___ Developing quizzes or exams

___ Grading

___ Dealing with difficult students

___ Balancing teaching/research

___ Succeeding in distance education

___ Innovative classroom experiences

___ Other _____

CHECK AREAS OF PROFESSIONAL ACTIVITY ON WHICH YOU WOULD LIKE TO RECEIVE GUIDANCE (0-3) FROM A MENTOR:

___ Understanding promotion and tenure

___ Developing a plan for career advancement

___ Finding your professional niche

___ Accessing/utilizing institutional support

___ Prioritizing professional demands

___ Improving time management

___Other_____

___ Identifying collaborators/partners

___ Communication skills and networking

___ Connecting to local/community resources

___ Connecting to industry

___ Balancing personal/professional demands

What do you consider to be the most major obstacles in attaining your career goals?

_____
_____
_____
_____

What do you consider to be your strongest skills/strengths?

_____
_____
_____
_____

What are the most important areas you would like to enhance during the next year of mentoring?

_____
_____
_____
_____

Please list any other comments or questions regarding your expectations and participation in the faculty mentoring program.

_____
_____
_____

_____

APPENDIX 6

SUMMARY OF DATA FROM FACULTY CAN APPLICATION FORMS

HIGH PRIORITY AREAS
1= Highest

SELECT AREAS OF <u>RESEARCH ACTIVITY</u> ON WHICH YOU WOULD LIKE TO RECEIVE GUIDANCE (0-3) FROM A MENTOR:

4   Conducting research

5   Manuscript preparation/writing

7   Presentations

2   Publishing

3   Identifying funding opportunities

1   <u>Grant writing</u>

6   Developing a research portfolio

Other: Journal selection, peer-review of my work

CHECK AREAS OF <u>TEACHING ACTIVITY</u> ON WHICH YOU WOULD LIKE TO RECEIVE GUIDANCE (0-3) FROM A MENTOR:

4   Developing a course

4   Delivering classes (lectures)

5   Developing quizzes or exams

6   Grading

4   Dealing with difficult students

1   <u>Balancing teaching/research</u>

3   Succeeding in distance education

2   Innovative classroom experiences

Other: Engaging students during very long classes, effective techniques for large lectures

CHECK AREAS OF <u>PROFESSIONAL ACTIVITY</u> ON WHICH YOU WOULD LIKE TO RECEIVE GUIDANCE (0-3) FROM A MENTOR:

2   Understanding promotion and tenure

1   <u>Identifying collaborators/partners</u>

6   Communication skills and networking

2   Developing a plan for career advancement

7   Finding your professional niche

9   Accessing/utilizing institutional support

3   Prioritizing professional demands

4   Improving time management

5   Connecting to local/community resources

3   Connecting to industry

8   Balancing personal/professional demands

Other:

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APPENDIX 7

Mentoring Program Guide
New Jersey Institute of Technology
Pilot Program Sponsored by the ADVANCE Project
2011-2012

NJIT ADVANCE is funded by

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WELCOME: GOALS OF THE CAREER ADVANCEMENT NETWORK PILOT

Welcome to the inaugural year of the NJIT Faculty Career Advancement Network Pilot, supported by an NSF ADVANCE grant to NJIT. We hope to eventually grow to a university-wide Faculty Career Advancement Network (Faculty CAN), supporting the advancement of faculty at all ranks. For this first year, we are pairing tenured faculty members with newer, tenure track assistant professors.

The overall goals of this program are to:
1. Help new faculty to reach their full potential as quickly as possible
2. Assist in the retention of new faculty
3. Aid the recruitment of new faculty, by being able to describe a program in place
4. Provide a stimulating and rewarding relationship for both Mentor and Mentee that will lead to increased research initiatives at NJIT
5. Create an environment conducive to professional growth and success for all faculty

For mentees, program goals include:
1. Improve success for tenure and promotion
2. Enhance professional and personal development
3. Assist in defining career goals
4. Provide networking opportunities across campus and beyond
5. Provide knowledge about organizational structure and culture

Mentor benefits include:
1. The satisfaction of helping a colleague
2. Contributing to the overall success of NJIT by strengthening its faculty
3. Fostering joint research potential and productivity through contacts with all faculty in the program

This guide should be read by both mentors and mentees in support of their first formal meeting. It also provides some forms and suggestions that might be used during the mentoring process.

The heart of the Faculty Career Advancement Network Pilot is the communication and individual meetings between Mentor and Mentee. However, we will also sponsor "brown bag" lunch meetings where we will discuss topics of interest to all involved.

Since this is the first year, we want to capture knowledge about what works and what does not work so that we can make the program even more effective in the future. Please keep notes about your meetings and your progress, and give us suggestions for improvements and additions to these materials.

With many thanks for your participation,

The ADVANCE Mentoring Team: Nancy Steffen-Fluhr, Katia Passerini, Brook Wu, and Starr Roxanne Hiltz
& The Office of the Provost

THE ROLE OF THE MENTOR[2]

Mentors are trustworthy advisors who are willing to share wisdom gained from their own experiences. Mentors should be accessible and approachable, helpful problem solvers, and willing to offer advice. Ideally, a mentor is:

- knowledgeable about NJIT's institutional culture and faculty life
- a promoter of scholarly values and academic integrity
- an advisor who helps the mentee to set and attain career goals
- an experienced teacher
- helpful in resolving difficult work-related issues
- sensitive to the challenges of creating a balance between work and personal life
- willing to make a reasonable time commitment
- a strategist for building good relationships that will sustain a vibrant academic career
- sensitive to identity issues (of gender, race, class, sexual orientation, family status) in the academy

WHAT ARE MENTORS AGREEING TO DO?

1. Read this packet.

2. Initiate contact with your mentee to set up a first meeting.

3. Share information about your own background with your mentee; sharing CVs is a good introductory activity.

4. Meet regularly with your mentee: we suggest once a month.

5. Know how to access University policies on tenure and promotion and work/family balance.

6. Share your experiences as a member of the NJIT Faculty.

7. Respond as quickly as you can to emails, phone calls, requests from your mentee.

8. Communicate with your mentee to assess whether or not the mentoring match is working. If it isn't working, gently suggest that s/he request a different mentor.

9. Make referrals and/or gather resources to respond to questions you can't answer.

10. Help to evaluate the Faculty Career Advancement Network Pilot at the end of the academic year.

---

[2] Adapted from Brown University

TIPS TO HELP MENTORS MAINTAIN A GOOD MENTORING RELATIONSHIP[3]

1. Take the initiative in the relationship.

2. Make it easy for your mentee to meet with and contact you. Take advantage of email and telephone as a way of staying in touch; email in particular allows for relatively short but more frequent contact. Not all mentoring has to take place in person.

3. Respect your mentee's time as much as you respect your own. Be explicit about your own needs and limits, specifying times you wish not to be disturbed or ones that are particularly good for communication. Your mentee may have similar needs and limits.

4. Help your mentee explore options and understand the impact of different choices.

5. Encourage your mentee to consider your suggestions *along with* advice received from others.

6. Do not divulge confidences. Your mentee must trust that anything said to you will be held in the strictest confidence unless instructed otherwise.

7. Be willing to discuss strategies or approaches that have helped you balance the demands of work, family, and personal interests.

8. Share your failures as well as your successes.

9. Give your mentee honest, thoughtful feedback.

10. It is often a mentor's job to encourage the plans of their junior colleague and to praise their instincts and work. It is also a mentor's job to offer constructive feedback intended to improve a mentee's work or situation. Ask if you can make a suggestion or offer criticism before doing so. When criticism is offered, it should be followed by mutual problem solving and plans for improvement. If possible, provide specific examples based on your experiences and expertise.

11. Over-dependence can go in either direction in a mentoring relationship. However, it is not wise for a mentee to become overly dependent on his or her mentor. Mentors should encourage their mentees to cultivate other mentors.

12. Know or be willing to investigate University resources, such as tenure relief (tenure clock pause) policies, information on the role and functioning of the Tenure and Promotions Committee, etc.

13. Prior to your first meeting, exchange CVs with your mentee to stimulate discussion about career paths and possibilities.

14. By early in the spring semester, discuss the annual performance review process, including how to prepare the necessary materials for their department.

15. Share knowledge of important university and professional events that should be attended by the junior faculty member.

---

[3] Adapted from Emory U's passages program, Brown U., and the University of Wisconsin Women Faculty Mentoring Program

THE ROLE OF MENTEES

A Good Mentee prepares for a mentoring relationship by thinking about what s/he hopes will come from it (see next page) and is specific about the kinds of support, feedback, listening, and advice that will be most helpful. Mentees should be open to feedback and willing to listen to advice, even if they decide not to act on some of their mentor's suggestions. Remember that you are ultimately in the best position to recognize and make decisions about what is in your best interest. Mentees should commit to

- Meet regularly with their mentors, establishing meeting times and modes (email, phone, in person) that work for both parties.

- Share specific accounts of professional activities and experiences, successes and challenges at NJIT, within a mutually agreed upon understanding of confidentiality.

- Follow through on tasks agreed to with their mentors.

A good mentee will recognize that no single person can meet all her/his needs. Begin to cultivate a circle of advisors that includes your cross-departmental NJIT mentor, senior and other tenure-track faculty from your home department, and respected colleagues in your field from other institutions.

WHAT ARE TENURE-TRACK FACULTY MEMBERS AGREEING TO DO?

1. Read this packet.

2. Respond promptly to your mentor's invitation for a first meeting. If you haven't heard from her/him within 10 days after notification of the "match," contact her/him.

3. Share your CV with your mentor.

4. Meet regularly with your mentor: once a month is suggested.

5. Be able to articulate what you need or want to know about University policies on tenure and promotion, work/family balance, et al.

6. Respond as quickly as you can to emails, phone calls, requests from your mentor.

7. On a regular basis, communicate with your mentor to assess whether or not the match is working. If it isn't working, have a conversation with your mentor to talk about getting a different mentor.

8. Help to evaluate the Faculty Career Advancement Network Pilot at the end of the academic year.

Prior to your first meeting, think about what you need and want from your mentor.

- Information about tenure and promotion at NJIT

- Help with career aspirations and goal-setting

- Advice about courses of action to address a specific problem

- Information about family -friendly policies and supports

- Someone with whom you can share experiences in the academy based on identity markers (gender, race, class, sexual orientation)

- Help with time-management and procrastination problems

- Perceptions of how you come across (the impression you make on others)

- Information about how to advance into academic leadership positions

- Help identifying people at NJIT who can be helpful to you, and how to approach them

- Thinking through or role-playing difficult situations that you need to negotiate

- Reassurance that you can be successful when you doubt yourself

- The relative importance of teaching, publishing, and service for faculty members at NJIT

- University evaluation processes and procedures

- Advice about participation in professional organizations and conferences

- Formulation of career goals and timelines

- Balancing personal interests and family time with life in the academy

- Help acquiring or improving skills, such as how to give a talk, how to supervise graduate students, managing classroom dynamics, etc.

- Other:

It is often useful to try to first establish a long term plan for 2-3 years or longer. Then go back and think together, what do you have to do this year and next year to be "there" in three years?

First Meeting and Parameters of the Relationship[4]*The first meeting*
Both the mentor and mentee should come to their first meeting prepared to share some of their histories in the academy (at NJIT and elsewhere). To facilitate this opening discussion, we suggest that you exchange CVs ahead of time.
Mentor and Mentee should be ready to talk about their goals for the relationship:
e.g., Why did you want to be a mentor?
Discuss confidentiality in terms of operationalizing it for your relationship.

Getting Acquainted
Following are some suggested questions for mentees *and* mentors to discuss. Each party could choose 2 or 3 questions for discussion for the first meeting, then use one question at the beginning of subsequent meetings to develop your relationship.
1. Where do you hope to be in three years? What do you need to get there?
2. How does mentoring affect academic careers? Does it matter?
3. Describe someone who has been a good mentor to you in any area of your life.
4. What does good mentoring look like? How can you find it if it doesn't occur naturally?
5. When has your gender mattered in your academic career? Race? Marital/partner or family status? Nationality?
6. Mentor, what was your tenure process like? Mentee, what are you most worried about as you anticipate your tenure process?
7. What publishing hurdles are you facing/have you overcome?
8. How does tenure clock relief for parenting play out in your department?
9. Are there faculty members in your department who are marginalized? How does this occur? What strategies might work to contribute to an atmosphere of collegiality and inclusion?
10. Have you approached a department chair or senior colleague with a difficult issue? What went well? What would you do differently?
11. What do graduate students expect/need of you in your department?
12. How do you achieve a balance between your work/research and personal demands or interests?
13. Have you felt "stuck" at any point in your academic career? (How) did you resolve the situation?
14. What is your most important career goal at the moment? How will you approach it?
15. **End your first meeting** with a discussion about the frequency of your meetings, and which modes of communication (phone, email, in person) will work for each of you.
We **recommend that mentoring pairs meet once a month,** but no less than once every two months with at least one other meeting by telephone or email.
Set a date and time for your next meeting.

---

[4] Adapted from Brown U.

THE IMPORTANCE OF CONFIDENTIALITY[5]

You should use some time in your first meeting to establish a mutual understanding of confidentiality – what it means to each party and how it will be handled. Mentoring pairs may need to revisit this as different or particularly difficult issues come up.
You might utilize these questions to begin your conversation about confidentiality.
1. Who can we talk with about our conversations? Should our names ever be used?

2. What topics or issues feel most in need of protection for the Mentee?

3. At what point might the Mentor feel s/he has to act on an issue brought up by the Mentee? In what situations would it be difficult for the Mentor to act on the Mentee's behalf?

4. Mentor and Mentee should disclose whether or not their spouses/partners are faculty members at NJIT and, if so, in which departments. Is it OK to share with spouses/partners what's discussed in Mentoring sessions – with or without the use of names?

5. Are there other confidentiality considerations or concerns for either the Mentee or the Mentor?

---

[5] Adapted from Brown University

SUSTAINING THE RELATIONSHIP

One of the central purposes of the NJIT Faculty Career Advancement Network Pilot is to make institutional processes, procedures, and practices more transparent, and to help junior faculty members clarify what is expected of them if they are to thrive at NJIT. Mentoring pairs should spend time discussing and seeking resources that will ultimately *enable the Mentee to answer these questions*:

- Are there informal as well as formal University criteria for promotion and tenure?
- What/where are they?
- Who can help to clarify my department's expectations and practices?
- What if procedures meant to ensure the consistent and coherent application of those expectations and practices are not being followed?
- How is teaching reviewed and evaluated at NJIT?
- What teaching resources have you found helpful?
- How is service to the University evaluated?
- How is professional organization membership and participation evaluated?
- What are the powerful and relevant University committees?
- Who sits on those committees? How are faculty selected for those committees?

Below are some areas for further suggestions for discussion topics. It is a good idea to revisit these from time to time, to see if the tenure-track faculty member's needs are being met. Decide which areas of concern you can address together, and in which areas the mentee will need to seek out other senior faculty mentors and/or peer mentors.

- Identification and development of career goals
- Balancing personal interests, family life, and work
- Skills (how to give a talk, how to supervise graduate students, managing classroom dynamics)
- Time Management
- Advice on relevant University policies and processes
- Strategies for promotion
- Gender, race, identity in academia
- Publications and writing
- Professional development (organization or society membership, conference attendance)
- Funding resources and support at NJIT

CHANGING MENTORS OR ADDING ADDITIONAL MENTORS

If the Mentoring Match Doesn't Work
If the mentee wants assistance in an area in which the mentor does not feel confident giving advice, the mentor can help the mentee find additional resources. The mentee should be encouraged to take the initiative to approach another person for advice in that specific area, or the mentor may make a contact with a mutually agreed upon person within or outside the mentee's department. It may be advantageous to have more than one mentor.

In cases of changing commitments, incompatibility, or where the relationship is not mutually fulfilling, either the new faculty member or mentor should seek confidential advice from the ADVANCE PI, Nancy Steffen-Fluhr. It is important to realize that changes can and should be made without prejudice or fault. The new faculty member, in any case, should be encouraged to seek out additional mentors as the need arises.

MENTORING WORKSHEET[6]

This might be good to fill out mid to late spring, 2012 to keep track of a list of goals developed during the first meetings.

Mentor: _____

Mentee: _____

Date of Meeting: _____

CV Reviewed: ☐ Yes   ☐ No

Goal: Teaching   ☐ Goal met   ☐ Making Progress   ☐ No

Accomplishments: _____

_____

_____

Obstacles: _____

_____

_____

New goal or strategy to overcome obstacles (if needed): _____

_____

_____

Goal: Research   ☐ Goal met   ☐ Making Progress   ☐ No

Accomplishments: _____

_____

_____

Obstacles: _____

---

[6] Adapted from Emory University and UC Cal Davis

_____

_____

New goal or strategy to overcome obstacles (if needed): _____

_____

Goal: Service   ☐ Goal met   ☐ Making Progress   ☐ No

Accomplishments: _____

_____

_____

Obstacles: _____

_____

_____

New goal or strategy to overcome obstacles (if needed): _____

_____

Goal: Networking   ☐ Goal met   ☐ Making Progress   ☐ No

Accomplishments: _____

_____

_____

Obstacles: _____

_____

_____

New goal or strategy to overcome obstacles (if needed): _____

_____

Goal: Work/Life Balance   ☐ Goal met   ☐ Making Progress   ☐ No

Accomplishments: _____

_____

_____

Obstacles: _____

_____

_____

New goal or strategy to overcome obstacles (if needed): _____

_____

Goal: OTHER   ☐ Goal met   ☐ Making Progress   ☐ No

Accomplishments: _____

_____

_____

Obstacles: _____

_____

_____

New goal or strategy to overcome obstacles (if needed): _____

_____

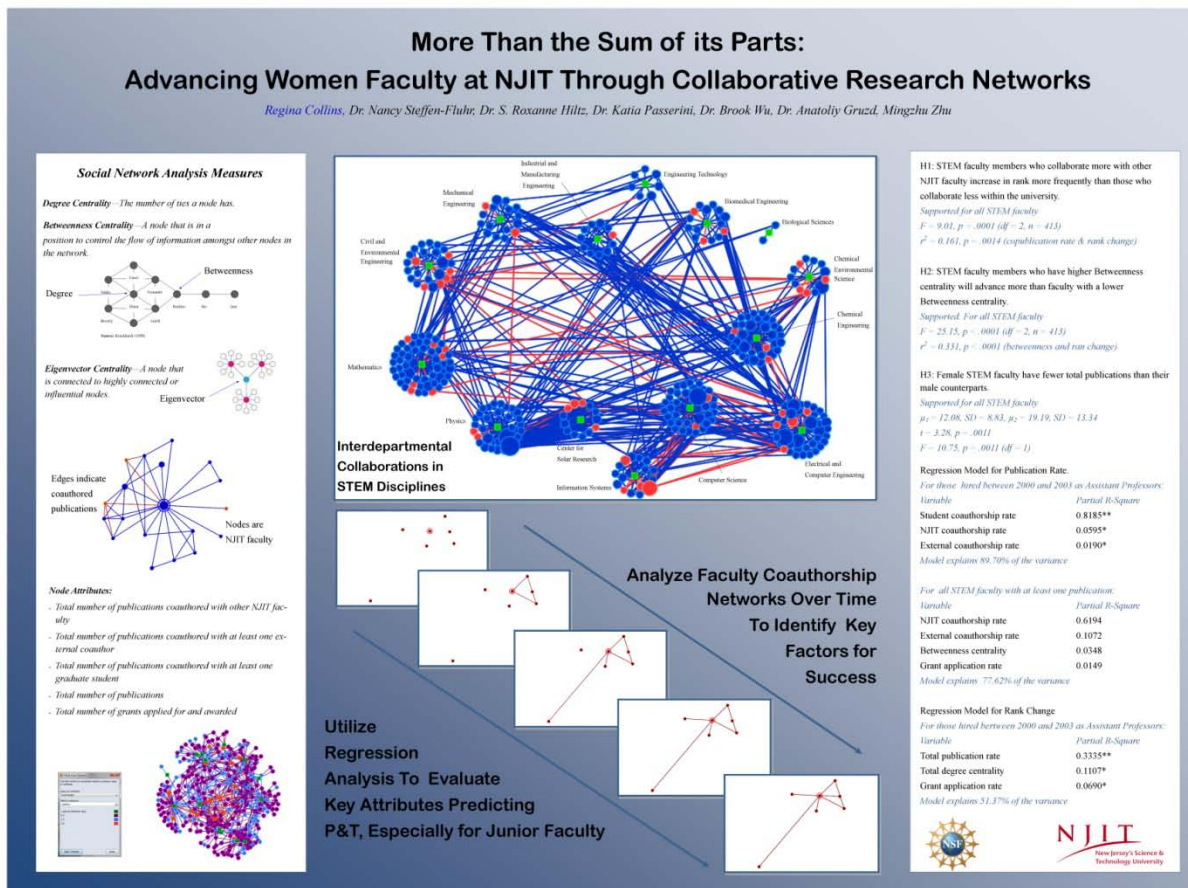# APPENDIX 8

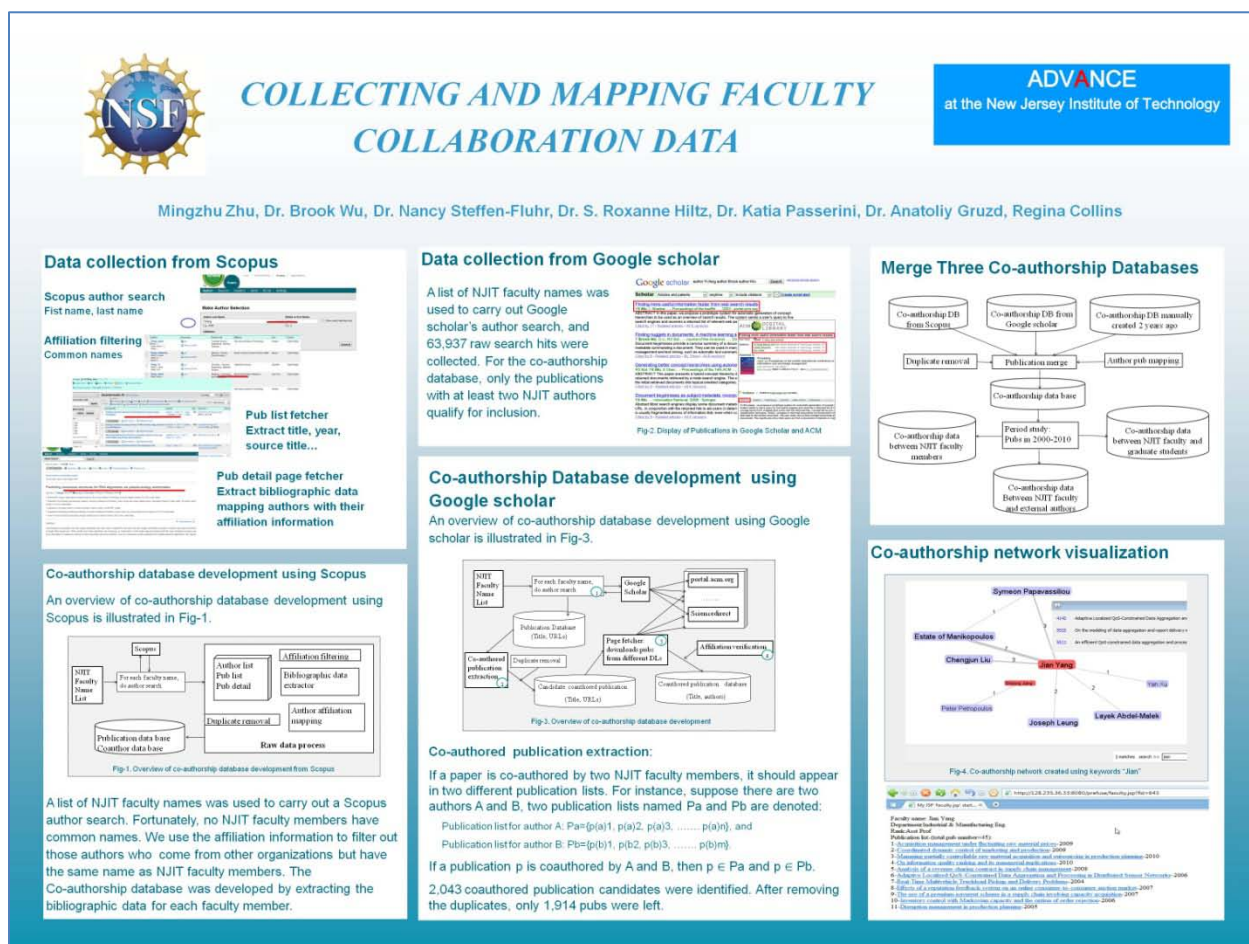## Poster Presented at NSF ADVANCE PIs Meeting

November 2011

Alexandria, VA
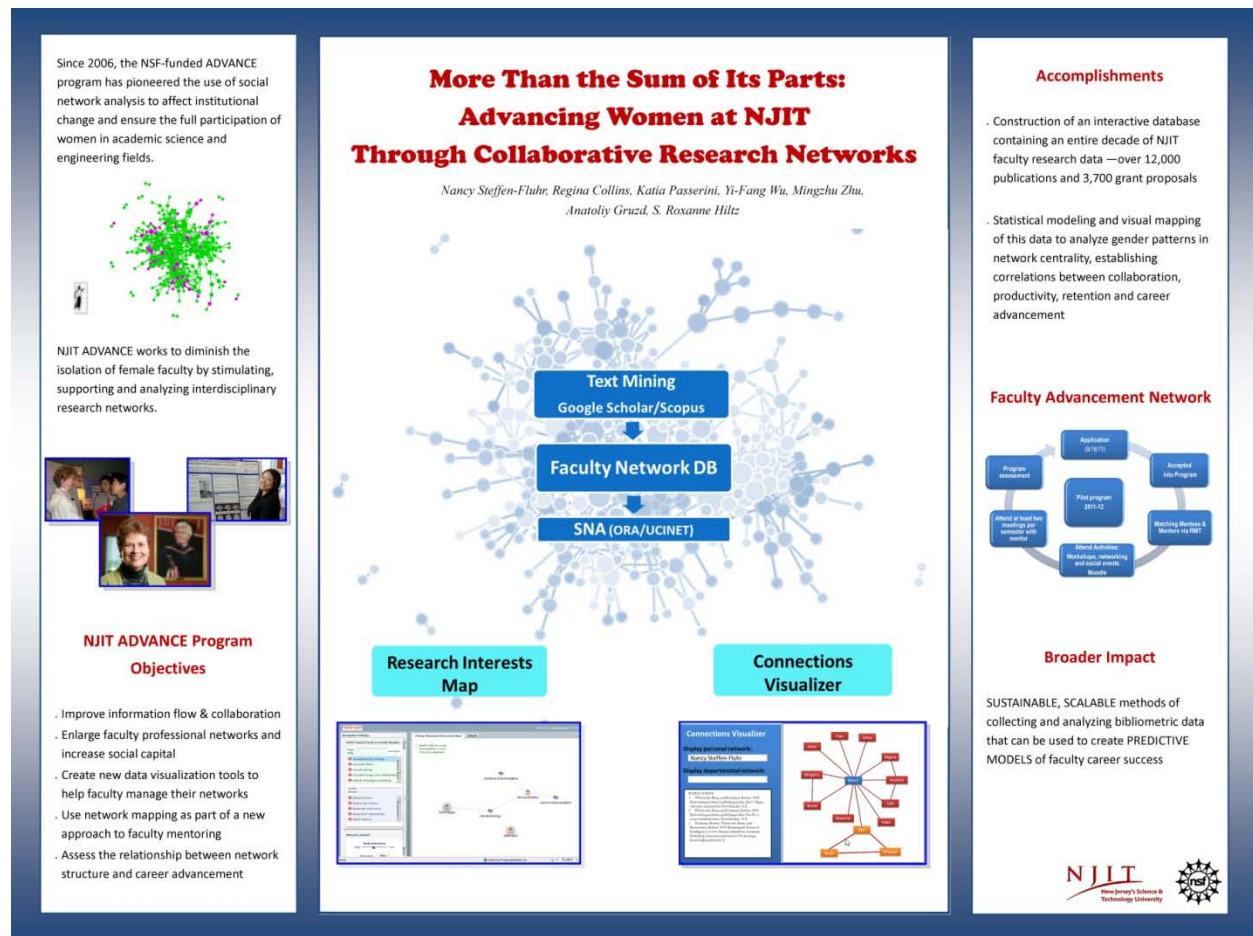
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Poster Presented by Regina Collins at

The ADVANCE Research Showcase (March 2012)
and
The Dana Knox Research Showcase (April 2012)

APPENDIX 10

Poster Presented by Mingzhu Zhu at

The ADVANCE Research Showcase (March 2012)
and
The Dana Knox Research Showcase (April 2012)

APPENDIX 11

Leveraging Social Network Data to Support Faculty Mentoring:
Best Practices from NJIT Advance

Nancy Steffen-Fluhr, Regina Collins, Anatoliy Gruzd, Mingzhu Zhu, Brook Wu, Katia Passerini

NJ Institute of Technology (NJIT)/NJIT/ Dalhousie University/NJIT/NJIT/NJIT

"The Old Boys Network" used to be a metaphor, signaling hidden inequalities. Now it is a map--a web-like highway on which we can track the flow of social capital from one human node to another. At the NJIT Advance Project, funded by a grant from the National Science Foundation, we are learning how to read that map and to transfer our navigational ability to young faculty and university change agents. In broad terms, the goal of NJIT Advance is to demonstrate that social network analysis can be used to affect institutional transformation, ensuring the full participation of women in academic science and engineering. Our specific objective is to develop predictive models of faculty career success as part of a novel, network data-driven approach to faculty mentoring. In this paper, we discuss the methodology we have used to collect and analyze faculty network data over the past decade (2000-2010) and demonstrate how we are making that data available to faculty mentors and mentees through two new mapping tools: the *Research Interests Map* and the *Faculty Connections Visualizer*.

The roots of this project go back to 2005 when research for our *Status of Women Faculty Report* made it clear that at NJIT, as at other similar institutions, women felt isolated, outside the information loop. In our initial grant, we addressed this issue by stimulating greater interconnectivity among researchers and, simultaneously, studying existing patterns of interconnectivity. The good news, seven years later, is that many of the gender differences suggested by our preliminary data seem to have diminished. Our most recent analysis (presented in greater detail below) shows that there are no statistically significant differences between female and male retention. Men and women are promoted in rank at essentially the same rate as well. These local results are consistent with national data. A 2010 study published by the National Academies Press, *Gender Differences at Critical Transitions in the Careers of Science, Engineering, and Mathematics Faculty*, concluded that, "For the most part, men and women faculty in science, engineering, and mathematics have enjoyed comparable opportunities within the university, and gender does not appear to have been a factor in a number of important career transitions and outcomes" (p. 23). A more recent longitudinal study of 2966 science and engineering faculty from 14 universities drew much the same conclusion: "Overall, men and women are retained and promoted at the same rate" (Kaminski and Geisler, 2012, p. 864).

This good news tends to obscure some very troubling data, however. Despite apparent progress in equity, the gender composition of the academic STEM workforce is still profoundly different from the human population it serves. And likely to remain so. Despite slightly improved hiring rates for women (up from 25% to 27%, according to Geisler), retention failures for both men and women are so frequent, especially at the assistant professor level where the 11 year attrition rate is 50%, that " it may take 100 years before women are 50% of the faculty in STEM departments" (Kaminski and Geisler, p. 866). At NJIT, where the 2001-2010 hiring rate for female STEM faculty was only 17.8%, it may take forever!

When the results of the Kaminski/Geisler study were announced in *The Chronicle of Higher Education*, readers inundated the E-journal with cynical comments, the gist of which was "So what?" The notion of *equality* is a lot easier to sell than the notion of *parity*. And yet parity is profoundly important. For one thing, trying to solve important problems using only half of the

1

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APPENDIX 12

ADVANCE OVERVIEW (PPT) PRESENTED TO PROSPECTIVE FACULTY CAN MENTEES

16 September 2011
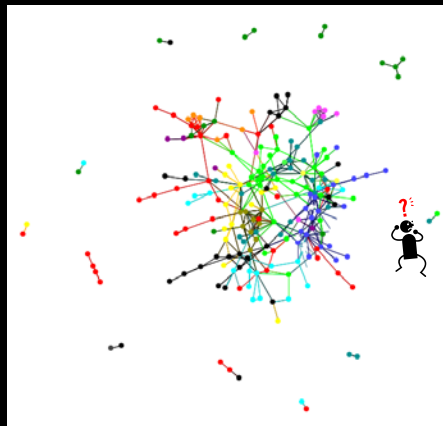
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**PRESENTATION (PPT) BY CONSULTANT SUSAN S. METZ
& THE ADVANCE TEAM
TO THE FACULTY CAN MENTORS**

27 January 2012

APPENDIX 14

OVERVIEW OF RELATIONSHIP BETWEEN COMPONENTS OF NJIT ADVANCE NETWORK PROJECT