Vulnerable heroes: Problematizing metaphors of male socialization in engineering

Dr. Prashant Rajan, Iowa State University
Charles T Armstrong, Purdue University
Elizabeth J. O'Connor , Ketchum Change
Prof. Patrice Marie Buzzanell, Purdue University, West Lafayette

Patrice M. Buzzanell is a Professor in the Brian Lamb School of Communication and the School of Engineering Education (courtesy) at Purdue University. Editor of three books and author of over 150 articles and chapters, her research centers on the intersections of career, gender communication, leadership, and resilience. Fellow and past president of the International Communication Association, she has received numerous awards for her research, teaching/mentoring, and engagement. She is working on Purdue-ADVANCE initiatives for institutional change, the Transforming Lives Building Global Communities (TLBGC) team in Ghana through EPICS, and individual engineering ethical development and team ethical climate scales as well as everyday negotiations of ethics in design through NSF funding as Co-PI. [Email: buzzanel@purdue.edu]

Dr. Rebecca L Dohrman, Maryville University

Rebecca Dohrman (Ph.D. Organizational Communication, Purdue University) is an Assistant Professor of Communication at Maryville University - St. Louis.

Dr. William "Bill" C. Oakes, Purdue University, West Lafayette

William (Bill) Oakes is the Director of the EPICS Program and one of the founding faculty members of the School of Engineering Education at Purdue University. He has held courtesy appointments in Mechanical, Environmental and Ecological Engineering as well as Curriculum and Instruction in the College of Education. He is a registered professional engineer and on the NSPE board for Professional Engineers in Higher Education. He has been active in ASEE serving in the FPD, CIP and ERM. He is the past chair of the IN/IL section. He is a fellow of the Teaching Academy and listed in the Book of Great Teachers at Purdue University./ He was the first engineering faculty member to receive the national Campus Compact Thomas Ehrlich Faculty Award for Service-Learning. He was a co-recipient of the National Academy of Engineering's Bernard Gordon Prize for Innovation in Engineering and Technology Education and the recipient of the National Society of Professional Engineers' Educational Excellence Award and the ASEE Chester Carlson Award. He is a fellow of the American Society for Engineering Education and the National Society of Professional Engineers.

Dr. Carla B. Zoltowski, Purdue University, West Lafayette

Carla B. Zoltowski, Ph.D., is Co-Director of the EPICS Program at Purdue University. She received her B.S. and M.S. in electrical engineering and Ph.D. in engineering education, all from Purdue University. She has served as a lecturer in Purdue's School of Electrical and Computer Engineering. Dr. Zoltowski's academic and research interests include human-centered design learning and assessment, service-learning, ethical reasoning development and assessment, leadership, and assistive technology.

Vulnerable heroes: Problematizing metaphors of male socialization in engineering

Abstract

While extensive research and intervention has occurred over the past two decades to ameliorate the underrepresentation of white females and, male and females of color in STEM disciplines, less attention has been paid to the experiences of male STEM students and professionals. The present study sought to explore the mentoring socialization experiences of males in STEM disciplines. An inductive thematic analysis of interviews with 25 males studying and working in STEM disciplines suggests that a multiplicity of d/Discourses influence how these males experience and construct mentoring. Furthermore, these d/Discourses can constraining for males similar to how the literature suggests they are for females. A two-dimensional typology of mentoring models is presented.

Introduction

Improved mentoring and socialization of female students are critical for increasing women's participation and advancement in engineering disciplines and careers.[1] For instance, Scholars studying career decision-making and vocational socialization of women engineers have: (a) drawn attention to the prevalence of masculine tropes in engineering schools' mission statements,[2] (b) related the dominant disciplinary and occupational stereotypes to women's disciplinary and career preferences,[3] and (c) explained a woman's choice to build her career in engineering professions requires negotiating the masculinist cultures that prevail in contemporary organizations involved in educating, training and hiring from the workforce that has received tertiary engineering education.[3,4] Such examples have sought to improve the socialization and mentoring experiences of women engineers by highlighting the origins and nature of deterrents to the enrollment and advancement of women in engineering.[5] Key conceptual tools such as *chilly climates* and *tokenism* have equipped faculty, students and administrators alike to recognize and articulate the subtle and not-so-subtle ways in which discrimination and isolation are enacted in engineering programs.[5] Diverse formal and informal initiatives have emerged across campuses to increase the recruitment and retention of women engineers.

Meanwhile, the enduring academic and anecdotal image of male engineers' mentoring circumstances and socialization experiences is the *heroic journey*.[6, 7, 8] Male engineering students are constructed as heroic protégés who are tested by stoic mentors on their ability to handle stressful situations and accomplish tasks independently without nurturing or care.[7, 8] Tasks are typically interpreted under the heroic metaphor as challenges that emphasize individual achievement over cooperation.[8] Such challenges presumably leverage the instrumental and technical motivations of male engineers who prioritize individual achievement over collaborative endeavors that would require integration into larger groups.[9] The heroic metaphor suggests that male engineers are independent actors who engage in solitary efforts that are driven by instrumental and technical self-interest.[7,9]

The expansion of research on women engineers' perceptions and experiences has yielded valuable data that naturally calls for analyses involving: (a) examinations of, and, (b) points of comparison with the dominant *male* experience with tertiary education and professionalization in engineering disciplines. Yet, few recent studies have examined or sought to generate data with the objective of providing points of comparison between male and female engineers' mentoring and career socialization discourses or focused analyses of male engineers' discourses. We report on results from the second leg of a two-part research study designed to address this gap in comparative gender analyses of mentoring and career socialization discourses. The present analysis is motivated in part by results from a previous comparative analysis[10] of the aggregate dataset comprising interviews with 45 women and 24 men who participated in the study. These results are discussed in the next section describing the background to the present analysis.

Results from an inductive analysis of transcripts from interviews with 11 white male engineering students and 14 students representing non-white racial identities indicate first that male engineers' experience mentoring in a variety of informal and formal settings. Second, male engineers struggled initially to connect the concept of mentorship to their mentoring experiences. Over the course of the interviews, they were able to provide examples of specific individuals including family members, peers, teachers and supervisors as role models and mentors. Third, male engineers did not describe mentoring solely as an instrumental or task-focused exercise,[7,8] Engineers reported mentoring experiences in both relational and task-oriented terms and often emphasized the relational aspects and benefits to having a mentor. Overall, their acknowledgement of mentoring while struggling to initially recall such experiences and later emphasizing their feeling of being highly self motivated and autonomous reflected the autonomy-connectedness dialectic. In the following sections we briefly review the literature on careers, career socialization and mentorship.

Background

Previous research on female engineers' mentoring and career socialization discourses

A study focusing on the nature of men's careers in STEM disciplines has merit beyond generating data to use as a comparison point for female participants' data. The association of sex and gender with women allows men to go un-gendered and thereby avoid being subject to critique.[11] The taken-for-granted nature of male educational and professional experience renders it frequently invisible and under-explored.[11,12] We analyze male engineers' talk to demonstrate that men have and *do* gender, as well.[12] Furthermore, the lack of scholarly attention to racial diversity among male engineers and the increasing participation by international students in engineering disciplines provided a rationale for examining whether conventional articulations of male mentoring and career socialization experiences remain as instrumentally driven and task-focused as has been suggested by past research.[7,8]

In a previous analysis, we have demonstrated that men's discourses are often devoid of acknowledgments of their structural privilege and emphasize their identities as autonomous decision makers.[10] Concomitantly, male engineers' discourses portray engineering as an elite field where only the intellectually tough could survive.[10] Additionally, there was a sense across all our male participants that becoming an engineer required a high degree of self-motivation and a natural inclination toward "hard" sciences and mathematics.[10] Females were often viewed in subtle and exclusionary terms as peers who were (a) "differently" abled and interested with a

possible preference for the visual and aesthetic and lacking quantitative and, (b) in need of female role models and additional institutional support in contrast to self-motivated, hard working and independent male counterparts.[10] While some male engineers acknowledged that social norms and stereotypes might inform female preferences for learning to be engineers, they too did not did not exhibit an understanding of the need for programmatic recruitment and retention efforts directed toward females. Such efforts were spoken of as if they functioned as an unnecessary crutch for less motivated and less capable candidates.[10]

On the other hand, discourses of women engineers suggested that women relied on their positive recall of past task performance, drew inspiration from female role models, and benefited from verbal encouragement when seeking to achieve higher self-efficacy levels.[10] While male personalities figured prominently in the discourses offered by female engineers, females remained largely absent from male engineers talk, except when responding to questions that explicitly probed their perspectives on female engineers. Beyond demonstrating that a subtle sexism is manifest in male engineers' talk, our interest remained in: (a) situating such articulations in the career socialization and mentoring literature, (b) providing a more nuanced approach to understanding how male engineers construct themselves and others within the status quo, and (c) identifying transformative possibilities that require change in dominant category's members' discourses as opposed to finding institutional remedies or defining female attributes as being in need of modification. Therefore, we conducted further analyses of the interview data obtained from male participants.

Careers, Socialization & Career Socialization

Career has been understood in both individual, psychological terms and interactive, sociological terms. Psychological theories tie individual development to career development, typically emphasizing how the latter provides a stage for the former. While not neglectful of the individual nature of careers, nor of the importance that careers have for individual development, sociological conceptions connect career development to larger social structures. Specifically, sociologists have viewed career as a process of socialization. Socialization, "describes the process by which a person enters a social structure",[14] and in Brim's formulation, "refers to the process by which persons acquire the knowledge, skills, and dispositions that make them more or less able members of their society".[14] Society exists at multiple levels--family, community, organization, profession, and so on. So too do socialization processes, leading to the notions of organizational and career socialization. Thus, sociological conceptions of career situate individual experience in larger social structures.

The theoretical foundations for viewing career as socialization go back at least as far as Becker and Strauss, who argued that for workers in the modern West, work and work organizations are foundational, formative social structures affecting individual experience and identity.[15] Similarly, career experiences are life-long sources of personal meaning, a dynamic that organizations reinforce in their search for--and active socializing of--committed members. In short, modern experiences of career and work have much to do with identity, and vice versa. In fact, work, career, and the employing organization have previously constituted a closely intertwined set of experiences. That is, it was common for one's experience of career to play out in a single organization, doing a relatively consistent form of work. The others would necessarily

definitively influence one's experience of work, career or an employer.

In recent decades, however, globalization, increased worker mobility, and organizational restructuring have largely separated the individual strands of work, employer, and career.[16] This has led to reformulations of career, moving away from models that assume organizational stability to those that presuppose some amount of fluidity, change, and discontinuity, i.e., "boundaryless careers".[17] As Sullivan wrote,

> Whereas the traditional career was defined as professional advancement within one or two firms, a boundaryless career is defined as "...a sequence of job opportunities that go beyond the boundaries of a single employment setting". Rather than developing a long-term fit within, and commitment to, a single employer, the new career involves continual or periodic search, pursuit, and selection of new opportunities.[16]

That is, some of the hallmarks of a boundaryless career include: portable skills, knowledge, and abilities across multiple firms; [17] personal identification with meaningful work; [18] on-the-job action learning; [19] the development of multiple networks and peer learning relationships; [17] and individual responsibility for career management. [17, 20]

In light of these developments, career socialization has become more fragmented and complex, and Hall's definition of career socialization is all the more appropriate: "a 'bundle' of socialization experiences, as the person moves in, through, and out of various work-related roles".[17] The image of 'bundling' effectively captures the lack of 'neatness' in contemporary careers, which are characterized by flux and instability. In the relative absence of orderly, predictable career paths up the hierarchy of a single firm, models of a career as a linear sequence of positions held are increasingly inadequate.

As Buzzanell and Goldzwig argued, linear, hierarchically oriented conceptions of career have a limiting and dehumanizing effect, as they reinforce managerial control, external (rather than personal) definitions of success, and bureaucratic/hierarchical organizational forms.[21] They suggested alternative, non-linear models whose chief merit would be the opportunity to regain control over assigning meaning and value to one's career, on one's own terms, not the organization's.[21] The question emerges, then, of what career socialization looks like given the increased personal agency advocated by Buzzanell and Goldzwig in the face of the broad changes identified by Sullivan and others.[16]

One avenue for answering this question is to explore the discourses surrounding mentoring. In her review of the literature, Jacobi defined mentoring as a personal, reciprocal relationship between a protégé and someone of greater experience or accomplishment who helps the protégé toward some achievement(s) by providing psychological/emotional support, career or other instrumental help, and role modeling.[22] Mentoring has been considered to be critical to successful socialization into organizational life.[23] Hill highlighted two themes that he found to be common across the mentoring literature: (a) mentoring is necessary for career success and (b) women often are restricted in forming mentoring relationships.[17] Mentoring is a gendered phenomenon, in that opportunities and norms for mentoring, experiences of mentoring, and outcomes of mentoring produce and reproduce taken-for granted gender ideals, practices, and patterns.[24] The literature suggests that mentoring not only aids individual career development, but also fits the individual to the social structures relevant to work (e.g., organization,

profession), and that it does so in different ways for men and women. Scholars have made progress in identifying or locating the processes through which women are socialized into gendered work, but less is known about how men are likewise socialized into gendered experience of work and career. The present study addresses this deficiency with particular attention to the discourses that define male engineers' mentoring experiences and thinking. Thus for the purposes of this paper, we raise the following research questions:

RQ1: How do participants construct mentorship?
RQ1a: Who are identified as potential or actual mentors?
RQ1b: What are the professional and educational contexts in which participants experience mentorship?

Method

Participants

A total of 25 male undergraduate and graduate engineering students from a large, midwestern university participated in the study. From an initial pool of personal contacts, researchers utilized snowball-sampling methods to create "chains of referral".[25] We attempted to diversify our interview pool to reflect the various disciplines of engineering by utilizing additional recruitment methods because sampling through "chains of referral" can lead to a bias toward selecting interviewees who share homogenous attributes such as backgrounds or preferences,[25] These methods included posting recruitment flyers in campus buildings (See Appendix C), attending engineering student organization meetings, and offering extra credit for engineering students participating in a service learning academic program where they worked to provide technology solutions to local not-for-profit community organizations.

Participants represented a wide range of engineering disciplines, as well as diverse ethnicities and nationalities. Table 1 provides an overview of participant demographics (Appendix D). Of 14 participants were U.S.-born students and 11 were students represented non-U.S. nationalities. The students born in the U.S. represented variety of ethnicities including European American, Indian American, and African American. International students were from India, Malaysia, Thailand, Nicaragua, Pakistan and Trinidad & Tobago. Engineering disciplines represented include civil, chemical, aerospace, industrial, mechanical and electrical/computer. Referring to participants by pseudonyms and removing any identifying information regarding the university and academic programs whose members were invited to participate in the study helped maintain the confidentiality and anonymity of participants' response.

Procedure

Each of the 25 participants completed a semi-structured, one-on-one interview (Appendix C) with one of the two male members of the research team, mirroring the female-to-female interviews of the original study. In both studies, the researchers adopted this approach in order to avoid any reservations by participants to respond candidly, especially with regard to questions explicitly related to gender. The interview protocol replicated the one used in the original study of female engineers, altered so that two gender-specific questions reflect male interview participants. All interviews but one were audio recorded and transcribed, resulting in 241 pages of single spaced text. (One interview was not recorded to due a technical malfunction.) The

average interview was approximately 45 minutes. Interview transcripts were coded and analyzed separately and collectively by all three researchers.

It is important to note the diversity of the three-person research team that conducted this project because researchers are the instruments in qualitative research.[26] Triangulation can serve to clarify meanings and verify the repeatability of observations and interpretations during data analysis.[27] Involving multiple perspectives enables the researchers to understand various ways the data is being interpreted.[27] The members of our research team have notably divergent backgrounds and life experiences that shape how data were interpreted and analyzed. The authors who conducted analysis included *male analyst 1*: a 27-year-old, married Ph. D. student from India who completed his undergraduate degree in polymer engineering from India and obtained a Master's degree material science and engineering in the United States, *male analyst 2*: an American born, 29-year-old Master's student with an undergraduate background in the humanities, also married and father to a 21-month-old son, and *female analyst*: an American born 23-year- old Master's student who self-identified as a feminist. Both the male analysts had worked full-time jobs before returning to school to pursue advanced degrees, while the female analyst transitioned from her undergraduate degree in communication into the Master's degree program at the same university.

Our differences in age, gender, life experiences, and the various social roles we fulfill enabled our team to tease out a multiple possible interpretations of the data. Male analyst 1's experience as an engineer and an international engineering student, led him to approach the data from the perspective of an insider and an outsider, often relating participants' responses to his own experiences. Male analyst 2's roles as husband and father often lead him to examine to how participants' comments related to expectations of being a provider for their current or future families. The female analyst's separation from the participants, both through gender and physically not conducting any interviews lead her often to think in terms of which aspects of participants' responses were shaped by gender. Taken alone, each researcher brought their own values, beliefs, and biases to the qualitative analysis, but together, through rigorous coding and analysis procedures, our diversity among researchers lead to a dynamic and fruitful reading of the data. As proposed by Barry, Britten, Barber, Bradley, & Stevenson, "reflexivity employed as a team activity, through the sharing of reflexive writing... and group discussions about arising issues, can improve the productivity and functioning of qualitative teams and the rigor and quality of the research".[28]

With the goal of generating a thorough understanding of the common patterns and themes of the experience of male engineers, the researchers conducted an inductive thematic analysis of the interview data. Guided by Owen's criteria for thematic analysis-- recurrence, repetition, and forcefulness --three specific coding procedures were utilized. The coding procedures are known as open, axial, and selective coding.[29] First, data was broken apart and organized through *open coding*, known as the "initial, unrestricted coding of data".[25] Using our first 5 transcribed interviews, each researcher individually coded as many categories from the data as possible. During this time, unaware of what the final themes and categories may be, researchers were open to all possibilities and all interpretations remained tentative.

Next, the researchers came together to discuss emerging themes and patterns of experience among participants. During this time, *axial coding* was employed by the researchers to refine

categories, make connections between categories, and create new categories or themes that span several. Our axial coding process broke down an initial list of over 60 categories and themes into approximately 25.

After reaching consensus, we created a coding scheme, an agreed-upon guide of how to code various incidents in the data. We then returned individually to the initial 5 transcripts and recoded them following this coding scheme and came together again to verify our findings and ensure we were coding similarly. As additional interviews were transcribed, we divided them between each other and coded them individually until every transcript had been analyzed and coded by one, two, or all three researchers. Throughout, the process remained iterative, allowing incidents and patterns in the new data to be grouped with previously identified themes and categories, or to create new ones.

During the coding process, the constant comparison technique was utilized.[30] By continually comparing each new incident to other incidents in the data for similarities and differences, researchers can group conceptually similar incidents into categories. Such comparison is crucial for all analysis because it allows researchers to separate one category or theme from another and to identify unique properties of a particular category or theme.[30]

Once all transcripts had been analyzed and coded, the researchers engaged in the final phase of *selective coding*. During this time, the researchers came together to merge and solidify all findings into core categories and to finalize themes.[30] Three overarching themes were found in the interview data: (1) Influence and Independence, (2) Convergent and Divergent Career Discourses, and (3) Wanting More. Two of the three themes, Influence and Independence and Wanting More, emerged consistently in the category of mentoring, which is the focus of this paper.

Results

Our analyses indicate that male engineers' perceptions of mentoring may be analyzed in terms of: (a) the interactivity of their mentoring relationships, and, (b) the extent to which they integrate task and relational aspects of mentoring. Male engineers' varied descriptions of mentoring relationships included observations of individuals sans direct interaction, and, close relationships that involved direct and frequent interactions. Among participants who described direct interactions, variations were observed between engineers who compartmentalized mentoring relationships as task-focused, relationship- centered, or integrative of both task and relational aspects. We present a two-dimensional typology of mentoring mindsets that combine the extent of integration and interactivity to locate participants' conceptualizations of actual and potential mentoring relationships. We argue that the extent of integration in relational and task-oriented terms and the level of interactivity in mentoring relationships reflect dialectical tensions articulated by participants in their career discourses. In the following section we highlight the main findings from our interview data in response to the research questions on the sources of mentorship and contexts in which mentoring is experienced.

Contexts of Mentoring

Research questions two and three asked who are identified as potential or actual mentors and in what social and temporal contexts participants experience mentorship. These questions were answered by participants in response to specific questions that asked them to identify individuals who they thought were mentors or fulfilled mentor-like roles and to discuss the nature of such relationships. Other questions that probed participant mentoring experiences asked participants about (a) who they went to for answers about their work or their career, and (b) experiences when someone explained what was expected of them in a particular position, or provided valuable work or career information. Additional information on individuals who might have acted in a mentor- like capacity was also obtained from participant discourse about the factors that motivated their decision to pursue education in the engineering disciplines.

When asked to give examples of mentors or relationships that helped them with career- related decision-making, participants cited a wide range of individuals and groups including parents and other relatives, university professors, senior and graduate students in their discipline, peers, superiors at traditional and academic workplaces, teachers in middle and high school, friends, and individuals from local communities and outreach programs. Nearly half the participants described parents and family members as mentors or engaging in mentor-like behavior. Parents were most often identified as being supportive of career or education-related actions. This support was borne out in two ways. First, some participants appreciated the manner in which parents encouraged them to be independent and make career and educational decisions without overtly trying to steer them toward possible educational or career options. For example, Tarrin valued his parents' supportiveness toward his decision to pursue aerospace engineering in spite of their lack of knowledge about the discipline. He appreciated the fact that his parents were available to listen to him:

> I mean I talk to my parents sometimes. But since both of them are not in engineering, they don't know much, but they're really supportive of my decisions so that's nice. And I guess it's kinda nice to have someone to talk and sometimes you don't really need an answer, but just someone to listen.

Dan echoed Tarrin's thoughts about parental support when he said:

> My parents have always been supportive and helpful in everything that I've talked to them about, but like I said, I think they really did a good job and they really tried to not influence me and not try to mold me into something that they wanted to see. Rather, they gave me broad insights that I should look for and kind of let me figure it out.

Other participants explicitly identified one or both of their parents as mentors or fulfilling mentoring roles by attributing their career-related decisions to them:

> I would say my father if I had to pick one. Um and my cousin. I would say mostly my father. My career choices have been mostly because of my father (Rishi) Well, I guess my father. He'd probably be the main guy. That's about it otherwise. Actually he was big in my deciding on electrical engineering. (Jeremy) When asked if he had ever had a mentor, Rishi described how his family filled this role to a limited extent: "… my family. I guess I take them as a mentor, so I'd have to say 'yes,' they would be my mentors; as far as like directly in chemical engineering, not really."

In addition to parents, other relatives were cited as fulfilling mentor-like roles. Some participants

looked to family members and family friends with relevant experience for social support when they had questions about their career. Rajit talked about the specific role his uncle played in helping him understand his responsibilities as an engineering student:

> My uncle. He really helped me understand what I'm here to do, why I'm here… And he guided me in the right direction, you know? Like why did I come to a school? Why did I come to [this] university? What is my role here?

Participants especially valued career advice from relatives who were engineers themselves. When asked who he spoke with when he had questions about his career, Rudra said:

> It's usually someone who has a feel for this idea or something like that. I'll speak with my uncle as well. I mean, he went to school and grew up in India, but he moved to the U.S., went to grad school, and he works here and he's quite accomplished. He's retired now. He was also an engineer. He's someone whose opinion I can know that he knows what he's talking about.

More than one third of participants touted professors at the university as having played a mentor-like role. Professors were described as mentors for different reasons in a variety of contexts. Participants spoke about their observations of professors' teaching and research practices in addition to their professors' explicit advice. Diallo talked about how he came to perceive certain professors as mentors by observing them in class and desiring to emulate their work ethic:

> I found some professors just standing out. They are mentors in the sense that I looked up to them, I admire their style, and I tried to replicate some of the way they operate, and you know, they are like the benchmark standard, so to that respect, they are mentors.

Sabir thought of his professor as having been a mentor in terms of the guidance and professional support she provided by writing recommendations for him:

> She really guided me through undergrad, you know, advising me on classes and all of that. And in grad school, as well, she has been really, really helpful. To get me into grad school, she was really helpful. I think she wrote really good recommendations for me.

Tarrin looked to his professors for guidance on long-term career-related issues, saying, "When I have questions about long-term career and whatnot, I normally go to a professor that I trusted." Walter likens his graduate program advisor, also a professor, to a mentor for helping him create a plan of study, but he goes on to appreciate his advisor's ability to engage with him at a more informal level, "It's nice, too, like he usually pops into the office and just talks about general things." Dan shared his experience of mentorship through observation of his academic service learning community advisor, also a professor, and said:

> I guess one mentor I've had is my academic service learning community advisor... he's given me a lot of not explicit advice, but just sort of observing the way that he does his job and the way that he deals with people has really affected me... I think he has showed me how to, like I said, be respectful to people in general... But I guess more than anything, I've observed his professionalism and work ethic.

Thus, participants relayed experiences of mentorship with professors through observation, direct guidance and support--related to both academics and general life, and engagement on formal and informal levels.

Academic seniors, such has upperclassmen and graduate students, were another source of

mentorship in the academic context for some (one fifth) of the participants in the academic context. Participants noted the potential for academic seniors to prepare them for their majors even before they started attending university as well as sharing experiential knowledge. Michael noted the importance of benefiting from the experience of enrolled students before he entered college:

> If you come and you talk to a professor, you talk to a department head, you know they're going to feed you the company line, but it's when you really talk to the students and see how they like it or if they do or who do avoid or who to try to work for, that's what becomes really, really helpful.

Tarrin recounted his experience with a student planning a double major in aerospace engineering and applied physics:

> When I was a freshman there was like this guy who was in aero and also double majoring in physics and my advisor gave me his contact information. And he was really nice. He gave me, like, his study plan, and tell me like you know, what class I should take and stuff like that. So that was really nice to know that they did before I did. But I- I never really met him in person, but I think of him as a mentor in the sense that he gave me information and tell me that it actually can be done, to get a double major and stuff like that.

Other participants experienced academic seniors as mentors in terms of the guidance they provided with respect to making career-related decisions and imparting skills for class or project related material. Thus academic seniors provided mentorship to the participants by sharing their experience and knowledge about academic and career related options and helping participants to develop expertise on specific tools by training them.

In addition to academic seniors, participants also cited peers as a source of mentorship. Peers are individuals with whom participants share common academic responsibilities and goals such as majors, classes, and projects or assignments or individuals whom the participant considers to be a friend. The assumption that friends be considered as peers is acceptable given that references to friends in participant narratives referred ostensibly to individuals who belonged to the same generation as the participants. Shared objectives and responsibilities allowed participants to discuss specific issues such as the implications of academic choices on access to future opportunities in education and career. Dinar's comments on mentorship reflect this view of peers as mentors: "Mentors? Uh, I think my peers, like who I have classes with and same major as me, we- I think we kind of help each other out." Rudra explained how he consulted with his classmates when he had questions about his career: "I'll talk with some of my classmates, some of friends about things like this. It's usually someone who has a feel for this idea or something like that."

A minority of participants referred to friends as mentors. Martin spoke about the mentoring influences his peers have had on him by serving as positive role models and providing social support:

> Typically, it's actually one of my peers who I look at and see more along the lines of social or academic abilities, even if they're in a different field, where they stand out particularly well. I had one friend in grade school who, by the end of it, had just really

> stood out academically. He had the recognition of all of our teachers and was really a well-known individual, and so that motivated me through middle school and high school to kind of stand out in that way. And then into high school, all of my fellow peers were kind of academically standouts, and so we worked together and really had a just very strong support structure there for working together.

Other participants evidenced similar descriptions of friends as mentors. Ken talked of a friend who helped him with rational decision-making and Tim referred to his friends as role models in that he tried to imbibe ideas or qualities that he identified as representing positive attributes of his friends.

Outside of academic settings, a primary context where participants experienced mentoring was the workplace. Participants cited superiors, supervisors, formally assigned mentors, and one participant considered his coworker to be a mentor. Superiors may be understood as individuals in the organization with a higher rank or station and greater experience than the participant. Some participants referred to superiors in terms of the task-specific mentoring they provided. Such mentors were usually immediate superiors or individuals who the participants were assigned to in their initial days with the organization.

Participants would distinguish between mentors who fulfilled task-specific roles and mentors who might provide guidance on career-related issues. Tristan made this distinction when he spoke about his superiors at work, "I've definitely had mentors for specific tasks or specific jobs... but I don't see them as being mentors in more than just the one setting." Tarrin acknowledged the value of having formally assigned mentors in a co-op work experience when he said, "it was kinda nice actually, the company kind of assigned me a mentor... she was really helpful when I get stuck with work or not sure who I'm supposed to talk to get more information about the task that I've been assigned to." Other participants recounted superiors as individuals who provided guidance on matters beyond the task at hand. Randy's thought about the owner of a repair shop that he used to work for is an exemplar, "I still talk to him, owned a repair shop, but he's very insightful, very helpful on career path choices, entrepreneurship." In sum, participants recounted superiors in work contexts as being supportive, sharing their knowledge and experience and providing task-specific mentoring.

A minority of participants referred to their teachers in middle or high school as mentors. Rishi spoke of a teacher in high school who acted like a mentor by encouraging him to work hard, "I think one particular teacher of mine clearly took interest in me and pushed me to work hard." Tristan recounted an English teacher who served as a role model by advocating responsible behavior with whom he still keeps in contact with. Martin spoke of his chemistry teacher in high school as a mentor who helped him to develop a particular learning style or habit:

> Certain teachers along the way have either been very strong mentors along specific fields or about specific styles of learning. I had one that was one of my personal favorite professors: my chemistry high school teacher, who told me that he was not there to teach us chemistry, he was there to teach us to learn, and that chemistry was just a very hard subject that he could use to teach us to learn.

Teachers can thus provide mentorship by imparting learning habits, providing encouragement and acting as role models to stimulate ethical behavior on the part of their students. Finally, a an

even smaller minority of participants referred to individuals associated with their community or with community outreach programs as mentors who inspired them to study engineering.

The main contexts in which participants experienced mentoring were school, home, work and, for some, the local community. Individuals from a variety of backgrounds acted as mentors and/or exhibited mentor-like behavior from the perspective of the participants. In various school contexts, teachers, professors, advisors, senior students and peers acted as mentors. At workplaces outside of school or the university, participants frequently recounted superiors as fulfilling the role of a mentor. For some participants, coworkers at the workplace fulfilled mentor-like roles. Participants' accounts of the individuals and the contexts in which they experienced mentoring, provided us with implicit, and sometimes explicit details of who participants deemed to be mentors and what they perceived to be mentor-like behavior. These findings are fleshed out in more detail in the following section.

Constructions of Mentoring

Research question 1 asked how our participants construct mentoring. In this section we relate definitions, descriptions, and metaphors of mentoring provided by the interviewees. In most interviews, participants were not asked to define mentoring, so definitions either emerged unsolicited or remained implicit (the majority of cases). We begin with two basic foundational observations. First, it is evident that the respondents distinguished between an abstract model of mentoring and their own mentoring-related experiences. Second, many of the men interviewed struggled to connect the concept of mentorship to their experiences. Nearly half of the men commented initially that they had not had any mentors, and upon consideration decided they had. Others did not change their minds but proceeded nonetheless to describe individuals whom the scholarly literature would clearly label a mentor. Evidently, mentorship was not a salient experience for many of these men.

The participants' models of mentoring were in most cases consistent with the literature, which is well represented by Jacobi's definition of mentoring as a personal, reciprocal relationship between a protégé and someone of greater experience or accomplishment who helps the protégé toward some (usually school or work-related) achievement(s) by providing psychological/emotional support, career or other instrumental help, and role modeling.[31] While no respondent produced this comprehensive of a definition; they invariably highlighted one or more of the features, thus demonstrating which aspects of mentoring were most salient to them.

The participants were most homogenous and consistent in identifying the work and school-related achievement focus of mentoring; nearly all suggested this in one way or another. However, about half of our respondents added--often with some emphasis--that mentoring is not just instrumentally or achievement focused, but is personal and holistic, including genuine affection, interest in one another's life outside of work and school, and frequent interaction not limited to discrete instrumental needs (e.g., advice on academic course selection). (These are principles of mentorship also present in the literature.) Regarding personal interest, Walter expresses appreciation for this quality in his advisor: "It's nice, too, like he usually pops into the office and just talks about general things. That's nice, too." A number of interviewees highlighted the importance of frequent, diverse, and lasting interaction, often deciding that someone was not a mentor based on of this criterion. Thus Tristan, questions whether his task-

oriented, limited-term "mentors" really merit the title:

> I've definitely had mentors for specific tasks or specific jobs, they've all…Yeah, I mean, they were all engineers, which was I guess helpful, but I don't see them as being mentors in more than just the one setting.

Thus the men in our study, consonant with the literature of mentoring, describe mentoring as focused on, but not limited to, one's work or academic career. The participants also aligned with each other and the mentoring literature in identifying the means or modes of mentoring: support, instrumental help, and role modeling. Representative quotes include the following:

> support: My mother's always been there for me no matter what. So, you know, whether that's good, bad, ugly, my mother's always going to be there. She's going to back me up no matter what I'm doing. (Rajit)
>
> instrumental help: I wouldn't really call them mentors, I guess [because] we never really sat down and talked about career guidance or where I looked to see myself. (Tristan)
>
> role modeling: I guess one mentor I've had is my service learning advisor. I took one of his classes and I'm also working with him on my senior design project, and he's given me a lot of not explicit advice, but just sort of observing the way that he does his job and the way that he deals with people has really affected me, I guess. (Dan)

Our interviewees spoke very little about the potentially reciprocally beneficial nature of mentoring. Jacobi explained that reciprocity means that both mentor and protégé benefit--either emotionally or tangibly--from the relationship.[31] With few exceptions, our participants seem unaware of their mentors' experience and motivations. Sabir concluded only that his mentor, who went to some lengths advocating for him, is just "really nice." True as that may be, it overlooks other, more self-interested (but not necessarily selfish) motivations for mentoring. Emilio, on the other hand, suggested perceptively that a mentor might derive satisfaction from helping someone who is similar to the mentor himself in background, interests, goals, and challenges:

> He's a friend who got the same scholarship I got. When he was doing his Master's, he got a scholarship from the Central Bank. We met there because I was a grantee from the Central Bank also, but he was studying his Master's and I was studying college, but we got along because we enjoy playing basketball. He kind of tutored me. I don't know. I guess he saw my intentions, and he just helped me…

Craig speculated about similar motivations of the leader of a minority-engineering program he participated in. Finally, Tim, who shrugged off the notion that he had *been* mentored, expressed the satisfaction he felt in *being* a mentor--he used the term explicitly to describe himself--through his position as resident assistant. Specifically, he spoke of his pleasure in seeing his influence on his residents' moral values ripple out into the wider world.

Another diversion from the literature concerned the possibility of peers being mentors. While a few men dismissed peers as potential mentors, others endorsed them as fulfilling at least one variety of mentorship. Martin's statement is representative: "Typically, it's actually one of my peers who I look at and see more along the lines of social or academic abilities." Others looked to peers in weighing decisions or receiving support, but saw these kinds of relationships as substituting for mentoring relationships, not fulfilling them.

Of all the components of mentoring mentioned by our participants, two emerged most prominently, guidance and role modeling. Indeed, these were two of the top three metaphors applied to mentorship by the participants. Most of the men referenced mentors' functions of guiding, directing, or advising protégés on career (work and academic) choices and other discrete decisions, as the following quotes illustrate:

> Like he realized that I had similar interests to engineering, and so he said, "Engineering. You should look into engineering." (John)
> [My advisor] helps decide […] so I just gave him a list and said, "These look pretty good." He looked at them and then we talked about them and decided on which ones I should take. (Walter)

A minority of the participants also referred to general life guidance and shaping values. Emilio, exemplifies this as he described how his mentor influenced him:

> [He] helped me—having conversations about life, how did he do some things, how did he get the family he got because he's a happily married man, and I don't know. Some of those things I'm telling you now—like I want to be a good man and not well-known as an engineer but a good man—those thoughts were coming from that direction.

Many respondents talked about guidance received from mentors in ways that emphasized their (the participants') own agency, control, and independence. The typical form of this rhetorical move was to acknowledge some kind of dependence (or interdependence), then quickly qualify or undermine it. For instance, Michael, explained his advisor's overly strong opinions on the aerospace engineering community, and then said, "You kind of catch that along the way--and not just in sort of a sheep-like quality, but I really do […] buy into a lot of his arguments." Notice, first, his off-the-cuff metaphor of mentoring-- contagion--that minimizes his agency, followed by his expressed concern for being perceived as sheep-like. Finally, notice how he reframes his advisor's influence as convincing arguments. Other respondents were equivocal about their independence, as in the case of Dinar, who had not had a mentor, and commented:

> I wish for one, one mentor, if you want to designate one, but at the same time I think that I had the freedom to choose in a way, you know? So […] I want to learn, but I don't want to be taught, mm…blindly.

From here, Dinar went on to shift his position two more times.

Autonomy-related concerns appeared in about two-thirds of the interviews. Such concerns reveal perceptions of mentors as apt to encroach upon one's freedom, protect one unhelpfully from reality, overshadow one's own thinking, or in some other way circumscribe one's autonomy. Interestingly, these participants appeared to reference a model of mentorship that includes the same *activities* as the traditional model--advice and guidance, support, and role modeling--but question the *intentions* of mentors or the *benefit* to protégés in mentoring relationships. Thus mentors were conceptualized as controlling and robbing the protégé of control over his own life.

As Dinar explained: "So that's the difference. Somebody is constantly telling you what to do. Sometimes it overshadows your own opinions. So I think in a way [not having a mentor] was a blessing in disguise, I guess." Conversely, but with similar thinking, Randy appreciates an informal mentor for the non-directive nature of his "advice": "Sometimes it isn't even what he's saying pertaining to the situation, he'll just tell me some story he had and I'll take whatever I

needed to take away from it." Or, the mentor may simply be overprotective, depriving the protégé of the opportunity to grow through facing challenges independently, as Diallo explained vividly: "I like to be pushed out into the open and face the battles and, you know, *move*. So I tend to get away from the 'get-onto- my-shoulder,' 'get-under-my-wing' kind of mentorship." Note Diallo's battle metaphor and his emphasis on individual accomplishment.

It should be noted that approximately one-third of the respondents expressed unequivocal appreciation for, and comfort with, the idea of being influenced by a mentor, seeing such influence as both benevolent in aim and beneficial in outcome. Still, the remainder of the participants employed one or more strategies for countering the threats to autonomy represented by mentorship. Some respondents rejected mentoring out of hand as unnecessary unless one were weak or clueless, as Diallo did above and as Mark also explained: "For some people, I guess [having a mentor] would be nice, if you really don't know what you're doing; but I kind of figured it out pretty quickly--well, at least how to get through college." Other individuals talked about mentoring in such a way as to maximize their autonomy--for instance, Michael, in his change of metaphors (above), and also Vinesh, who, when asked if he has had any mentors, refers to and then discounts the activities of a friend and of his father: "Apart from [the friend's influence], no, not really. I told you about my dad, of course, but yeah." Even one participant who described several positive experiences with mentors academically and personally went on to make a point that although listens to advice, he is the ultimate decision maker. He says, "even if someone... If ten people tell me, 'Go right,' and I still feel like I want to go left, I'll still go left because that's my instinct; that's what I feel is my choice" (Rajit).

Discussion

Typology of Mentoring Mindsets

Throughout the interviews, participants identified an actual or potential mentor, as well as where and when they experienced or might expect to experience mentoring, thereby constructing and defining mentors and mentoring along the way. Participant responses were diverse, with some participants compartmentalizing mentoring functions into separate task and relational/life categories, and others describing mentoring relationships in ways that include all elements traditionally noted in the literature. These perceptions can be viewed along a spectrum, with completely compartmentalized mentoring at one pole and fully integrated mentoring at the other. Participants also varied in the level of direct interaction they associate with mentoring relationships. Some described mentor experiences as observing someone they had never interacted with or even never met, while others characterized mentoring in terms of frequent interaction and/or discussion. Participants' responses fell along a spectrum between almost complete separations to frequent interaction with mentors.

By combining the two spectrums of integration and interactivity, we have developed a two-dimensional typology of mentoring mindsets that can be used to locate participants' conceptualizations of actual and potential mentor relationships (Figure 1). For example, Diallo, who felt inspired to study geomatics (a task oriented endeavor) through the example of a member of his community, falls in the low interactivity, low integration (completely compartmentalized) section of the graph. On the other hand, Martin spoke of interacting with his peers as sources of social support and also as role models for their social as well as academic abilities. Martin

thought of his chemistry teacher in high school as a mentor who did not just teach chemistry but also supported Martin's personal growth by encouraging independent thinking both inside and outside of the classroom. Thus, Martin can be classified as having a fully integrated and highly interactive perspective on mentoring. Rishi is an example of an individual who understand mentoring in both relational and task-oriented terms. However, the nature of his interaction with mentors was passive in that he either received encouragement (from his teacher in high school), or career guidance (from his father), or received information that was relevant to his tasks as a graduate researcher (his professor). Thus, Rishi can be classified as someone who experienced relational as well as task-oriented mentoring from different individuals at low levels of interactivity. A complete classification of the participants using our two-dimensional typology is provided in Figure 2. We argue that the level of integration in relational and/or task-oriented terms and the level of interactivity in mentoring relationships reflect dialectical tensions experienced by the participants. This argument is explored further in the following discussion.

Autonomy-Connectedness Dialectic

The primary theme that surfaced in the comments of our male engineers with respect to mentoring was that of personal autonomy. Despite variety in their mentoring-related experiences, conceptions, and attitudes, these men--with few exceptions--emphasized their *in*dependence in the context of an *inter*dependent relationship (mentoring). For some, this took the form of an anti-mentoring mindset: they reject mentoring as impinging on their independence. For others, this meant advancing a compartmentalized or non-interactive view of mentoring. For still others, this surfaced as paradoxical assertions of personal sovereignty while acknowledging their dependence on, and interdependence with, others. Across the spectrum of participant positions on mentoring, it is interesting to note that participants' emphasis on autonomy can be substantive --i.e., they made actual, strategic decisions to protect and preserve their independence--or rhetorical in nature--i.e. when talking about mentoring, they use language to foreground their independence, whether such representations accurately reflect their relationships or not.

This broad trend in the data speaks to the salience of relational dialectics.[32] According to Relational Dialectics Theory (RDT), "meanings emerge from the struggle of different, often opposing, ideologically-freighted discourses.[33] Grounded in Bahktin's dialogic approach, the goal of utilizing RDT is "to show how particular meanings are socially constructed and maintained through everyday communication activities".[34] In this study, meanings of mentors and mentorship emerge through a tension between autonomy--the freedom to act independently and govern oneself--and connection--the mutual commitment to depend on, and embrace the influence of, the other. Though the variety of mentoring conceptions in Figure 2 might seem to suggest that both sides of the dialectic are equally evident in our data, the bulk of the men in our study exemplify a consistent preference for separateness over connectedness--even as they make references to relational connection.

Competing dialectics are often informed by larger socio-cultural discourses that permeate American society.[33]This study provides insight into which discourses may be informing the centripetal forces of autonomy among our participants. Gender differences in work and career start early and are influenced by Western developmental and lifespan processes that emphasize independence for boys and relational development for girls.[35] The strong emphasis on

independence by our participants echoes this emphasis, which is tied to the American value of individualism. Engineering as a career has been deemed "the prototypical masculine profession",[36] and decades of research have identified engineering culture in university and organizational contexts to be dominated by values of masculinity and engineering.[37] Our findings combined with this evidence would suggest the tension experienced by participants between connectedness and autonomy is heavily influenced by the d/Discourses of engineering, which is in turn shaped the d/Discourses of Western individualism and masculinity.

Contributions

This study extends what is currently known about a single, yet critical, agent of career socialization: the mentor. By deconstructing the dominant, we have presented a more nuanced understanding of the competing d/Discourses that shape how male students construct and experience mentors and mentoring in one of the most gender segregated fields. Prior research has focused on how educational and organizational systems fail to meet the needs of women, but as the nature of career continues to shift from the once stable, linear and hierarchical path in a single organization to the more fluid, changing, boundary-less model, the pipeline becomes leakier for everyone, not just women.

Scholars agree that mentoring is critical for career success. It has also been found that in general, women are less likely to find mentors or have as beneficial of mentoring relationships. Considering the extent of gender segregation in engineering it is safe to assume this field is no exception, and due to the sheer lack of numbers probably even more difficult for women to engage in mentoring relationships. In the tension of autonomy and connectedness among our participants, the need to exert autonomy often outweighed the latter, leading a majority of the participants to resist actual or potential mentors or mentor-like relationships, at least in their talk. This discourse, however, is likely to pervade their everyday talk in classrooms, with peers, professors and otherwise further reinforcing the aforementioned ideals. Therefore women in engineering, who maybe more likely to need mentoring to be successful due to their minority status, may be even less likely to seek out, engage in, and succeed in mentoring relationships due to the constraints imposed by traditional engineering discourse.

Implications

With these findings in mind, the challenge for scholars, educators, professors and advisors is to alter the discourse of engineering. The current discourse, reinforcing ideals of individualism and masculinity, is constraining for both men and women. Although men may not be as obviously affected due to their majority status, our findings illustrate how the discourse of engineering often constrained or outweighed desires for more interdependent mentor relationships. To do so effectively, we must take into account the multiple and varied d/Discourses for men and women in relation to education, careers and work in engineering.

By examining the small “d” discourse of engineering students, one can utilize the Typology of Mentoring Mindsets to locate how individuals experience and prefer to experience mentoring. Challenging the big “D” discourse of engineering might be a more daunting task, but some of the data reveal one possible avenue. Ideals of collaboration and social impact were evident in some interviews with student members of the service learning program. The discourse of the service

learning program emphasizes the dialectic of connection, specifically highlighting collaboration, interdependence and social impact. Academic service learning community students work in multidisciplinary teams to develop technical solutions for local education and community service agencies. As noted on the program's website, service learning is characterized by "fulfilling mutual needs," "professional ethics," and "the role that engineering can play in the community". This discourse was echoed by some of our academic service learning community member research participants, and seemed to provide a counterpoint to more individualistic, non-relational discourses they experienced.

Conclusion

It is well established that the culture of engineering is problematic for females. This study has revealed how the stereotypically masculine and individualistic discourses that permeate engineering can be problematic and constraining for males as well. Male engineers interpret engineering careers as being simultaneously constraining and liberating. They aspire to financial prosperity in careers that are perceived as a narrow, constraining paths along which only limited opportunities for self-fulfillment and creative expression may exist. They express apathy for societal norms and expectations even as they seek career opportunities that might help them impact society in a positive manner. Male engineers decry the inadequacy of formal education in enabling genuine collaboration, and value collaborative work experiences afforded by their education. It is well established that the culture of engineering is problematic for females. Examining contemporary career discourses of male engineers suggests that stereotypical, masculinist and individualistic discourses that permeate engineering can be problematic and constraining for men and women.

References

1. Eden, D. Female engineers: Their career socialization into a male-dominated occupation. *Urban Education, 27*, 174-195 (1992).
2. Faulkner, W. "Nuts and bolts and people": Gender-troubled engineering identities, *Social Studies of Science, 37*, 331-356 (2007). doi:10.1177/0306312706072175
3. Faulkner, W. Doing gender in engineering workplace cultures. I. Observations from the field. *Engineering Studies, 1*, 3–18 (2009). doi:10.1080/19378620902721322
4. Dryburgh, H. Work hard, play hard: Women and professionalization in engineering-Adapting to the culture. *Gender & Society, 13*, 664-682 (1999).
5. Cech, E. A. Preaching to the choir: The responsibility to share WIE research with female students. Frontiers in Education Conference, 36th Annual, 1-6 (2006).
6. Seymour, E. The Loss of Women from Science, Mathematics and Engineering Undergraduate Majors. *Science Education*, *79*(4), 437–473 (1995).
7. Broome, T. The Heroic Mentorship. *Science Communication*, *17*(4), 398–429 (1996).
8. Broome, T. The Heroic Engineer. *Journal of Engineering Education*, *86*(1), 51–55 (1997).
9. Seymour, E., and N. Hewitt, Talking About Leaving: Why Undergraduates Leave the Sciences, vol. 79, (Westview Press, 1997).
10. Arendt, C., Dohrman, R., Buzzanell, P. M., Zoltowski, C. B., Oakes, W. C., et al., Elisitsm and Exclusion Discourses of elitism and exclusion: Relating self-efficacy and subtle sexism. Paper presented at the annual conference of the National Communication Association, Chicago: IL (November, 2014)

11. Pawley, A. and Phillips, C. From the mouths of students: two illustrations of narrative analysis to under-stand engineering education's ruling relations as gendered and raced. 121st ASEE Annual Conference and Exposition, (2014).
12. Hearn, J. Gendering men and masculinities in research and scientific evaluations. *Gender and excellence in the making*, 1, 57-68 (2004).
13. Mumby, D. Organizing men: Power, discourse, and the social construction of masculinity(s) in the workplace. *Communication Theory*, 8, 164-183 (1998).
14. Hall, D. Careers and socialization. *Journal of Management*, *13*(2), 301-321 (1987).
15. Becker, H. S., & Strauss, A. L. (1956). Careers, personality, and adult socialization. The American Journal of Sociology, 62, 253-263.
16. Sullivan, S. E. (1999). The changing nature of careers: a review and research agenda. Journal of Management, 25, 457-484.
17. Arthur, M. B., & Rousseau, D. M. (Eds.) (2001). The boundary less career: A new employment principle for a new organizational era. New York: Oxford University Press.
18. Mohrman, S. and Cohen, S. When people get out of the box: New relationships, new systems. *The Jossey-Bass social and behavioral science series, 28* (590), 365-410, (1995*)*.
19. McCall, M., Lombardo, M., and Morrison, A. Lessons of experience: How successful executives develop on the job. (Simon and Schuster Publisher, 1988).
20. Brousseau, K., Driver, M., Eneroth, K., and Larson, R. Career pandemonium: Realigning organizations and individuals. *The Academy of Management Executive, 10*(4), 52-66 (1996).
21. Buzzanell, P. and Goldzwig, S. Linear and nonlinear career models: Metaphors, paradigms, and ideologies. *Management Communication Quarterly, 4*, 466– 505 (1991).
22. Jacobi, M. Mentoring and undergraduate academic success: A literature review. *Review of Educational Research, 61*, 505-532 (1991).
23. Frazee, V. Welcome your repatriates home. *Workforce*, *76*(4), 24-28 (1997).
24. Ragins, B., and Cotton, J. Easier said than done: Gender differences in perceived barriers to gaining a mentor. *The Academy of Management Journal, 34*, 939- 951 (1991).
25. Lindlof, T., and Taylor, B. *Qualitative communication research methods* (2nd ed.). (Sage, 2002).
26. Creswell, J. *Research design: Qualitative, quantitative, and mixed methods approaches (3rd ed.)*. (Sage, 2012).
27. Patton, M. Enhancing the quality and credibility of qualitative analysis*. Health Services Research*, *5*, 1189-1208 (1999).
28. Barry, C., Britten, N., Barber, N., Bradley, C., and Stevenson, F. Using reflexivity to optimize teamwork in qualitative research. *Qualitative health research*, *9*(1), 26-44 (1999).
29. Owen, W. Interpretive themes in relational communication. *Quarterly Journal of Speech, 70*, 274-287 (1984).
30. Corbin, J. and Strauss, A. *Basics of qualitative research: Techniques and procedures for developing grounded theory* (3rd ed). (Sage, 2008).

31. Jacobi, M. Mentoring and undergraduate academic success: A literature review. *Review of educational research*, *61*(4), 505-532 (1991).
32. Baxter, L., & Montgomery, B. *Relating: Dialogues and dialectics*. (Guilford Press, 1996).
33. Baxter, L. A dialogic approach to interpersonal/family communication. *Distinctive qualities in communication research*, 13-31 (2010).
34. Bakhtin, M. *Problems of Dostoevsky's poetics*. University of Minnesota Press, 1984).
35. Hartung, P., Porfeli, E., and Vondracek, F. Child vocational development: A review and reconsideration. *Journal of vocational behavior*, *66* (3), 385-419 (2005).
36. Jorgensen, J. Engineering selves: Negotiating gender and identity in technical work. *Management Communication Quarterly, 15*, 350-380 (2002).
37. Faulkner, W. The power and the pleasure? A research agenda for "making gender stick" to engineers. *Science, Technology & Human Values*, *25* (1), 87-119 (2000).

Appendix A: Interview Protocol

Part 1: Demographics
What is your age?
What is your current job status? (retiree, student, job title, etc.)

Part 2: Career Decision-Making
As a child, what did you want to be when you grew up? Why? What made you change your mind?
What was the highest level of schooling that you achieved?
Probe: How did you decide on your major? What jobs have you held since graduation?
Probes: What was your first job after graduation?
How did you secure your job?
How did your family and friends respond to your decision to take this job?
What other jobs have you held in your life?
Probe: Why did you change jobs throughout your life?

Part 3: Career Experiences
What were the most important factors that led you to join this field?
Did you ever consider leaving the discipline? If so, what were your reasons?
What is the nature of the work you do? (i.e., tasks, working with people, autonomy, prestige)
What is meaningful (to you) about the work you do? How would you describe your career?
What is "career" to you?
Has anything surprised you about your career?
Who do you go to when you have questions about your position or career? Tell me about someone who has helped you understand what is expected of you in your position.
What was the most valuable piece of information you received during your career?
Probe: What made it so valuable?
Who gave you this information?
What is the best piece of advice that you have received during your career?
What advice would you give to other individuals interested in your field?
Have you had one or more mentors during your career? If so, please tell me about those relationships.

Part 4: Gender, Work, and Career
What were the biggest factors in your decisions to pursue work in STEM areas?
If you had it to do all over again, would you be in this line of work?
If you know what you know now, what kind of work and career would you have had?

How do you think the STEM disciplines can recruit more individuals into the fields?

Should there be different strategies for recruiting men and women or the same? Discuss.

Is there anything else about your career, work, or life experiences that you feel is important for us to know?

If so, what is it?

Is there anything that we should know that would be helpful to us in interpreting your answers?

Table 1
Participant Demographics

Pseudonym	Grad / UG	Year	Engineering Concentration	Age	Ethnicity/ Nationality
Albert	UG	Junior	Chemical	22	Malaysian
Billy	UG	Senior	Computer	20	European American
Craig	UG	Freshman	Industrial	18	African American
Diallo	Grad	Senior	Civil	32	Afro-Trinidadian
Dan	UG	Senior	Engineering Management	23	European American
Dinar	UG	Senior	Electrical	23	Indian
Emilio	Grad	First	Industrial	26	Latino (Nicaragua)
Hari	Grad	Sixth	Mechanical	27	Indian
Jeremy	UG	Junior	Computer	20	European American
Ken	UG	Junior	Mechanical	20	European American
Michael	Grad	Post	Aerospace	28	European American
Martin	UG	Senior	Computer & Information Technology	22	European American
Mark	UG	Junior	Mechanical Engineering; Applied Physics	21	European American
Peter	Grad	Second	Electrical and Computer	29	European American
Rishi	Grad	Fifth	Mechanical	26	Indian
Rudra	UG	Senior	Chemical	22	Indian
Rajit	UG	Senior	Industrial	23	Indian
Randy	UG	Senior	Mechanical	22	European American
Sabir	Grad	First	Electrical	23	Pakistani
Se-hong	UG	Junior	Mathematics/ Pre-Medicine	20	Asian
Tarrin	UG	Senior	Aerospace Engineering; Applied Physics	22	Thai
Tristan	Grad	Fifth	Mechanical (3+2 BS/MBA)	22	European American
Tim	UG	Senior	Aeronautics; Astronautics	22	Indian American
Vinesh	Grad	Second	Industrial	24	Indian
Walter	Grad	Third	Aerospace	23	European American

Figure 1
Typology of Mentoring Mindsets

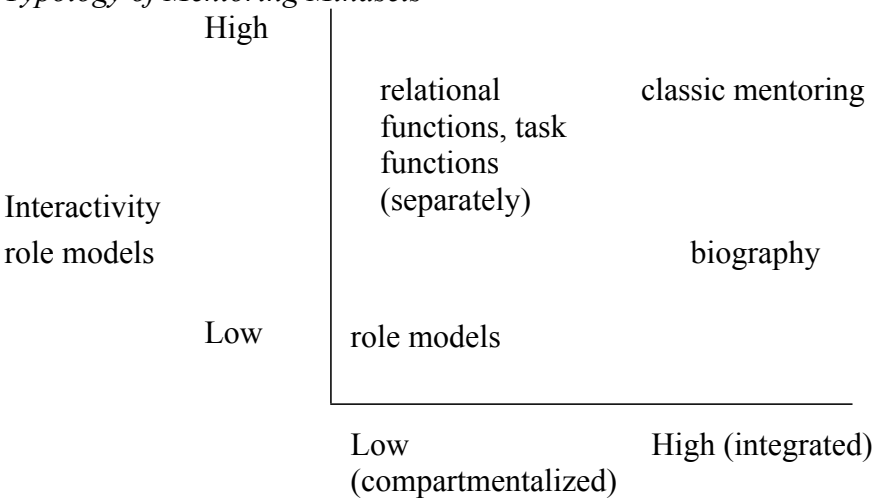

Figure 3
Participant Categorization via Typology of Mentoring Mindsets

	Low Interactivity	**Medium Interactivity**	**High Interactivity**
Fully compartmentalized	Diallo, Mark	Tristan, Vinesh, Jeremy, Albert	Billy, Hari, Randy, Peter
All activities represented; task and relational activities separated among mentors	Rishi	Dinar, Michael, Tarrin	Ken, Rajit, Sabir
Fully integrated	Dan	Craig, Rudra, Tim	Emilio, Martin, Walter