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Becky Wai-Ling Packard

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TO CONSTRUCT A "COMPOSITE MENTOR": COLLEGE WOMEN'S CONCEPTIONS OF MENTORING, FUTURE IMAGES, AND MOTIVATION IN SCIENCE

By

Becky Wai-Ling Packard

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ABSTRACT

TO CONSTRUCT A "COMPOSITE MENTOR": COLLEGE WOMEN'S CONCEPTIONS OF MENTORING, FUTURE IMAGES, AND MOTIVATION IN SCIENCE

By

Becky Wai-Ling Packard

This project investigated whether college science women's conceptions of mentoring could be expanded in the direction of a "composite mentor" and the influence of this redefinition of mentoring on their future career concerns and motivation in science. It was anticipated that the composite mentor model, emphasizing a diverse set of mentors and a pro-active student role, would help women in science who struggled with the discord between their desired future images and negative stereotyped images in their field, or clash of future selves. Thirty college women in science and engineering participated in a 12-week "future career concerns" workshop series designed to introduce the "composite mentor" strategy. Pre-assessments provided evidence that clash of future selves was a salient concern and that students were searching for one mentor who represented their desired future image. Workshops scaffolded students' reflection on and participation in mentoring through interactions with a role model web site, focus groups with women professionals, and assignments. Post-surveys indicated several important findings linking conceptions of mentoring, clash of future selves, and motivation in the field. First, students' conceptions of mentoring moved in the direction of a composite mentor; students expanded their mentor selection criteria to include men and people out of their fields and saw a pro-active role for themselves. Second, this redefinition of mentoring influenced their actions because students reported new mentoring and career-related experiences. Third, although students' experiences of clash of future selves (e.g., being a "science person", combining family and

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career) remained at the end of the program, students were now motivated rather than discouraged by their concerns. This was influenced by students seeing clash as an on-going tension shared by the professionals across fields. Fourth, students reported a renewed motivation to stay in the field, both at the conclusion of the program and 16 weeks later. Implications for integrating future images and mentoring into science education and implementing future iterations of the program are discussed.

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To my students-- who inspire me to believe in alternative images of success

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ACKNOWLEDGMENTS

In many ways, the stories of these women in the sciences parallel my own as I try to define my own image of success. There have been several people-- my mentors-- who have supported my journey and without whom I would not have made it this far. The following set of people make up my composite mentor.

During my first days of graduate school, I met three amazing women in my cohort who cheered me (us) on through courses, through comprehensives, and toward the dissertation. Su C. Jones, Joan E. Hughes, and Valerie L. Worthington and I collectively paved our paths through graduate school. Even though our paths are going in different directions, I look forward to following their contributions and consider myself honored to have been part of their group.

My dissertation committee was made up of an extraordinary group of people, each offering a valuable perspective. Gail Richmond, a woman scientist and science educator, asked me good questions, offered insights on the mentoring of women in science, and provided me with a great deal of encouragment. Jere Brophy always reminded me of the "value-side" of motivation and allowed me frequent drop-in visits to his office where he could always highlight for me what was new, interesting, or important about my work-- or about anything in the field for that matter. David Pearson mentored me into the practice of research and wherein we learned about the benefit of hypermedia and multiple teacher models; I applied similar ideas to the learning of women in science. Finally, my advisor and chairman David Wong was a mentor for me in multiple ways. He encouraged me to dream, to believe in my ideas, and to be myself-- while still challenging me to rethink, refine, and rewrite. David was a captive audience for my daily insights about my work and my personal life. I can never thank him enough for supporting my growth as a person, as a scholar, and as a teacher.

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Thank you to my family who understands how important my work is to me. I am proud to be part of the first generation to go to college and the first to earn an advanced degree in our family. My parents instilled in me a strong work ethic and a love of learning. I consider myself lucky to have had the chance to pursue such endeavors as I have reaped the opportunities that come from having a good education. Thank you to my mother who asked me every day when the book would be done, my father who is more than pleased I will finally be employed, and my brothers who patiently listened to my stories of women in science. Most of all, I would not have made it without the support of my significant other, Seamus, who saw me through the emotional and intellectual ups-and-downs of writing, made me laugh, and continued to believe in me even when I did not. These are my mentors, and I thank each of them.

I would like to gratefully acknowledge the support of an MSU/Spencer Research Training Grant which allowed me to conduct this research. In addition, I am thankful for the support of MSU's Graduate School which helped to defray the cost of the workshops. The views expressed in this document are my own and should not be considered a reflection of these organizations.

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CHAPTER I

INTRODUCTION

The under-representation of women in science still remains an important focus for several organizations, researchers, and educators (Vetter, 1996). The words from Suzanne, one of my students who participated in a past research study, help to illustrate why this issue is still so complex and compelling.

> My professor talked about the negatives of research. He talked about how his wife used to get upset with him when he'd have to spend three nights in a row at the lab because he had to do all these tests. And he posed the question to me, "Do you really want to do this if you plan on having kids?" You know for me, my family is definitely going to come first. It's always been that way. I didn't want to have my life be in the lab. And I thought that is how he said it was going to be. And so, I made a definite snap decision. I'm not going to be a science major any more. I called my mom [a teacher] and said, I'm going to be a teacher. And she said, "Good. I've been waiting for you to tell me this for 2 1/2 years." And I e-mailed the professor and [told him]. He e-mailed me back and said, "I understand, I've been trying to ask questions so that you would end up coming to this decision. Because I knew a few months ago that you shouldn't be a researcher. You're not going to have as fulfilled of a life doing that as you would being a teacher." And I agreed.

At this point, Suzanne left chemistry to become an English teacher. Like other students in my research, she pursued science for at least two years before switching to another field. Approximately 40 percent of the students who initially declare science majors in college later switch to other fields (Seymour & Hewitt, 1997). In addition, women still make up less than 20% of the engineering degrees and are still underrepresented in the physical sciences (Vetter, 1996). Thus, Suzanne's experience is just one of many.

Listening to Suzanne's story raises several important questions. Why did she leave science? Is her assessment of the field accurate? Could she have lived a fulfilled life as a researcher? Did her mom and professor help her to make the right decision? These types of questions drive my research program including the current project. While I am very committed to the retention of women and promoting diversity in science, I am also keenly aware that behind the statistics are names and faces of individual students. In the following chapter, I show that there are a lot more students like Suzanne—students who enjoy

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science and dreamed of becoming scientists, but at some point decide that the kinds of lives they wish to lead are not possibilities in science fields. In my work, I am trying to learn how to help students make the most informed decisions possible, whether that means pursuing or leaving the field. For me, that often means pushing on conventional beliefs of who does science and what is socially and intellectually required of those who want to do science.

Despite years of research, our theories still do not fully explain why it is that women students, to include first generation college-goers and minority women, who are interested and competent in the sciences to make the career choices they do. Women may be interested (Lips, 1993), efficacious (Farmer, Wardrop, Anderson, & Risinger, 1995), and academically qualified in science (Seymour & Hewitt, 1997; U.S. Department of Education, 1998), yet still choose to leave the field. It is clear that other factors influence the career decisions of women in the field and my research examines this line of inquiry. Suzanne's words offer insight into other factors that may influence women's career decisions in science.

Researchers have argued that students' views of science and scientists (Harding, 1991) are important to their career decisions as early as middle school (Baker, 1987; Baker & Leary, 1995) and high school (Eccles, 1987), and are certainly salient during the college years (Seymour & Hewitt, 1997; Stage & Maple, 1996; Tobias, 1990). Sheila Tobias (1990) suggests that science-related fields lose many talented, yet "different" college students—students who do not fit the mold of the stereotypical scientist. While both men and women may feel ambivalence toward the images of their career (U.S. Department of Education, 1998), it is predictable that women may be more inclined to feel this way because science has over time been defined as a "nerdy, male and White" occupation (Eisenhart, Finkel, & Marion, 1996). In addition, women may question the likelihood of having family or making a contribution to society when pursuing a science career (Eccles, 1987; Packard & Wong, 1997; Seymour & Hewitt, 1997).

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These "future images" of scientists send conflicting messages to women who do take an interest in pursuing science fields. On the one hand, women should pursue their interests and talents, but on the other hand, science does not appear to be a place they can see themselves fitting in; some refer to this as a case of "we can, but I can't" (Lightbody & Durndell, 1996). They may struggle with the conflict between their own desired future image and the discordant images in their environment, a tension I call a "clash of future selves" (Packard & Wong, 1997). In order to work through this conflict, women may be on the lookout for images of others, especially other women who have made it in science careers. These people in their environments represent "possible selves", or samples of what their future lives might be like (Markus & Nurius, 1986). For example, women may look for ideas of how to successfully meld their professional and personal lives (Gilbert & Rossman, 1992). But, unfortunately many women in science report an inability to find (female) mentors or role models (Astin & Sax, 1996; Osborn, Ernster, & Martin, 1992). Women students may even decide to leave the field if the women professionals they do encounter differ from their desired future images (Meetha, Takayama, & O'Neil, 1997; Packard, 1998a; Sonnert & Holton, 1996). In other words, a fruitless search for mentoring may intensify women's feelings that they are in the wrong field because they do not find images consonant with their desired future images.

While the experience of mentoring can support the retention of women in the field (Baker & Leary, 1995; Didion, 1996; Oliver, Pettus, & Hedin, 1990; Seymour & Hewitt, 1997), other authors agree that there is a lack of research addressing how women conceive of mentoring (Herzog, 1997), how one selects role models and mentors (Pleiss & Feldhusen, 1995), or how these successful mentoring relationships are initiated (Turban & Dougherty, 1992). In this project, I begin to address these questions. I suggest that the ways in which students conceive of mentoring can influence their experiences of mentoring and then their retention of science. In a recent paper, I examined students' access to mentoring, suggesting that the ways in which women students conceived of mentoring

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influenced their experience of mentoring (Packard, 1998a). In the study, college women who left science fields were looking for one individual mentor in the field who represented their desired future image and were discouraged when they could not find such a person. In contrast, women who continued to pursue science fields constructed a composite from multiple mentors in and out of their field to support their desired future image. I suggest that this "composite mentor" strategy, emphasizing an expanded mentor selection criteria and a pro-active student role, holds promise for women who are struggling with the lack of images consonant with their desired future images. The strategy can help them to see a way to make use of the people and resources in their environment and support their desired future image in science.

This brings us to the current study. Based on the research focusing on the retention of women in science and two empirical studies of my own, I developed an understanding of why many women leave the field. I wanted to learn more about what can help women to make informed decisions about their career choices in science. I designed the current project so we could learn more about the influence of these factors while women were still deciding whether to leave or stay. I created an intervention designed to introduce a "composite mentor" strategy to group of women who had future career concerns, in the hopes of helping them to manage their concerns and take advantage of the resources around them. I expected that having a chance to work on mentoring and concerns about the future may also positively impact students' motivation to pursue the field. Thus, in addition to examining the interrelationships among mentoring conceptions, future images, and motivation, I was trying to actively support women's career decision-making in science within the context of this intervention.

I build on a large literature examining previous work in this area. Chapter II examines the literature on retention of women in science, future images, and mentoring relationships and highlights the contribution of this study to that domain. In addition, the design of the intervention and research are described. Chapter III describes the procedures

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of the intervention in more detail and the methods. In this study, both quantitative surveys and qualitative responses on surveys were used to assess change due to the 12-week intervention and were substantiated by interviews with a subset of students. Chapter IV describes how students moved, both as a group and as individuals, towards the composite mentor model. These changes in ideas are supported by their changes in actions toward new experiences of mentoring. Chapter V examines how these changes impacted their ability to manage future career concerns, particularly their clash of future selves. Chapter VI evaluates the impact of the program on students' motivation to stay in the field and how the curriculum facilitated these changes even 16 weeks later. Finally, Chapter VII highlights the important findings, suggests implications for integrating these ideas into science education and future questions to be explored.

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CHAPTER II

RELEVANT LITERATURE

In this chapter, I examine the literature contributing to our understanding of women's career choices in science near or at the college-level. Science is a broad term used to describe the large number of fields within and related to science, including biological, physical, medical, engineering, and computer sciences. Next, I examine how future images impact career decisions. Then, I look at the role of mentors and role models to include students' conceptions of mentoring and experiences of mentoring. Finally, I outline the research questions and design for the current study.

Pursuing or Leaving Science-Related Fields

Why do women leave science? One hypothesis is that college students leave science because they become discouraged when they do not do as well in science courses as their peers. Seymour and Hewitt (1997) completed a large ethnographic study of college science students across several universities, reporting "no support for the hypothesis that switchers and non-switchers can be sufficiently distinguished in terms of high school preparation, performance scores, or effort expended, in order to explain why one group leaves and the other stays" (pg. 392, emphasis added). Thus, women students do not leave because of poor performance in courses and, in fact, have higher grades than men students who leave (U. S. Department of Education, 1998). In other words, women students may leave science for reasons other than difficulty with science courses.

Another hypothesis is that women may switch from science careers because they lack self-efficacy or interest in science. However, in a ten-year longitudinal study of students who graduated from high school with science career aspirations, Farmer et al. (1995) surveyed students to examine why these they entered either science-related or more traditional careers. Farmer's model of career attainment, which includes self-efficacy in science along with high school preparation, explained ninety-seven percent of the career

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behavior in men, but only thirty-four percent in women, which suggests that women may be efficacious in science but still not choose careers in science. Similarly, Lips (1993) did not find a relation between college women's interest in science and their perceived likelihood to pursue a science career (where for men, a positive relationship existed). Initially, interest and efficacy are important when women are considering science careers but may not be decisive factors in their actual career choices.

It seems puzzling, then, that women may be interested, efficacious, and competent in science as a content area, yet still may not pursue science careers. Women's interest, efficacy, and academic performance may be an initial condition to pursue science careers, but there may be additional salient factors for college women. Following the line of inquiry of others who have examined science identity (Baker, 1987; Baker & Leary, 1995) and self-concept (Eccles, 1987), I suggest that an examination of women's views of science, of scientists, and of themselves as scientists is important for understanding women's career decisions in science.

Future Images in Science

Researchers have documented the dominant negative images of science professionals which affect women's decisions to consider science careers. These undesirable images make it unlikely for many women to consider science careers for themselves. Eisenhart et al. (1996) characterized mass media's stereotypes of scientists as "nerdy, male and White" (pg. 272). Others suggest that the negative stereotypes force women to choose between being "feminine" or being "scientific" when considering a science career (Frieze & Hanusa, 1984). Students imagine professionals working in isolation (Stage & Maple, 1996). In addition, stereotypical images portray scientists as lacking families or personal relationships of their own, an undesirable image for young women who want to have relationships or children in the future (Eccles, 1987; Holland & Eisenhart, 1990). In sum, these images make the career undesirable for women whose desired future images differ from these images. Given the labeling of such images as

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"negative stereotypes", it would seem that these images would be, in fact, undesirable to many young women.

But why would these images negatively influence an individual woman's career decision? These future images represent "possible selves" we are motivated to become or avoid. Markus and Nurius (1986) introduced the notion of possible selves, as multifaceted, rather than static, self-conceptions that span the present, past, and future. In particular, we have future-oriented selves which motivate our current behavior. Using this perspective, if women have negative images of science professionals, they may be less motivated to pursue science careers because they do not want to become these negative science images. However, women who pursue science are also likely to have positive, desirable images that bring them to the career. This creates a tension among competing positive and negative future images that I call a "clash of future selves."

To examine this clash, I completed a study that compared the experiences of students who left science to those who continued to pursue science careers during college (Packard & Wong, 1997). I interviewed two groups of college women: 1) those who majored in science for at least two years but later switched to non-science majors (Switchers) and 2) those who intended to graduate in science and pursue a science career (Pursuers). Both groups of students were interested in science, faced obstacles, and described experiences of clash of future selves. The nature of this clash spanned three categories: being a "science person", lifestyle choices, and the purpose of science work. The source of this clash was the discord students felt between their desired future images and the images in their environment. For example, students wanted to be a collaborative person who had a family and wanted to contribute to society, but they had images of others in the field who were cut-throat, childless, and doing work for the sake of science or money (see Figure 1).

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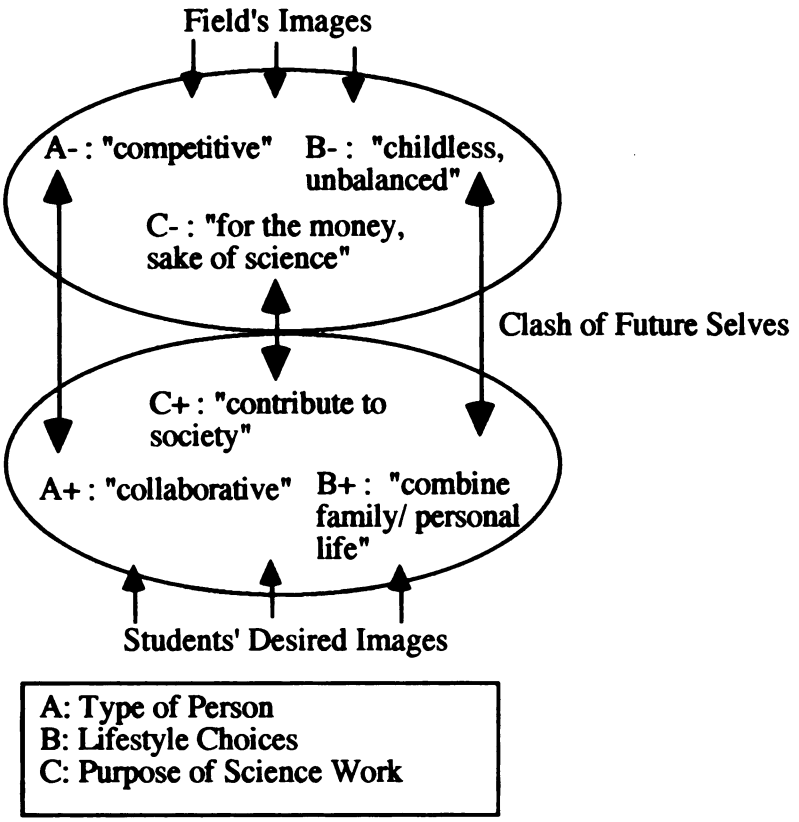

Influence of Mentors and Role Models

In the aforementioned study, students sought mentoring to help them work through these conflicts and learn about their possibilities. Pursuers were more likely to have mentors in science who provided positive possible images or strategies to help them achieve their desired future images, leading them to shift majors within the sciences. In contrast, Switchers were more likely to have found mentoring in a non-science field and reported a lack of support in science, leading them to switch to a non-science field. These results highlighted the importance of future images in women's career decisions and the important connection to mentors and role models.

Students look to examples of others to learn about the personal and professional melding that occurs in real science professionals' lives, something that women students especially struggle with when considering careers (Gilbert & Rossman, 1992; Oyserman &

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Saltz, 1993). But, how do students select role models and mentors? Many studies point to the degree of perceived similarity between mentor and student. Kalbfleish and Davies (1991) found that the race of the mentor was the best predictor of a mentoring relationship in their study of the mentoring of black professionals. Haas and Sullivan (1991) found that students who had read career materials using Hispanic role models held less stereotyped beliefs after reading them, and even held less stereotyped views of careers that they had not read about. Frierson, Hargrove, and Lewis (1994) found college students with Black mentors perceived the research environment and interactions with their mentors more positively than students with White mentors. By the end of the program, students with Black or women mentors had more positive attitudes in contrast to students with White male mentors. These studies suggest that students are more motivated by mentors who seem similar to them.

Schunk (1987) found that coping models, or models exhibiting struggle before achieving success, were more effective in raising self-efficacy than models easily achieving success in experimental studies with children. Thus, one reason why similarity based on gender and race may be important for minority and women students is because the students may perceive that these models had experienced similar difficulties as them. Following this literature, we might expect mentoring relationships to be most successful when students are able to find mentors who are similar to them, in terms of past experiences, gender, or race.

A problem: Identifying "similar" role models and mentors

Many women may not find role models or mentors (Astin & Sax, 1996; Meetha et al., 1997; Osborn et al., 1992). Osborn et al. (1992) found that women in medical school were less likely to be considering careers in academic medicine than men did. The study suggests that their decisions were tied to the availability of role model relationships. Over half of the women post doctorates said they never had role models compared to 25% of men. Even more dramatically, 45% of the junior faculty women said they had never had a role model compared to 9.5% of the men. Meetha et al. (1997) found in focus groups with

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medical students that they did not have role models. Similarly, Packard and Wong (1997) found that students who left science did not report having mentors in science.

These women had encountered many professionals in their environments, including some women. Why did they not consider them to be role models or mentors? Revisiting the similarity issue raised earlier, one reason might be that students may envision a different lifestyle (e.g., having children) or see themselves as being different kinds of people (e.g., collaborative) than other science professionals. Therefore, professionals with different life choices or experiences may be eliminated from students' consideration. According to Sonnert and Holton (1996), women who had women advisors during their post doctorates in science actually left science at a higher rate than those who did not; one woman explained that her decision to leave science was influenced by the negative example set by her "lonely and isolated" female advisor. Meetha et al. (1997) also found that "negative" role models discouraged medical students from pursuing certain career paths. As Astin and Sax (1996) explain, the presence of one role model alone may not have a significant impact on students nor the power to counter negative stereotypes. In addition, as Davis and Rosser (1996) suggest, "mere" role modeling may not have the impact that mentoring does. This sets up a problem in mentoring: although mentoring is important, women do not seem likely to find similar images in their environments because of the lack of female images and desirable images in their environments. Women may not be likely to identify viable role models or mentors in their environments. This inability to identify mentors or role models who are consonant with their desired future images may influence them to leave the field.

How women identify potential mentors can facilitate or discourage their access to mentoring and their retention in the field (Packard, 1998a). In a recent study, I examined the mentoring experiences of women who left science and women who continued to pursue science. Students who left science during college appeared to be looking for traditional forms of mentoring, the "similar" mentor described earlier. They envisioned, but could not find, a woman in their field with similar life experiences and a desirable lifestyle who

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would guide them into the field. An important part of their conceptions of mentoring was their mentor selection criteria. When looking for this science mentor, students had very specific or narrow criteria for choosing a mentor, confining them to gender, race, lifestyle, and field matches. One student illustrated how her mentor selection criteria did not yield any mentors in science.

> It would help if the mentor was the type of person who you wanted to become. The university does have a lot of mentoring programs where they pair people up. But I wouldn't identify very well with a 50-year-old single woman who's never been married. I need to find somebody who is in their mid 30s, had a family, took time off to be with her family, went back, and explain all that.

In this example, the student is looking for a mentor who represents her desired future image. As a result, she says she would not benefit from a mentoring program unless she had a mentor like the one she described. Given the state of women in science, the likelihood of finding such a person in her specific area of science at her institution is still small. This student was unable to find suitable mentors in science and subsequently left to another more traditional field where she was able to find more female images similar to what she was looking for.

Another important component of their mentoring conceptions was the role they saw for themselves and the mentors. These students placed responsibility and expectations on the one mentor, to anticipate their questions and help them into the field. As one student said:

> I would say it's someone who is in their field, interested in what you're interested in, and someone that you would like to be like but not necessarily exactly the same...But someone that's gone through what you've gone through, understands the struggles, understands all of that. And is there to support you in all of your learning.

This student does not describe herself as having a pro-active role in the relationship; she does not envision initiating contact with her mentor or contributing to the mentor's understanding of her needs. Further, she places heavy expectations on the mentor to have similar experiences and to support her. Much of the mentor-knowledge is taken for granted and this may contribute to the frustration felt by students-- when mentors do not select them, people do not help them, and they do not find the type of mentoring they seek.

Students' conceptions of mentoring are importantly tied to their experiences of clash. Their fruitless search for mentoring only serves to perpetuate their clash because they become more aware than ever of the lack of mentor images that are consonant with their desired future image. The lack of initiative exhibited by students also decreases the chances that students will connect to potential mentors.

In contrast, students who continued to pursue science were successful in gaining access to mentoring, in part, because of their conceptions of mentoring. As stringent mentor selection criteria kept Switchers from identifying suitable mentors, Pursuers had an expanded selection criteria which included men and people outside of their fields that facilitated their ability to identify potential mentors. In addition, these students saw a pro-active role from themselves, expecting to interact with and draw from multiple mentors. One student talked about combining the notion of women working with becoming a doctor.

> My mother is a woman and has a family and a job. I don't want to be a Spanish teacher. On the other hand, my boss is a doctor. I want to be a doctor. But, there are very many ways in which he's different from me. But I think you really have to select the ways in which you say-- this is what I want to be.

Although she did not have access to a woman doctor who combined career and family, she was able to draw from her own mother and her male supervisor in defining her own future image. Another student illustrated her active student role in her conceptions of mentoring.

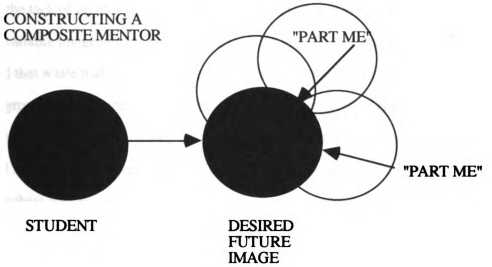
> Technically [my boss] is not an engineer...The things I try to take from him are his people skills. He has such a way with people and clients--making people feel like he really cares...Those are the types of traits I would want to have when, if I were ever to be a manager--to have my technical background but not be so frigid to people and cut-off. He is really good at that. I can pick up a book and teach myself as much as I can, and I can learn technical things from other people too. I am trying to pull from everybody...Like that guy at my other company. He was really good as far as knowledge...but I didn't agree with the way he handled himself...I would take from him what I could and I learned a lot technically. But from [my boss], I am learning the other side and I am trying to put the two together.

Even though this student did not find an exact mentor match, she combined the strengths of two people into a composite of a mentor who could support who she wanted to become. This study suggested that while the images in students' environments may not always be

ideal in nature, some students are able to connect to them and draw from the composite of many mentors in an effort to pursue their desired future images.

I call this strategy the "composite mentor". It combines 3 main elements: 1) it is driven by the desired future image, 2) includes an expanded mentor selection criteria, used to identify a diverse set of mentors, and 3) involves a pro-active student role in selecting mentors and initiating mentoring (described more fully in Packard, 1998b). The composite mentor was important in helping students to negotiate their clash. By constructing a composite mentor, they were able to connect to available mentors in their environments. In addition, students did not need to be confined by existing mentor images, and instead assembled the multiple mentors who could support their desired future image. In Figure 2, I illustrate how the student's desired future image is supported by a composite mentor, rather than seeking an ideal mentor match.

Figure 2. Composite Mentor Model



While there were other factors involved, it was clear that one important factor facilitating students' differential mentoring experiences was students' conceptions of mentoring. To summarize, recall the first study which examined the experiences of students

who pursued and left college science (Packard & Wong, 1997). In that study, students who found mentors (read: positive images) in science were more likely to shift majors but stay within the science field while students who did not have mentors in science and found positive images in another field were more likely to leave. The second study (Packard, 1998a) followed up on these trends and highlighted a third possible way that mentoring can influence students' decisions in science: by redefining mentoring, students could stay in the field of their choice and would, in effect, be using a redefinition of mentoring to redefine the field. This redefinition of mentoring was the focus of the current study.

A solution: Redefine mentoring

While the previous study did not determine whether students using the composite mentor strategy came in with those ideas about mentoring or were adapting to their environments, it seemed likely that such a strategy could be introduced to students who were struggling with the lack of desirable images in their environments. I suggest that the composite mentor is promising for women in science, especially for women who struggle with the lack of mentor images in the field, because it would help women to make use of the available images in their environments. This supports the goals of researchers who have found that white males can be successful mentors of students from diverse ethnic backgrounds and women (Atkinson, Neville, & Casas, 1991; Scott, 1989). This suggests that helping students to see men and people from different backgrounds as viable mentors could lead them to gaining important mentoring experiences. This work also supporting the researchers who suggest that multiple mentors and networking are important to the mentoring of women (Bird & Didion, 1992).

The composite mentor model challenges the view of mentoring as a dyadic interaction. Spiro's theory of cognitive flexibility (Spiro, Feltovich, Jacobson & Coulson, 1992a; Spiro, Feltovich, Jacobson & Coulson, 1992b) suggests that multiple models may be advantageous to learners when one model or analogy cannot explain the full complexity of complex phenomena. While Spiro's theory was initially used to promote the use of

multiple analogies for students' learning complex knowledge (e.g., medical students learning about muscle fibers), this notion of multiple models has been more recently extended to learning from role model and mentoring relationships. Specifically, the notion has been applied to case-based approaches to learning to teach (Hughes, Packard & Pearson, 1998; Shulman, 1992; Sykes & Bird, 1992). This work suggests that students need access to multiple cases of teaching so they do not rely on one case as a prescription for how to teach. For women in science, the notion of the composite mentor suggests that students need access to multiple models when learning about the science field and in constructing their own future image of becoming a scientist. Students have an important role in assembling a number of people who can form their composite mentor. In a similar vein, Smoot (1996) found that women who were "constructivists" of knowledge were more likely to make use of informal mentoring opportunities and gain access to multiple mentors than students who did not see themselves as such actors.

This notion of the "composite" mentor is not the predominant or traditional model of mentoring described in the literature. There are various conceptions of mentoring in the literature with one literature review identifying fifteen different definitions of mentoring (Jacobi, 1991). Some of the definitions focus on mentor functions and others on mentor roles. Some researchers offer their own working definition of mentoring (Healy & Welchert, 1990), while others have described the varied conceptions of mentoring of teachers and their preservice students (Franke & Dahlgren, 1996). Varied definitions of mentoring are accompanied by varied expectations of mentoring, of mentors, and of students. The consequences of having different conceptions of mentoring and the promise of expanding one's conceptions of mentoring toward the composite mentor needs to be examined. While the composite mentor approach is not the only approach to mentoring, it provides: 1) a model that has been productive for other women students and a place to begin developing ideas about mentoring, and 2) a model to which students could compare their own working models and look for places to expand.

In this study, I explore the promise of a mentoring intervention designed to expand students' mentoring conceptions in the direction of a composite mentor. In addition, this intervention provided a context in which to understand how mentoring conceptions influence students' motivation and future career concerns regarding their clash of future selves[1]. Research has not investigated whether these conceptions can be expanded, and how these mentoring conceptions influence career decisions, experience of mentoring, and retention. The goal of the program was to help students expand their conceptions of mentoring in order to gain more experiences of mentoring and make more informed decisions about their careers in science. Therefore, "success" of the intervention was measured by whether students thought about mentoring, gained mentoring, and felt more informed about their decisions. I also hypothesized that this program may positively impact students' motivation in the science field.

Research questions:

In this study, I examine the role of mentoring conceptions in women's science career pursuit. Specifically, I ask the following questions:

1. Do conceptions of mentoring develop, change, or expand in the direction of a composite mentor in the context of this intervention? If yes, in what ways?
2. How does this redefinition of mentoring influence students' future career concerns, in particular, how they manage clash of future selves?
3. What is the impact of the program on students' motivation to pursue the field?

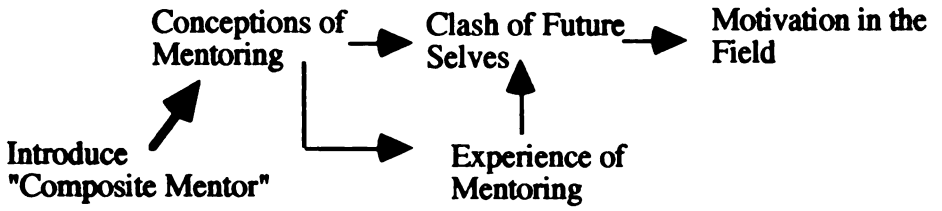
Research Design

In order to examine these questions, I collected pre- and post- intervention assessments to look for change across and within participants on the three key variables. It was expected that the intervention would specifically target conceptions of mentoring, and

[1] In this work, I interchange the use of future career concerns, clash, and future images from this point on, depending on whether I am talking more generally about future-oriented concerns, the specific nature of clash, or about the types of images they describe for themselves or of the field.

that the outcome variables would be conceptions of mentoring, the managing of clash of future selves, and motivation to pursue the science field (see Figure 3).

Figure 3: Research Design



Using surveys, I assessed students' conceptions of mentoring prior to the intervention and after the intervention, the nature of their future career concerns before and after the intervention, and their motivation and new experiences of mentoring at the end of the intervention. Post-interviews and assignments collected during the intervention served as triangulating devices to assess whether and how conceptions of mentoring influenced future career concerns and motivation. In addition, a 16-week follow-up was scheduled to look at long-term changes. The following section describes how the intervention was designed to target students' conceptions of mentoring and to provide students with opportunities to try out their ideas about mentoring.

Designing a "Composite Mentor" Intervention

Design Principles for Intervention

According to the literature, certain principles may facilitate the effectiveness of this intervention. First, a critical aspect of the instructional design was scaffolding how students think about mentoring as a form of "cognitive apprenticeship" (Brown, Collins, & Duguid, 1989; Palinscar & Brown, 1984). Through modeling and assignments, students were supported in reflecting about mentoring, in selecting mentors, and in identifying strategies to initiate mentoring. For example, students completed worksheets that connected students' concerns to their plans for selecting mentors who could address those concerns.

Secondly, facilitating students' initial access to mentoring was important. Turban and Dougherty (1992) found that protégé initiation of both men and women led to

mentoring experiences. This was facilitated by high locus of control, high self-monitoring, and emotional stability. In addition, Ragins and Cotton (1992) found that women perceive greater barriers to mentoring but later experience as much mentoring as men do. In addition, early experiences of mentoring help decrease the perceptions of barriers to mentoring. As a result, helping students to see themselves as taking initiative in their own mentoring success was a goal in the intervention by helping student to develop plans to seek out mentoring.

While some argue that informal mentoring benefits exceed those of formal mentoring assignments (Chao, Walz, Gardner, 1992), and others argue that formal mentoring has potential and is necessary especially for special populations, such as women (Noe, 1988), the current intervention relied on both of these approaches. It used a formal program structure, but offered informal opportunities to mix with multiple people. Students participated in discussions with graduate and professional women from various disciplines and have access to a role model web site showcasing men and women from various fields who would also be available over e-mail. This intervention provided a relatively safe environment where they had access to multiple people and gave them the chance to initiate mentoring with a greater likelihood of success, given the voluntary and enthusiastic nature of the guests' participation.

Third, the focus of the sessions targeted future career concerns, especially raising their awareness of their experiences of clash. This would be accomplished by interacting with role models inside and outside of the intervention. Osborn (1993) found that "exposure to faculty advisors and role models who enjoy their specialties and are valued in the medical school can impress upon students the importance of primary care and its rewards" (pg. 574). Bartholomew and Schnorr (1994) found that videos that show women role models working through life choices can have a positive effect on the number of career options young women consider because they help young women to integrate their life and career choices. Similarly, according to Bird and Didion (1992), a good mentor shares

experiences and achievements in the field as well as sharing their obstacles and how they overcame them. In the current intervention, students engaged with graduate women in focus groups around issues of clash and had opportunities to interact with science faculty and other resource people. In addition, a role model web site showcasing a variety of models, including men and women various fields was available to students (contact author for more information). In the web site, 17 role models share their reflections on their career choices, about their lives, and their academic and personal strategies. This made explicit the kinds of struggles that the role models had experienced as well as showed the multiple layers of experiences within each person. This was expected to increase the possibility that students would connect to some aspect of multiple models in the showcase and help students to see that there are multiple ways to connect to role models in general. A database attached to each role model's web page allowed students to submit comments and learn what other students thought about visiting each role model.[2]

Fourth, the intervention was designed to be on-going in nature because longer-term interventions may produce sustained changes. Savenye (1990) found initial but not long-term effects in her study of role models and suggested that treatments more powerful than 20-minute presentations, such as repeated exposure to role models or multiple models, would help provide long-term effects. In the current intervention, students met 6 times over 12 weeks in a workshop-type format and were repeatedly exposed to multiple models. This increased the amount of time that students had to reflect on mentoring, engage in career- and mentoring-related activities, and be in a supportive environment. This was expected to increase the likelihood of seeing changes due to the intervention.

Recruiting Role Models

Role models from the university community and from science communities at large were invited to participate in workshops and in a role model web site. For the web site, I started with contacts with people I knew (e.g., medical students and engineers in

[2] Thank you to Rick Ferdig who added this function to the web site.

manufacturing corporations) and asked them to recommend others. I also e-mailed listservs recruiting potential role models. A letter or e-mail briefly described the program to potential role models. Graduate and professional women and men who were in a science field (e.g., science, engineering, medical, technical field), valued mentoring, and had an interest in being available to answer questions over e-mail were invited to be part of a web site showcasing role models in the field. (see Appendix A for the information submitted by role models).

I chose to invite only women for the face-to-face workshops to encourage a more peer-like atmosphere to the meetings. These individuals were recruited by contacting organizations on campus (e.g., Women in Science and Engineering, minority graduate student listserv), professionals in the area, and through e-mailing individuals who were recommended by others on campus. The criteria for being included as a workshop participant was being a women in a professional field (most were in science, medicine, or engineering), having a value of mentoring, and being interested in participating in discussions focusing on personal and professional issues for women in the sciences. Phone or e-mail about the format and goals of the workshops briefed models about what to expect. In the focus groups, 8-10 graduate or professional women participated each evening. Since there were two evening sessions for the program, the workshop participants differed slightly for each group, with some overlap among participants, and the topics discussed remained the same.

Curriculum

The workshop series consisted of 6 meetings over a 12-week period. We engaged in a variety of workshops focusing on issues of multiple aspects of identities, multiple options, and multiple mentors, with the support of electronic resources and discussions with graduate students and professionals in and out of their fields. Students participated in mentoring activities, completed personal reflections, and developed plans of action to target their concerns and involve themselves in mentoring (see Appendix B for curriculum plan).

Students participated in mentoring homework assignments, completed personal reflections, and developed plans of action to target their concerns and involve themselves in mentoring (see Appendix C for homework assignments). Most students participated in all of the workshops, with a few students missing each workshop. In those situations, I individually e-mailed or phoned the student to catch her up on the meeting. This curriculum aligned with the research goals (see Appendix D).

Pilot testing with a sample of college women helped me to refine my opening session and assessment tools. Students suggested that more scaffolding of the reflection process, initial access to mentoring experiences, and informal atmosphere would be helpful. As a result, I decided that a prototype version of the role model web site would help provide initial, albeit electronic, contact with people in the science field. In addition, I felt that a smaller group allowed for more tailored attention and so I decided to keep the groups small but I still wanted to look at a larger number of students' reactions to the intervention. As a result, I had two sessions, a Tuesday and Wednesday evening over the dinner hours. The sessions were run very similarly to each other and there were no indications that the students received the intervention differently by group. Thus, I share the results of the overall group of students who participated.

CHAPTER III

METHODS

Participants

Thirty college women attending a large midwestern university participated in the project. They ranged in age from 19 to 22 (mean = 20); 4 were Sophomores, 13 were Juniors, 13 were Seniors. Of these participants, 11 students declared a biological science major (e.g., zoology, microbiology), 5 students declared a physical science major (e.g., chemistry), 6 students declared a health or medical science major (e.g., medical technology), and 8 students declared an engineering or computer science major (e.g., material science engineering). All were considering careers in their fields, with 2 of the biological science students considering human medical careers and 2 considering veterinary medical careers. Their grade point averages ranged from 2.3 to 3.9 on a 4.0 scale (mean = 3.22). The group was diverse; 9 (30%) students were ethnic minorities (2 Hispanic-American, 5 African-American, and 2 Asian-American students participated) and 11 students (36.7%) were first generation college-goers. See Appendix E for a full list of participants. All names have been replaced with pseudonyms.

Procedure

Participant Recruitment. The College of Natural Science and the College of Engineering electronically posted an advertisement for a "future career concerns" program for women (see Appendix F). Interested students were asked to respond to me personally over e-mail and report their major, year, career goals, and why they wanted to participate. Within 5 days of the advertisement, I received an extremely large response from women students who wanted to participate (over 400 students). This represented expressed interest from approximately 10% of all women science and engineering students and highlighted the salience of clash in a larger group of women's experiences.

Participant Selection. I narrowed the responses to approximately 60 students who met the following criteria: 1) at least Sophomore status, 2) concerns/interests that would be targeted by the program (i.e., looking for a mentor, struggling with clash), 3) planned to pursue a medical, science, or engineering career. With the large number of responses, a student's e-mail response for why they wanted to participate served as an application for participation the program. Many students were not chosen because they did not provide a great deal of information in their e-mails about why they wanted to participate and this dramatically decreased the pool. Based on the students' schedules and their ability to commit to participating in all of the sessions, I selected 36 students total, with 18 per group.

Participant Attrition. After the first week, 3 students from Group 1 did not wish to continue because of their schedule and interest changes. As a result, there were 33 students in the program. In addition, one student participated in all 6 sessions but did not complete the post-survey. Two other students did not attend the final 2 sessions and as a result did not complete post-surveys. Based on their participation in sessions, they appeared to benefit from the intervention and did not appear to differ from other students; however, without the post-surveys, conclusions could not be made about change in the intervention. Thus, three students were excluded from the final analysis. The following analysis is based on the 30 full participants.

Data Sources

In addition to collecting descriptive information (e.g., year in college, grade point average, race/ethnicity, current major and career plans, and any past majors or career plans), several surveys were constructed to assess students' future career concerns, conceptions of mentoring, mentoring experiences, and motivation in science.

The first survey targeted students' future career concerns using a Likert-type scale ranging from 1-6, with higher numbers indicating a higher level of agreement with items (see Appendix G). The items assessed the various forms of clash that students may

experience (e.g., personal life, having children, working alone, working long hours, competitive work environment, the work will not help others), source of clash (e.g., not feeling similar to others in terms of personality, gender/race, lack of role models), strategies (e.g., knowledge of alternative career paths in science, pursuing careers outside of science), and perceptions of the fields' power on individuals (e.g., the field demands sacrifices from individuals). In addition, students could add comments in an open-ended space following the Likert-type items. In addition to being able to determine pre-and post-change on items from the survey, the survey also helped to determine the intensity of their struggles by looking at their responses more as a whole.

The second survey targeted students' conceptions of mentoring using the same Likert-type scale (see Appendix H). This survey assessed students' beliefs about mentoring by asking students their level of agreement with questions about what they think about when they think of the word "mentoring." Questions assessed the purpose of the mentoring (e.g., to emulate others). Other questions assess what mentoring looks like structurally and who is involved (e.g., mentoring as long-term relationship between two people, a series of ongoing relationships). Other questions assessed their role in the process (e.g., students asking questions). In addition, questions assessed students' mentor selection criteria (e.g., mentor is someone of the same background/gender, someone is who out of the field but supportive, a variety of people with various resources). In addition, students were asked to complete an open-ended portion about what the term "mentoring" brought to mind. These various questions helped paint a picture of their views on mentoring before the intervention and again afterwards.

The third survey assessed students' experiences of mentoring in order to gain a sense of whether students had any experiences of mentoring before entering the program (see Appendix I). This section asked students to complete an inventory of possible key supporters: an academic advisor, a family member, professor, formal mentor, professional from work, and a space to list others. Then an open-ended question asked students to

describe how others had helped them and what kinds of experiences they had had with mentoring. This served as a baseline to determine the extent of the students' networks and the types of mentoring they had experienced. At the end of the intervention, an open-ended post-survey was administered to inquire whether students felt they had gained experiences of mentoring. A fourth survey was administered to assess students' motivational changes at the post-intervention only; it asked students to reflect whether their motivation had decreased, increased, or stayed the same over the semester. Motivation was defined to the student as a general motivational level and/or a motivation to pursue one's field. In addition, students completed a take-home survey that was returned through campus mail. This survey asked them for feedback on the sessions. In addition, it asked about their perceptions of their field, including their personal fit with their field and their views of any "rules" in their specific field.

Ten students were selected to participate in follow-up interviews in late January, approximately 6 weeks after the conclusion of the intervention. These students were selected for interviews after reviewing pre-post changes on the surveys and it was determined that they represented a variety of responses to the intervention. Students were asked to act as co-researchers in interviews, offering their insights about the intervention and the key variables. The interview was open-ended, inquiring about students' changes in conceptions of mentoring, clash, and motivation and also students' reactions to elements of the program. In addition, 16 weeks after the conclusion of the intervention, all students were contacted via e-mail to follow-up on their thoughts about mentoring, any new career- or mentoring-related experiences, and career plan updates.

Data Analysis

Since conceptions of mentoring was the treatment variable and future career concerns (with a focus on future images) and motivation were the primary outcome variables, the survey data were analyzed for effect within group due to treatment and also for differences across individuals. For mentoring conceptions, students' responses to the

Likert-type items were analyzed for pre-post changes using t-tests to assess group changes. Then, changes in open-ended responses for conceptions of mentoring were analyzed within individuals; emerging patterns of individual change were described, categorized, and refined using such tools as the constant comparative method and triangulation using multiple data sources. This process was repeated for students' responses on items regarding their future career concerns, and additionally relied upon the take-home survey about students' views of their field. To assess motivational changes, students' responses on the post-survey open-ended item inquiring about their motivation and also their experiences of mentoring were used. After this analysis, ten students were selected to participate in follow-up interviews because they represented a range of change and experiences across conceptions of mentoring, future career concerns, and motivation. These interviews helped to refine and extend the findings from the surveys.

CHAPTER IV

CHANGES IN MENTORING CONCEPTIONS

Chapter Overview

In pre-surveys, students described similar conceptions of mentoring. When asked what the term "mentoring" brought to mind, students envisioned a long term relationship with one woman in science, balancing career and family, who would guide them into the field. This suggested a very specific and narrow mentor selection criteria and a defined mentor's role, with little mention of multiple mentors or the student's role. Post surveys showed evidence that students' conceptions of mentoring had developed and expanded in the direction of the composite mentor in the context of this intervention. They were now more likely to agree on Likert-type items that mentoring involved multiple people in and out of their fields. In addition, they had more reasonable expectations of mentors and described a pro-active role for themselves. Open-ended responses and interviews illustrated the changes within individual students: 11 students described their move toward constructing a composite mentor from a diverse set of people, 10 expanded their mentor selection criteria to include men and people outside their fields, and 9 became more aware of their role and needs in mentoring. Cases within each category are presented to illustrate these changes. This redefinition of mentoring was accompanied by changes in their actions. Students' motivation to seek out mentoring and their experiences of mentoring increased. Overall, students' redefinition of the term "mentoring" helped them to see a purpose for mentoring and motivated them to seek new mentoring experiences.

Group Changes Toward the Composite Mentor

Quantitative data

Students (n=30) responded to Likert-type items (1= strongly disagree to 6=strongly agree) to indicate their level of agreement with statements that described what the term "mentoring" meant. Paired t-tests were conducted to assess changes after the intervention. Students were more likely to agree that mentoring described "multiple relationships, some closer than others" (m1=4.20; m2= 5.00; SD=1.37; t=3.188, $p<.001$), "a variety of different people" (m1=4.47; m2= 5.33; SD=1.28; t=3.710, $p<.001$), and "someone outside of my field but offering insight" (m1= 3.83; m2=4.43; SD=1.00; t= 3.275, $p<.001$). In addition, they were more likely to disagree that mentors must be able to "anticipate important questions" (m1= 5.00; m2= 4.63; SD=.81; t= 2.483, $p<.02$). Other items, including students approaching mentors, modeling themselves after someone else, and mentors taking students "under their wings" and leading them into the field were not significantly different after the intervention.

These data illustrate that students had moved toward the composite mentor because they increased their agreement that mentoring makes them think of multiple relationships, with a variety of different people, including people out of their field. In addition, students were more likely to disagree that mentors could anticipate their important questions, suggesting a more realistic expectation of mentors and foreshadowing the more pro-active stance students had toward mentoring.

Qualitative data

In addition to the Likert-type items, students completed an open-ended section of the survey which asked them to describe what the term "mentoring" brought to mind. These open-ended responses provided more evidence of change in students' mentoring conceptions.

Pre-surveys. In presurveys, their responses usually opened with, "A mentor is someone who..." and the student went on to describe the role of the mentor or the criteria

she used to select a mentor. In fact, 28 of the students defined mentoring as explicitly involving "someone", "1" mentor, or meaning a "1 on 1" relationship, rather than "some people" or other plural descriptor. For example Jane described:

> A mentor is someone who explains the opportunities available to you (the best that they know), helps connect you to other resources, and answers suggestions to keep you on the right track, in terms of career goals and requirements to achieve them. (pre-survey, emphasis added)

In contrast, only 2 people wrote the words "people" or "many people" to describe mentoring. This suggested that the word mentoring brought to mind a conception of one single mentor.

Students' responses lacked a description of the student's role in the relationship besides benefiting from the mentor's guidance. The majority of the students described what the mentor "should" do or should "provide" to the student in terms of advice, guidance, or encouragement, with the exception of 2 students who suggested that the mentor may benefit from the exchange with the student. For example, Keshia wrote:

> Mentoring brings to mind someone who has experienced situations relating to things I would like to do and guiding/providing me with insight as to how I can be successful towards my achievements. I am looking for a mentor who I can develop a good relationship with and someone to provide me some kind of insight as to what's ahead of me. (pre-survey)

Keshia, like other students, was looking for a mentor to guide and provide her with insight. The students wanted someone who they could emulate: a woman in their field who balances career and family, who is approachable, and who will guide the student into the field. This specific mentor selection was vivid in their responses. One student, Brianna, was looking for a "one-on-one relationship with someone (preferably a woman) in my field that could help me see what it's 'really like' doing this job." Another student described:

> I am looking for someone to provide insight to me. I seriously have tried to get know my advisors and professors here but it seems like they don't want to make an effort as well. I haven't really talked to anyone in my medical field...I want to find a mentor for myself. Someone I can look up to, and try to be like. To be able to say, "Gee, I really want to be like him/her when I'm all done with my schooling," that would be wonderful! (Annie, pre-survey)

Thus, students' conceptions of mentoring were strongly defined by the mentor they were seeking. When asked what the term "mentoring" brought to mind, students envisioned a long term relationship with one woman in science, balancing career and family, who would guide them into the field. This suggested a very specific mentor selection criteria and a defined mentor's role, with little mention of multiple mentors or the student's role.

Post-surveys. In their post-surveys, students were more likely to describe mentoring as involving multiple relationships. Consistent with the quantitative changes, 27 students now described mentoring as involving "people", "multiple relationships", "mentors", or other ways of signifying a multiple conception of mentoring. For example, one student explained:

> I don't see mentoring as a one-one relationship anymore. I really do think, now, that you can draw off of many sources for different things. My friend and former boss would be someone I turn to for advice about the business world and politics, but she couldn't give me advice about getting into med school. I have learned now that you can't expect to have a one-stop shopping mentor. It isn't humanly possible. (Lori, post-survey)

Another student corroborated:

> Now I don't think mentoring involves 2 people only. I think mentoring involves a lot of people that can help you in different areas. Each mentor can help you in one area. (Zarah, post-survey)

In addition to seeing mentoring as involving multiple people, students no longer thought these mentors had to be in one's field, with students acknowledging the important role of men and women out of their fields, peers, and advisors. An impressive change involved students' descriptions of their role in mentoring, with 18 students mentioning their role in post-surveys. For example, one student said:

> I still think of mentoring in pretty much the same way. But because of the program, I think it is much more important than before and I need to make more of an effort to establish more mentoring relationships. (Jill, post-survey)

This pro-activeness was evidenced by the students' changed expectations of mentors, their need to be pro-active, or how they were actively drawing from the resources they had available.

Summary. To summarize, there were several changes in students' responses to the open-ended section which extend our understanding of the quantitative data. First, students' conceptions of mentoring shifted from 1 to many. Initially, only 2 students suggesting that mentoring could include more than one mentor and in the post-survey, 27 students described mentoring as involving more than 1 person. Second, students' conceptions of mentoring shifted to include their role in the mentoring relationship; at post-test 18 students defined the students' role. Further, students were more likely to have an expanded mentor selection criteria in the post-responses, specifically noting their inclusion of men, people out of their fields, and one-time interactions as having mentoring opportunities. This suggests that students' conceptions of mentoring did indeed move toward the composite mentor during the intervention.

Changes Within Individual Students

There was a range of ways that students individually changed their conceptions of mentoring. The 30 students' changes can be placed within 3 categories: 11 students moved toward articulating their composite mentor, 10 expanded their mentor selection criteria but did not articulate a set of mentors for the composite, and 9 defined their role and needs in mentoring. It is not to say that these are mutually exclusive categories, but rather patterns of change that are exemplified by students in each categories. For example, students who articulated their composite mentor had expanded their mentor selection criteria and had become more pro-active in the mentoring process. Each of the themes and students within each theme is introduced, followed by more in-depth case examples.

Cases of Moving Toward the Composite Mentor

Of the participants, 11 students articulated the composite mentor they were constructing. These students described how different people targeted a different part of them and who was involved in their set of mentors. These students redefined mentoring from a single mentor to a composite mentor. For example, Annie and Abha talked about combining multiple people into a "mentor". April and Jeri recognized that different mentors

could provide different things; the person who supports you emotionally may be different from the person who gives blunt advice. Kellie highlighted the importance of a changing set of mentors depending on the point in life or career. Brianna, Zarah, and Josie suggested that one can think about using multiple mentors to target different areas of one's life, such as work, family, or friendships. Corie, Lori, and Carol provided more specific details about how they integrated and applied a few different people's experiences to their own futures. Students had a mix of initial experiences; some students initially had more realistic expectations of mentors and others had very high expectations. Some students were more frustrated than others. The cases of Corie, Abha, and Carol are useful because they typify students in this category and they were articulate in describing their move toward the composite mentor.

Corie was a sophomore in computer science who was originally looking for a mentor who would carry a great deal of responsibility for her success. In her response to what the term mentoring brought to mind, she said:

> Someone to serve as an example to prove that what I am trying to accomplish can be done. Someone to warn me of trouble they encountered and tell me things that would help me; things that would have helped them along their career path. Someone I can tell my worries and concerns to...who can give me advice, but not necessarily have to form a close relationship with. (pre-survey)

Over the semester, she engaged with a number of guests and also used the web to explore career options. Her reconceptualization of mentoring was articulate:

> My definition of a mentor has stayed the same, but I have not found the "exact" match for me. So through this program, I pulled little bits of info from different mentors to get the full picture of what I was looking for. It changed my outlook by not pursuing someone who was doing "exactly" what I want, but got me to take what other people have done and apply it to my own goals. For example, J. is a grad student in computer science and M. is a consultant in engineering. I could combine these two and apply it to my own goals. (post-survey)

Corie's ideas about mentoring change from searching for the one ideal mentor to interacting with different mentors. In addition, she changed her views from needing the mentor serve as an "example to prove" her future image was possible, to her applying others' experiences to her own goals. She also describes pulling little bits from many mentors

instead of expecting a single mentor to give her complete advice. When I interviewed her 6 weeks after the intervention, she elaborated:

> I realized after watching the different kinds of people that you brought in, there was always one aspect that I could kind of relate to in that person. So I thought, "I know they don't have this, but they kind of have this." Then there was another consultant that came in and another lady talking about graduate school and things like that. I thought, I hadn't considered graduate school. So I started considering that. Then I took into account what some other lady had said. I kind of put those together and I thought "Okay, so I'm probably not going to find a lady who is in graduate school and determined going on to computer science and, by the way, wants a family on the side." I guess I could take both into consideration and probably try and balance it myself. (interview)

Corie describes her realization that she may not find a mentor who is consonant with her desired future image and her reaction to become more pro-active in pulling aspects from the various people that she did have available. In doing so, she could support her desired future image.

Abha, a computer science and English double major, was originally looking for a career mentor, someone who could offer her information about her future career.

> Mentoring, to me, would be my academic advisors, heightened by several degrees. I would like a mentor who could tell me more about what a science major ends up doing 5, 10, and 20 years after graduation. (pre-survey)

In her post-survey, it appeared that she was even more focused on finding a single mentor, but one even more multi-faceted than before. She said:

> With participation in the program, my thinking about mentoring has changed somewhat. I would like my mentor to be someone I could go to for information and counseling on all subjects pertaining to my career, not just about "how can I get a good job?" I would like to be able to ask my mentor about career advancement, alternative careers I could pursue, etc. (post-survey)

In an interview with her, she explained what she meant by this search for a mentor. In fact, she had reconceptualized "mentor" in such a way that she was referring to a composite mentor; she was actually looking for mentoring from different people in each of these domains. She said:

> I think [the composite mentor] is a good idea, if you have different people-- one of them who worked while she had a baby and another one that worked in a male-dominated field, that's a really good idea. I think one of my computer science professors I've had before...she has mentioned that she has worked for all these other companies before she became a professor. Also, my advisor for computer

> science [is a mentor]. There is one woman who has gone through all this before I even became a computer science major, I have always asked her about help and she referred me to other people. She had been kind of a mentor, too.

Abha clarified in her interview that she was indeed seeking multiple mentors who would complement the support she had from her father, who was a strong support in her life. In an e-mail 16 weeks after the intervention was over, she wrote:

> The composite mentor idea will never leave my mind, and I have thought about it quite a few times this semester. I have decided to look for mentors wherever I can find them. This way, different people can give me different pieces of information, all of which I need, but which probably could not come from one source alone.

These comments illustrate the long-term change in her thinking about mentoring and how she had reconceptualized mentoring for continued use after the end of the intervention.

Carol was a first generation college-goer and a Senior in chemistry. She expected that her ideal mentor(s) would be in her field and would be able to offer her advice about her concerns with balancing career and family.

> I am hoping for the chance...to meet and discuss (possibly develop a relationship) with people or a person who has already been where I want to go, to glean some advice, knowledge and realism with regard to careers and family in my field. (pre-survey)

Even so, she managed to further reconceptualize mentoring in the direction of the composite mentor. She said:

> I have come to realize that mentors can be people both inside and outside my field. A diverse group of mentors can help you to address concerns from different angles. Some of the most valuable exchanges I had came from a mechanical engineer/consultant/home-schooling mom, a math Ph.D., and a computer science graduate student. (post-survey)

Carol was initially thinking about a mentor(s) in her field, but realized that mentors can be people outside of her field too. Specifically, she sees a diverse group of mentors who can address her concerns from different angles. Carol worked on developing a clearer sense of her own future image and has been trying to take into account the perspectives of others.

By learning about the complexities of themselves, these students began to see the value in having multiple people who can address each aspect of them. This change in conceptions of mentoring was importantly accompanied by changes in their understandings

about themselves, their capacities, and their needs. Their pro-activeness was evidenced in students' descriptions of "pulling" from mentors and seeking certain aspects of others' experiences. These results provide evidence that students were now more likely to construct a mentor from a diverse set of people, guided by their own future images. These students who exemplify the implementation of the composite mentor suggest that a change in one's conceptions can occur and can have a powerful impact on one's actions.

Cases of Expanded Mentor Selection Criteria

Of the participants, 10 students expanded their mentor selection criteria during the intervention. This expansion of mentor selection criteria was more or less extreme; some students expanding their mentor selection criteria to include literally "anyone" willing to help, while others were more willing to concede that a man in their field or people out of their field could be potential mentors. Students within this category initially had more narrow ideas of mentors and were not able to find people who fit their mentor profile. At the end of the intervention, students were more likely to recognize "unofficial" mentoring — mentoring that is undefined, involving multiple people and situations, and that can occur even during one interaction.

For example, Rose specifically counted mentoring as involving a one-time interaction with anyone willing to share his or her experiences. Robyn and Ebony literally looked to anyone in their paths as potential mentors, with mentoring meaning a kind of help or guidance. Illustrating a more extreme expansion, these students used their own future images as a guide, leading them to seek out support from anyone willing to help. Tiffany, Kate, LaTisha, and Michaela said that they were willing to have mentors out of their fields, if the person was willing to share his/her experiences. Georgia and Kayla were more specific about how someone from another field could be helpful. Both of them mentioned that a career mom who was not in their specific field of interest could be a mentor for them. The cases of Robyn, Kate, and Georgia are useful because they represent typical students in this category and a range of mentoring experiences; Robyn was frustrated by her lack of

mentoring, Kate so wanted to find a role model to emulate, and Georgia had some rich experiences of mentoring coming into the semester.

Robyn was a junior in human biology who was originally frustrated with her lack of access to mentors and important experiences in the field. She was looking for a career mentor to help her. She wrote in her pre-survey, "I am looking for someone who will give me hints as to how to make myself more competitive for jobs, what activities to be involved in, etc." Her overall tone about mentoring and conception of who qualified as mentor dramatically changed over the semester.

> I think this program has helped me realize that almost anyone can be a mentor, your TAs for class, your professors, your parents, even your older friends. And I have also discovered that everyone enjoys answering questions about their field, and they are excited that you are interested in their field...It just seems that all of a sudden, all of these opportunities popped up, and I stopped being afraid to ask questions. I think as soon as you start to become aggressive in your pursuit, you will succeed in finding the answers to your questions. (post-survey)

Robyn's conception of a mentor expanded from a unitary "someone" to a multiple notion that "anyone" can be a mentor. She also noted her more pro-active stance to mentoring, that she "stopped being afraid" and started "to become aggressive" in finding the answers to her questions. She elaborated in her take-home survey that "office hours are vastly under-used resources" and in her interview that she had gained all new kinds of work-related and mentoring experiences. For example, she started seeing a new advisor, volunteering in an optometry clinic, and conducting research in a lab. She said:

> I think it was that first test [read: survey] "would you consider someone outside your field a mentor?" and I thought no, but now I think there is something to learn from everyone. I was intimidated to talk to professors and stuff like that but then I thought the worst thing they can say is no. The people that I met in your program made me realize that you can be finding this out from anybody. I didn't even know what mentoring was before I came to you so that has totally changed for me because I think that anyone can be a mentor. I'm even mentoring my friends who are a year lower.

Robyn revealed that her new open criteria for mentors. This appeared to lead to a pro-activeness to seek experiences and insights from multiple people. When she realized that many different kinds of people, rather than one mentor, could help her in some way she took advantage of existing connections and sought out new ones.

Kate was a junior in chemistry who was originally looking for a mentor with very specific criteria and was not having success in finding such a person. She said:

> Mentoring brings to mind some of my old teachers; the ones you go back to visit and get to know on a personal level, who can offer insight or advice. I would be looking for someone who is a female in a science field, who has managed to balance a successful career and family life. (pre-survey)

After the intervention, she noted that she was still on the look out for these ideal images, but was more willing to take instances of mentoring and mentoring from people who do not fit her ideal image.

> I still look for females in science, but I also accept other advice and insight as well. I have noticed that I tend to follow the advice given by women more often; usually because whatever the advice is seems more like "me." I also have talked to many types of mentors–some only over e-mail and some only once. Yet their advice was still greatly helpful. (post-survey)

Kate's expanded her initial stringent criteria for mentors, and in doing so, saw the value in gaining mentoring from these others. In addition, she elaborated in her interview:

> I usually look at people who are doing things that I would like to do or have done things that I would like to do just to see how they got there. There is a friend of the family who just graduated, she is an orthodontist now. I think she got married during one of her years of dental school, graduated from that, started her orthodontics and she was pregnant and had the baby in the middle of the term. It's nice to see that she has a family but it hasn't stopped anything else. There is one of the professors that I worked for in chemistry and he was telling me that he didn't go straight to grad school either...you can still take a year off and you're fine. I think everybody thinks you are going to go to college and some professor is going to take you under their wing and that doesn't happen, you have to be pushy.

Kate articulates what she is able to take from the various people she has access to. Rather than trying to follow a mentor's specific path she learned lessons from their experiences. This encouraged her to continue to pursue her interests in both chemistry and dentistry.

Georgia was a senior in forensic chemistry who had some prior experiences with mentoring through a summer mentoring program. This was reflected in her pre-survey

where she wrote, "'Mentoring' brings to mind showing the next generation the ropes, associating a person who may share similar research interests as you into your field." By the end of the intervention, her ideas had shifted to go beyond the one mentor in the field who shows her the ropes.

> My beliefs about mentoring have changed. Before I thought a mentor had to be in the same field but now I see that they can simply have the same goals or interests. A career mom can be a mentor to me just as a man in the Forensics field.

This was important to Georgia, who was interested in possibly marrying her current boyfriend. While her science career mentor (a man) provided important career mentoring, she was also seeking mentoring within her personal life. She felt that a career mom could provide mentoring of another kind to complement what support she gained from her science career mentor.

In summary, these students illustrate that expanding their mentor selection criteria can move students into action. Once students saw the potential insights existing in a range of mentors around them, they could do something seek out these insights out in more or less formal ways. They listened to people they met at school functions, in office hours, and over the Internet. Their new conceptions changed their experiences and perceptions of their field. Students began to see others in their environments as people who wanted to help them. This influenced students to see others, especially professionals in their fields, in a more positive light. In turn, students were very assertive in asking questions and seeking out multiple people and experiences to address their concerns and gain information. These results suggest that students expanded their conceptions of mentoring to include multiple people. In addition, these results suggest that students were trying to use their own future images as a guide for selecting mentors rather than letting the mentor images determine what their future images could be.

This was important for women who were not recognizing the support they did have, as there were key people supporting them from outside of their fields. This helped them to appreciate the aspects of those who were willing to share their experiences and

placed more responsibility on themselves to select what they would apply to their own lives. In addition, this change opened up mentoring possibilities for students. Including men and people out of their field was a breakthrough for students who were frustrated with the lack of women in their fields, and a lack of professionals with families. These results suggest that students expanded their definition of a "mentor", in these cases to include men and people outside of their fields.

Cases of Defining One's Needs and Role in Mentoring

Of the participants, 9 students' conceptions of mentoring expanded to include a role for themselves. Students felt it was important for them to seek out and initiate mentoring. Others realized how they thought about mentoring had an influence on whether or not they would find mentoring. In addition, some re-articulated what they were looking for in a mentoring relationship. For example, Estrella realized that she was ruling out people who did not fit her ideal notion of a mentor. Jill and Ryan suggest that they need to seek out mentoring. Lizzie, Genoveva, and Julie talk about how their expectations of mentors have changed. Sunita felt she specifically needed a mentor in her field. Keshia did not see her conception of mentoring changing, but she was more articulately described that mentor-student similarity was an important quality of the relationship. Jane also said that her ideas about mentoring stayed the same, but refining her description of mentor to mean multiple people. The cases of Genoveva and Estrella are useful; Genoveva reflects a dramatic shift in ideas regarding her role in mentoring, while Estrella struggled more and progressed more slowly.

Genoveva was a sophomore in civil engineering who took a phrase from the pre-survey item to describe her ideas about mentoring.

> Mentoring is when someone takes you "under wing" and helps you get acquainted with your field. A mentor should be well knowledged and patient, with a willingness to have someone next to them. I hope to find someone who doesn't think I'm incapable of learning new things, or who is afraid to give me some trust. It should be a strong relationship where we both give and take, and learn some engineering along the way! (pre-survey)

By the end of the semester, Genoveva's conceptions of mentoring had shifted dramatically, from seeing herself as a student who was carried by the mentor to a student who wanted to be questioned by her mentor(s).

> I thought you had one mentor who led the way! Slowly, I'm learning that it is better another way. I learned a lot from my one day with J. (a graduate student in computer science). I didn't ask a lot of questions, but she answered concerns I didn't even know I had. A lot of things she said are going to go with me through life. I also hope to find an engineering mentor too. But I don't want them to just shelter me and carry me along. I would rather have them question me and treat me like I'm going to be treated in the workplace. I think that's more beneficial than someone who will "take me under wing." I want to find emotional support elsewhere and find strong connections.

Genoveva realizes how her own conceptions have developed and articulates her new conceptualization of the mentors' and student's roles. In addition, she was interested in seeking multiple mentors.

Estrella was a sophomore in pre-med who was looking for a role model in the field of medicine. Her post-survey revealed a sophisticated understanding of her own role in the mentoring. She said:

> My thinking about mentoring has changed. It's been harder for me to find a mentor since I came to the U. But I think it's because I'm looking for a mentor, so I'm ruling out who ever doesn't seem [like they] could help me. Or someone who doesn't have what I'm looking for. The mentor I had [at my other university] — I wasn't looking for a mentor. It wasn't until I left and started the program that I came to realize that he was my mentor. In another way, my thinking on mentoring has developed in that I learned new ways of finding a mentor, and I learned what a mentor was and different ways they could help me. (post-survey)

Estrella had become more aware of her role in mentoring and how her own thinking about mentoring has changed. It was a significant revelation for her to realize that people who did not fit her criteria were being ruled out. She elaborated in an interview about the complexities of mentoring:

> I haven't been pursuing in finding one, but I do feel you do need one...[The composite mentor] sounds like a good idea but it's hard to get that. It sounds perfect but it's hard to get these people, what aspects of this person what do I want to grab or what do I not want. I'm just trying to get into one of the graduate students, speaking to my professors because I want to be involved in research.

Although she had not yet acted on these ideas, Estrella had a clearer understanding of the kinds of mentoring she was looking for and how she could be more pro-active in seeking

these experiences. These students shared how their having an important role in mentoring influenced their plans of action.

In summary, these students realized what was keeping them from mentoring was, in part, themselves. Besides seeing a more critical role for themselves in the process, they realized how much they expected the mentor to lead, guide and tell them everything. Without such high and unreasonable expectations of mentoring, and a determination to seek out mentoring, these students saw a greater likelihood that they would eventually find mentoring in their environments. These results suggest that students changed their thinking about mentoring to include a more pro-active role for themselves and more varied mentor roles. In addition, students were more aware of the different ways that mentors can help them. These results suggest that not all students embrace the composite mentor, but the program influenced students to become more articulate when defining mentoring and more focused on their own needs in the mentoring.

The Composite Model: Propelling Students into Action

Given the specificity of their mentor selection criteria and their passive role in the mentoring process, it was not surprising that students were frustrated with the lack of mentoring experiences they had prior to the program. Although they had supportive people in their lives, all but two of these students reported they had yet to find anyone who qualified as a mentor. During the intervention, students had the opportunity to meet several people in and out of their field. Students completed short assignments, asking them to visit a role model web site, to follow up with guests, and to explore career options and contact professionals on the Internet. It was predicted that if students could see these individuals as potential mentors and were motivated to participate in sessions, they would have greater experiences of mentoring by the end of the semester both through the intervention and in other settings. In this section, I show how the composite model motivated students to act by using students' responses on post-surveys about their mentoring experiences. I illustrate

these changes by offering sample quotations from the case study students within each category.

Increased mentoring experiences

In their surveys, 23 students reported that they had greater mentoring experiences after the intervention, meaning that they had more relationships or interactions with people that they counted as mentoring. The students reported that the people they met in the program provided mentoring that they otherwise would not have had access to before. In addition, they were seeking out new experiences of mentoring and began to see mentoring in places they had not before (e.g., from peers, advisors). For example, Carol said:

> My experiences of mentoring have changed in that I have been mentored by both peers and professionals, young and old, and in and outside of my field. Previously, my mentoring was solely within my field by professionals. (post-survey)

This illustrated the range of mentoring Carol experienced within the intervention. In addition, Robyn highlighted the increased experiences of mentoring in settings outside of the intervention.

> My mentoring experiences have completely changed. I am asking everyone questions now, and I have so many mentors now, without even calling them my mentors. They are more like friends, and they are always willing to answer questions and help you in your career pursuits. I don't think I had any mentors in the beginning of the semester, and now I feel like I have tons! I think I mentioned my mom at the beginning of the semester, but now I have TAs, graduate students, professors, academic advisors, etc., etc.! (post-survey)

These examples illustrate how most students gained new experiences of mentoring now that they were able to identify viable mentors in their environments. Their expanded definitions of mentors and pro-active role led them to find many mentors to support them.

Plans to seek mentoring

In addition, the other 7 students reported that their experiences of mentoring had not changed, with 4 of these students reporting plans to seek out mentoring. They explained that while their access to mentoring and motivation to seek out mentoring had increased, time constraints and possible procrastination or anxiety kept them from fully seeking out

the opportunities and people they wanted to. For example, Estrella voiced her belief in the value of mentoring.

> I haven't been pursuing in finding one, but I do feel you do need one. It sounds like a good idea but it's hard to get that. It sounds perfect but it's hard to get these people, what aspects of this person what do I want to grab or what do I not want. I'm just trying to "get in" with one of the graduate students, professors-- so they can get you into a program because I want to be involved in research. (interview)

Others, like Georgia, already had a mentor in the field and did not think her experiences had changed. Through her interactions in the sessions, it seemed that she was still looking for an additional person, a woman, who would help her to think about balancing career and family.

In summary, students not only changed their ideas about mentoring, but also became more motivated to seek out new mentoring experiences. Most gained new experiences of mentoring which was likely due to the expanded mentor selection criteria and pro-active role used by students.

Discussion

These results illustrate that mentoring conceptions were developed and expanded in the direction of a composite mentor. While searching for the perfect mentor may be something many students had in common initially, they were not bound to these beliefs. Students benefited from reflecting on their conceptions of mentoring. These results suggest that we can better understand how we think about mentoring and more strategically conceptualize how to use mentoring in ways that support our desired future images.

The redefinition was important in allowing students to let themselves experience mentoring. These results suggest that it is less important to have a common definition of mentoring and more important for students to identify instances of mentoring where they occur. It was critical that students learn about the complexities of themselves; this encouraged them to assess what experiences, interactions, and relationships they wanted to seek and count as mentoring. With the expanded definition of mentoring, and more focused ideas of the kinds of mentoring they needed to support their desired future image, students

were able to call more instances mentoring. This allowed potential mentors to be quite different from the student and to be "imperfect" in key ways. All the person has to do to qualify is be able to offer a new insight or help in some area of life.

There was a strong motivational feature of the composite mentor model. Students were less anxious and more likely to seek help from people inside and outside of the intervention. At the very minimum, students followed up with guests, e-mailed the web models, and went to office hours. Beyond that, students sought new career-related experiences or developed plans to do so. The composite mentor helped them to envision for themselves an important role in their own mentoring.

CHAPTER V

MANAGING CLASH OF FUTURE SELVES

Chapter Overview

Clash is a term to describe the tension between students' competing positive and negative images of themselves in their future careers. Students entered the program with experiences of clash; they were concerned about combining their personal life and science career, having a family in the future, and working in a competitive environment. At the end of the semester, students' clash remained, which was unexpected because of students' positive reactions to the composite mentor idea and their new experiences of mentoring. However, it appeared that students began to see clash as an on-going tension rather than a reason to leave the field. Students reported that professionals, regardless of their field, were still managing clash yet were happy with their decisions to pursue their careers in science. Interviews with students helped to substantiate the claim that clash, when redefined as an on-going tension experienced by professionals regardless of their specific field, began to motivate rather than overwhelm students. These results suggest a relationship between students' conceptions of mentoring and their experience of clash. Clash was rooted in students' inability to identify viable mentor images, or images that were consonant with their desired future images. When they began to see others as people with similar values and as experiencing similar struggles, they could start to see a place for them in the sciences.

In the last chapter, we learned that students' conceptions of mentoring moved in the direction of the composite mentor. Students expanded their mentor selection criteria and saw a pro-active role for themselves. In addition, they were seeking multiple mentors and gaining new mentoring and career-related experiences. What impact did this redefinition of mentoring have on their future career concerns, specifically, on their experiences of clash of future selves? I first present evidence that clash of future selves was a salient concern for students in the program.

The Salience of Clash of Future Selves

Pre-intervention. Recall that the program targeted students with "future career concerns". The advertisement asked students, "Are you trying to decide if a science or engineering career is really for you?", "Do you have concerns about your future career path? (For example, having a personal life or family in the future, diversity in the workplace, wondering if your work will make a contribution?)", and a range of other questions targeting their clash. The students who were selected fit these criteria. For example, Missy's application was typical:

> I am interested in the career workshop for women. My name is Missy and I am a senior majoring in Physiology. I will graduate in May and plan to work in biological research, and then attend medical school. Many of the issues you addressed in your e-mail are concerns of mine. I plan to get married and have a family but I am concerned about how everything will be juggled. My desire for a family conflicts with my desire to be a physician, and many of the people I have talked to say that I must choose or one or the other will suffer. I would like to believe that this is not so, and I hope your workshops would offer some insight. Thank you. (initial e-mail)

Missy's application highlighted one predominant type of clash involving lifestyle choices. As she explained, her desired future image involved combining family and becoming a doctor, while many people say that one must choose a lifestyle without a family to become a doctor.

Although the nature and intensity of clash varied student to student, the salience of some type of clash was apparent in all students who participated. Students completed a

survey that assessed their future career concerns and other experiences. The survey used a 1-6 Likert-type scale, with higher means reflecting higher levels of agreement. In their pre-surveys, students agreed with a number of items, illustrating this range of clash. Their chief future career concerns were having a family and science career in the future (mean= 4.8077), having a personal life and science career in the future (mean= 4.6923), and working in a competitive environment (mean= 4.5000).

In their pre-surveys, students described their future career concerns. These descriptions helped to paint a picture of their clash. Initially, their descriptions had an "either/or quality" and had a negative, frustrated, anxious, and worried tone. For example, students who were concerned with issues of combining family and career wrote questions such as, "*Can I* be a successful mother and a successful engineer?" or "Can I have a successful personal life?" to describe the nature of their concerns. Other students struggled in seeing themselves as future scientists, doctors, or engineers (e.g., Will I turn into a stressed-out, dull person?; Am I smart enough to make it?). Students came into the program with concerns that they had to make a decision between their desired future images and becoming the negative images in their environments. For example, students hoped to have families, work collaboratively with others, and become happy people. These desires conflicted with their images of child-less, stressed-out scientists, doctors, and engineers.

These survey results were extended by their comments during the first meeting. In the first meeting, students shared their concerns with everyone in the group. As we went around the table to share, it was clear that the concerns that brought them to the intervention centered on their clash of future selves. It was also clear that students had concerns in common with one another, as evidenced by Lori and Rose's exchange.

Lori: My main struggle right now is I don't know if I really want to be a doctor anymore or what aspect of the medical field I want to be in. It is sort of like having a mid-life crisis. The unfortunate thing is because I have no direction. I don't even want to go to class anymore (tears up). I feel like it is totally useless.

Rose: I kinda have the same concerns as you. I am not sure I want to go into medicine because I am not sure how much time I'm going to have for the rest of my life afterwards.

This exchange illustrates that Rose is speaking not only to the group, but also directly to Lori, by saying that she has similar concerns. Later, around the table, students continued to share their concerns, which affected science and engineering students as much as the medical science students.

> Genoveva: I don't know if any of you have heard, but engineers are dull people with stressful lives and no family life and I just can't believe that's true.
>
> Georgia: I have a whole bunch of struggles (laugh) but I want to go grad school, I want to go into forensics also. One of my big concerns is that I have a boyfriend. He lives in another state and I want to be with him but I want to go to graduate school. I am torn. Where do I go? Do I put this on hold? Or do I put him on hold?

Both Genoveva and Georgia illustrate their concerns of the future and salience of future images. For Genoveva, she had an image of what her life might be like as an engineer and for Georgia she had a more pending decision to make. Across students, as suggested in their surveys, there was an either/or quality to their concerns, meaning that students felt that they had to resolve the clash by making a choice between who they wanted to become and who the field said they could become.

The students who participated in interviews also supported the salience of clash. During the interview, students were shown a diagram with pursuing or leaving careers in the center and the variety of factors that can influence one's career choice pointing toward the center. These factors included: academics (e.g., courses, interests), support (e.g., financial and emotional support), knowledge about the field (e.g., knowing what an engineer does), and science identity (e.g., future images, seeing yourself as a scientist). The students were told that there could be other important factors, and were then asked to talk about what factors brought them to the program. While academics and support were important early on in their career path, and that knowledge about the field was becoming more important, the salience of science identity and future images in science was clear. One student explained:

> I think it has been this identity and seeing myself in that job. That's what I was struggling with, I don't want to be the Ph.D. that is going insane, that's not the only way. As far as what do I want my life to look like, what can I see myself

> [doing]. I do not see myself working in a lab. Maybe in the field but I don't know if I want to be a field researcher. Should I leave the science [and] go with the education department? (Brianna)

Brianna illustrates the clash between being a "Ph.D. that is going insane" and a person who helps others through science. Another student contrasted the other factors with science identity, to illustrate the importance of competing future images in her career decisions.

> The big one is science identity. Just because academics has never been a problem for me. [In terms of] support-- my Dad was my high school science teacher and everybody in the world should be a scientist. I think the science identity was a big one for me just because you are pulled in a lot of different directions, I think it's hard to figure out how you're going to do that. I get stressed out just going to school, I can't imagine having a house to take care of and kids and a car and all this stuff. I think there is a big difference in male and female, too, because I think you hit this age and you start thinking about that stuff. (Kate)

Kate's comments illustrate the clash between combining a career and a life that would be fulfilling in science and an image of a stressful life. Other students supported this view:

> A lot of it was the science identity... (Missy)
> I think for me mostly it's the science identity... (Robyn)

These quotes support that clash was a salient concern for students coming into the program. The source of clash was rooted in the lack of images they had access to who were happily combining the elements of their desired future image. Although they were interested in pursuing a science career, they were still trying to decide if pursuing the career would be worth the sacrifices evident in others' lives.

Post-intervention. In their post-surveys of future career concerns, students still recorded high means on the same items, including combining family and career, personal life and career, and working in a competitive environment. These high means indicated remaining concerns in those areas. T-tests were conducted to examine mean-changes within participants. There were only two significant changes on the t-tests. They became increasingly concerned with working long hours ($m1=3.9615$; $m2=4.6538$; $SD=1.08$; $t=3.14$, $p<.01$). These results suggest that students were more concerned than ever about the future career. In order for the intervention to "succeed", one might expect the students to have resolved their concerns about the future. But, as stated before, the goal was to help

students make informed choices about their future careers and it was hypothesized that the interactions with mentors could help students make these informed decisions. Coming into the program, students did not have as much knowledge of the vast options available to them and thought they were the only ones with these concerns. On the surveys, students reported that their awareness of alternative options within their fields increased significantly ($m1=3.2308$; $m2=4.0769$; $SD=1.40$; $t=2.90$, $p<.01$). As I will show in more detail in this section, students reported that they were now more aware of their concerns, confident that they could manage these concerns with the help of mentors, and were even motivated by their concerns. The following section helps to show that students began to see their concerns shared by peers and professionals and began to see clash as an on-going tension experienced by professionals across fields.

Seeing Clash as an On-going Tension

Details from our first meeting provide a baseline for illustrating how these changes came about. When asked what they hoped to gain from their participation, students said:

> Kayla: How to juggle a family and be a physician at the same time.
> Corie: See other women who have done it.
> Zarah: I want to get a mentor.
> Julie: To see if it is possible to have a social life outside of the lab. I'm in a lab right now and they don't have much of a social life.

It was clear that students were hoping to find the mentors whose images could be emulated and whose paths could pave their own ways into the field.

After this sharing time, I told students that in this program (in contrast to other programs where students are matched with a mentor) they would have the chance to select many mentors. I added that they would work hard to develop an understanding of what they want their own future images to be like, but they were not likely to find a perfect mentor who matched this image. Instead, they would try to assemble a diverse set of people who could help them get to where we want to go. After hearing this, students seemed ambivalent about participating and even disappointed. I could almost read students' minds. "You mean we're not getting mentors? What kind of program is this?" they might

have wondered. After this discussion, we headed to the computer lab and spent time interacting with the role model web site. It was here, after hearing all of these ideas, that the goals of the program began to make sense to students. The role model site, set up as a grid, resembled a place for "mentor shopping" as I had described. Corie recounted the experience in her interview. She said, "I think it was right after the first workshop when you talked about [the composite mentor]. I thought, 'Now I know what she's talking about.' So then I started looking up different people [on the web site] and it really helped me." After the initial disappointment, students seemed to see the potential benefit of the program. Through peer support, visiting the role model web site, and participating in focus groups, they began to see clash as a concern shared by others in the field.

Peer support. Even the initial interactions with other students also made the program beneficial. Students entered feeling that they were alone in their concerns. As illustrated in the previous section, students on the first day were beginning to see connections between themselves and others in the program. As one student wrote me after the first meeting, just the initial peer group and reflections were helping.

> I wanted to let you know that even just tonight I feel better. I think being able to talk to others that are in a similar situation to the one that I am in is VERY helpful. One of the girls and I talked a lot after the meeting was over and we found that we had had very similar experiences in the past. These experiences just tonight alone have helped me to gain insight into myself. 1) Not everybody who wants to go into medicine is in it for the money. There are people out there that really want to help people, just like me. (Lori, e-mail)

At this point, they began to learn more about themselves and began to see that their peers were similar to them. They might just contact some of the role models and just might return to see what the focus groups did for them next time.

Web role models. As part of their first assignment, students visited three role models on the web site and completed a worksheet about whether role models were similar or useful to them. If the role model made them think about something or if they resonated with their experience in some way, students submitted comments into the role model's

database, which was attached to each role model's web page. The following are comments from the database of Steve, a male medical student who was a role model on the web site.

> S1: It's very good for me to see someone who wasn't focused on medicine in college make it there. It gives me a sense of hope.
>
> S2: Steve seems committed to his field and I can identify with his lack of enthusiasm about classes during the undergraduate years. I know what I want to be but it is hard to justify the pain that organic chemistry causes.
>
> S3: I am also glad to see that other people in science careers try to be well-rounded. I am worried in my field (computers) that my employers will expect me to dedicate 100% of myself into my career, and I worry about being able to pursue my other interests, including my family. I am glad to see other people finding time to make sure their career does not dominate their free time as well as their work.

These comments suggest that students began to see similarities between themselves and role models on the web site, and suggest why they had positive anticipation toward meeting some graduates and professionals in person through the focus groups.

Focus groups. In the focus groups, students learned that professionals in the field were still struggling to have a social life, learning to juggle a family and career, and wondering how other people do it. After participating in discussions with graduate and professional women, reading the role models' web pages, and interacting with the role models over e-mail and others in their environments in person, they learned that these concerns were still on-going tensions for the professionals. As Abha said,

> Some of my concerns have gotten more worrisome. As I talked to other women professionals, I understood that there are other women in my field and it is possible for us to succeed. However, these same women's account of discrimination because of gender worries me immensely. I worry that because I am female, I will not have the same chances as male might have. (post-survey)

Six weeks later in her interview, Abha elaborated, "I thought maybe it would have gone away in the 90s but when women came in and talked about it they said yes it happens. I never even thought that would happen on the job but I guess it does." Talking with people in the field helped to complexify the images they had of scientists and scientists' lives.

Even with these concerns, women saw more of a place for themselves in the field. Although students saw that many people were still working on the trials of combining their personal and professional lives or finding supportive work environments, these

professionals were very happy that they had stuck with their careers in science. Because the professionals reported similar struggles, students saw a way to connect to these potential mentors. Rather than applying a mentor's solution to their lives, students seemed to take this element of "managing clash" and apply it to their own lives. Students experiencing this type of clash felt more confident after meeting women whose examples "proved" it was possible to combine their personal and professional lives and to be really happy in the field. As Corie said, "I get excited when people start telling me all the things you can do" which highlighted the motivating force of the words from people in the field.

As a result, students began to see their own experience of clash in a new light. Clash can be managed successfully by women in the field. Since the experience of clash was common to women who stay (and not just an experience of women who leave), their experience of clash did not mean they should leave the field. It could motivate them to continue to work hard for all of the things they wanted from life, just like the women they had met. This new perspective of what was possible was achieved by their interactions with guests who visited the students, role model web pages, and other mentors outside of the intervention. These changes are best portrayed through case studies of student progress.

Sample Cases

Genoveva was a student in engineering concerned about the kind of life she might have to lead if she pursued such a career.

> I wonder how stable civil engineering is in the long run. I'm also concerned that there won't be a great demand for my job. I'm not sure how to get a foot in the door, and my advisor isn't helpful. I've also heard that engineers have long hours, stressful jobs, strained families, and dull personalities (sounds fun, huh?). (pre-survey)

By the end of the semester, she was more positive about the possibilities for herself after interacting with the guests in the workshops.

> At the beginning I was seriously concerned about being in a male dominated field. I was also worried about balancing family and career. During the past few weeks, I've met some amazing women who are making it work. They're strong willed and confident, and are accomplishing things I doubted were possible. I know I can do

> it! I also know men are going to respect me and listen to my ideas. I'm now sensitive and aware of the stereotypes, and I hope to overcome those! I know I can make it! I have a lot of motivation to trudge forward and see my dreams come true. I just need to realize my goals, and not settle for anything less! (post-survey)

Genoveva was initially put off by the stereotypes in her field of engineering. After meeting "amazing women who are making it work" she was more assured that she could make it too. She saw that women were doing things she doubted were possible. Now, with that possibility in mind, she was beginning to take the steps forward to make it happen for her. She confronted the stereotypes and was more assured of the possibility that she could be herself and an engineer.

Kate was a talented student in chemistry who was overwhelmed with concerns about her future. One can gain a sense of her despair in her application to the program.

> I am interested in this session because I am so undecided about my career plans. I have even considered taking a year off to make up my mind. Making these decisions seems to have consumed my life. I can't even concentrate in class anymore because it's all I can think about. Chemist, Dentist, Engineer, Teacher... back and forth I go. I have used every resource I know of on this campus. I held research positions, I have observed high school teachers, I have contacted dentists, I have met with advisors of every shape and size. People who say, "Don't worry about it. Give it time and you'll figure out what you really want to do" have no idea what I'm going through. Or that I'm running out of time.

The source of her inability to choose a career appeared to be rooted in her inability to identify female role models around her. Without role models to emulate, it was hard for Kate to decide what career would allow her to have the kind of life she wanted. In the beginning of the semester she wrote:

> My biggest concerns are the lack of female role models in the academic environment. I've never had a female professor here. I am concerned about the sacrifice of family/personal time a science career seems to require. (pre-survey)

By the end of the intervention, it was clear that her redefinition of mentoring helped her to connect to women in the field and to identify role models in her environment.

> This program helped me by allowing me to talk with different women in different areas of science. I was able to see that it is possible to have a science career and a personal life at the same time. You always hear that this is possible, but it always seems like there are so few examples out there. I have decided that some type of graduate school is in my future; probably dental. (post-survey)

Kate's identification of role models and mentors helped her to see that her own dreams were possible.

In her interview, Kate talked about the impact of the program on her and how she was trying to make decisions about her future. "I was ready to drop out of school for a year. Then I got your e-mail. My mom said this was a sign." Kate's outlook on life and experiences changed a lot since she started the program. She had become a teaching assistant for her chemistry class and also was looking into volunteer opportunities with dentists to help her decide where to go next. Her decision to look more closely at a Master's in Chemistry or Dental school felt like a large accomplishment to Kate. These careers became more realistic possibilities for her after she met women who were combining family and career. With such high grades and interest in the field, it was disturbing that she felt such anguish and that the lack of role models made it so difficult for her to decide on a career. It was uplifting to see Kate feeling more in more control of her decisions and as developing a plan of action.

In summary, women learned about the on-going tensions experienced by women in the field. They were more convinced that what they wanted was possible for themselves because of the images of other women. By identifying their specific concerns (e.g., can I be both a successful mother and professional?), they were able to relate to a variety of women who were doing just that, even though these women may not have been in their exact fields. This suggests that there is an interrelationship between one's self-awareness of their own concerns and their redefinition of mentoring. By expanding their definition of mentoring, students were able to address their specific concerns with the help of several individuals.

Moving Forward with Clash

In addition to being motivated by the role models, students learned that they could take action to target their clash and to move forward in the field. This moving forward with clash was evidenced by their actions. Those who felt lost or unfocused reported that making decisions about their career paths and identifying concerns helped them to move forward. Conversely, students who felt trapped by a major or a negative image within a career reported that learning about their options in the field helped them to move forward. Although they do not represent the total sum of participants, the 16 students who specifically mentioned one of these two moved foreshadow the next chapter where we will see more of the group's willingness to move forward in the field. The following examples of the 9 students who both felt overwhelmed by possibilities and moved to make choices and the 7 students who felt trapped by narrow images and moved to expand their possibilities is important evidence in this chapter. Students were no longer paralyzed by their clash and were moving forward.

Making choices

Some students were able to narrow down the choices in front of them, which helped them to feel less anxiety and to better focus their energies. Even though they are still far from entering their desired careers, they have clearer pictures of themselves in the future now than when they began the semester. 9 students specifically mentioned this shift. For example, Julie and Ryan both reported in their post-surveys that they were able to narrow down their choices. Julie is thinking about pharmacy and industry possibilities while Ryan is considering a management aspect of engineering or zoology. Keshia reported that she was "not as confused" as she was at the beginning of the semester and had made some decisions which helped her to move forward in her graduate plans.

Jill said that she was "more focused on working with animals" at the end of the semester and that her financial concerns about higher education were still with her but she was willing to work on that in the future. Zarah said that her concerns have stayed the same

but she is trying "to work through them by talking to potential mentors through e-mail." Robyn was able to focus in on two career choices, while Kayla and Annie were more able to see herself in her future career. Carol and Estrella ended up making decisions regarding their future careers, with Carol deciding to pursue her perception of more family-friendly options in chemistry and Estrella deciding to stay in her major of biology. In-depth descriptions of Robyn, Estrella, and Carol help to illustrate this point.

Robyn had a variety of concerns that brought her to the program. Besides a lack of direction, she was concerned about the lack of models in her environment. She wrote:

> I am not sure of my career plans as of yet, but am considering a variety of options, including medical school, dental school, or a graduate program in genetics. I think this sounds like a very interesting group, and I would enjoy having the opportunity to talk to women in the fields I am considering. Many of the professors at the university are male, and their career experiences are not the same. I am concerned about having a family life as well as a demanding career such as medicine, and I think it would be very interesting to be able talk to women who are successful in both. This program sounds like a wonderful opportunity, and I am anxious to take part in it! (initial e-mail to apply to program)

Her concerns reveal some of her ideals about the kinds of mentors and role models she originally sought but could not find; she was a good example of how looking for mentors with the "same" kinds of career experiences can be difficult and frustrating. She elaborated on her concerns in her survey, which now stemmed to the difficulty of getting to know professors and the competitive nature in the sciences.

> I dislike the competitive nature in my major and the constant feeling of inadequacy. It is difficult to get to know professors, and I am anxious about obtaining letters of recommendation. I am worried that I will not have a stable job, or that I will not have flexible hours in order to accommodate a family life. (pre-survey)

In our first meeting, Robyn was vocal about her concerns and her tone was laden with frustration. She explained to the group:

> I'm worried about getting into graduate school and what to do with my undergraduate degree because it is kind of worthless. It is so hard to get volunteer experiences here. It is ridiculous. (first meeting)

Robyn indirectly blamed the university, their professors, and the other students for her difficulties with becoming connected. She was rather frustrated with the whole system. Throughout the semester, Robyn was an active participant in the seminars. She asked

questions and followed up with several of the guests. She completed short reflections over e-mail to me and sought out several volunteer and work-related experiences. She had narrowed her career options and felt more focused in that regard. She had a clearer sense of herself and her values and what types of careers she would like to pursue within science.

> I feel I have a better idea of what type of career I want to pursue. In the beginning of the semester, I was confused about going to medical school. After having the opportunity to meet the people I have, I feel that I have reached a decision. I don't think I want to go to med school. I think my idea of success may have changed. I think success is a balance between career and personal life, and I don't think that medical school will allow me to pursue that...Participating in this program has cleared up a lot of confusion I had about my career choice. I am now looking at options within optometry and genetic research. (post-survey)

Some of her concerns at the end of the semester had been addressed. Her overall tone was different, more optimistic. She said:

> I can't really remember what I told you in the beginning. I think I said that I hated how everyone was so "Why [grade] did you get in this [class]?" That hasn't changed because people are still like that, they still annoy me. I guess now so much I don't really care if other people think they're better because it doesn't bother me. (interview)

While the competitiveness and feelings of being kept from valuable resources was a salient concern for her early on, this was no longer a salient concern for her at the end of the semester. Many other students shared on the first day that these issues equally frustrated them, which helped students like Robyn to not feel alone. Robyn worked hard to learn what was important to her, which helped her to focus in on two career choices within science, but to move away from medicine. She realized that medicine was not the only career for someone who is smart in the sciences; she reported that other options such as optometry and genetics research could be combined with family, allowing her to achieve the kinds of success that she wanted.

It is important to raise that Robyn had dramatically changed her conceptions of mentoring over the semester. As she indicated in her first e-mail to apply to the program, she thought that male professors did not share the same experiences and that she wanted to find women who balanced career and family within her desired professions. As her ideas shifted to the idea that "anyone" can be a mentor, she branched out and became more

assertive in targeting her concerns. She gained new experiences in an optometry clinic and in research, and she looked into several graduate and summer programs. She looked to her peers, TAs, professors, advisors, and even me, as potential mentors who could help her. Once she saw that these potential mentors had valuable information and insights, she took further advantage of these connections and her original concerns were lessened. Rather than looking to others as examples of her future self, she took what she could from these individuals and spent time working on understanding herself.

Estrella was asking herself whether she was pursuing the right career and was very concerned about the future. She described:

> Right now my career goal is becoming a doctor, no specific interest yet but I have a few ideas. I would very much like to attend these sessions because some of the questions you have asked are the same questions I have and they greatly affect if or not I will pursue these goals. (initial e-mail)

In her pre-survey, it became apparent that she was experiencing a great deal of self-doubt. A first generation college-goer, she did not have a great deal of support from her Hispanic-American family. She wrote:

> Another concern I have is, "will I make it?" because although I'm just starting my science courses, I feel that either I'll be pushed down or "drop" myself. Also, I'll be the first in my family to pursue a Bach. Degree, and go for my Ph.D., my family are not really supportive. (pre-survey)

These feelings of self-doubt and concern about pursuing science and medicine were even more apparent in our first meeting when she almost broke down in tears. She explained:

> I haven't gone to my advisor but I don't think I will now! My advisor from my old school is great. My concern is, am I going to make it? (voice breaks as she stifles a cry.) Do I want to go to school — because I am stuck with going into med school or genetics? Am I going to make it? Am I going to be able to handle everything? (first meeting)

Estrella attended most meetings but did not complete many of the activities or self-reflections. She seemed to be interested in other career options and would tell me that she was exploring business or nursing. By the end of the program, she had made progress in assessing her own values and priorities.

> My concerns have somewhat stayed the same since the beginning of the semester. One thing that has changed is that I know I want to stay in science. Remember I

> was having second thoughts. As hard as it seems right now to pursue this degree, I feel that switching my major to business or education, which are other majors that interest me, may be a "way out" and I don't want that. (post-survey, emphasis hers)

In her interview, she talked about how her family was still unsupportive, characterizing her career pursuit as "selfish" and she found this difficult. However, she was started to see the other sources of support she did have around her, including her old advisor at the university she previously attended, the medical students she had access to through the program's web site, and even her advisor here. She said:

> I was never really good in science in high school so I am wondering if I'm going to understand it now that I'm in college. I decided just to stick with it and get help in every way I can. I decided to stick with science, stick with biology. Tonight I have an appointment with my advisor, next week Tuesday, so I'm going to talk to him and tell him what some of my concerns are. I know I want to become a doctor but I want to have some options just in case I don't make it because I know it's very competitive. (interview)

As a second year student, Estrella was making progress toward targeting her concerns through support and making decisions about her future.

Carol was a student in chemistry who was considering a number of options, but wanted to narrow in on an option that would make sense for someone who wanted to combine career, family, and a physician husband. She wrote:

> My major concerns surround what kinds of careers are available in the field of chemistry and which of those is a practical choice for someone who wants to be a mother and a wife to a man with a very emotionally demanding and time consuming career (doctor). (pre-survey)

Carol went on to elaborate this concern in the first meeting:

> The man I plan to marry is going to have a demanding career so I am worried about having enough time for my children so they are not in day care all the time and everything. Also, what I can do in my field. The professors are saying "you have to go to grad school and get your Ph.D." like there is no other conceivable option. I don't think I am going to have that kind of time commitment. (first meeting)

While other students saw themselves as able to be like the role models they met, Carol saw her situation as different because of the anticipated hectic schedule of her future mate. She learned from the role models the kinds of sacrifices to be made and flexibility required

when combining career and family. This helped her to make a decision about what her future career would entail. She described:

> My concerns about having a chemistry career and a family were addressed and my suspicions confirmed. To have a family, you have to sacrifice time and energy from your career. It helped me a lot to discuss these issues with the professional women and hear their experiences. (post-survey)

Carol elaborated on this point in her interview:

> I guess it confirmed the concerns that I have had from the beginning that it's really difficult to do both. If you want to do both then you pretty much have to have a spouse who is willing to give more time at home. With my work and he wanting to be a physician it's like I'll just have the low-key career in the family. All the people that I talked to were really rewarded by their raising their children and their part-time career so I'm not too worried about that. There's just a real stigma with women in the science field leaving to take care of your family, it's like you're not a real scientist in your field. (interview)

She went on to talk about the options she had learned about, including consulting and chemical education. She was currently considering high school or community college teaching where she could have more time for when she had children. She said that she felt "better about the whole situation" because she was being "practical about it" when considering her options. Carol's concerns were rooted in her perception of the lack of options for women who want a career and a high-powered career husband. Her decision not to pursue a chemistry career in Ph.D. level or industry settings was rooted in her anticipated conflict of balancing family (children and career husband) and her career. She realized that this conflict could not be resolved without pursuing a different line of work. An on-going struggle with this tension was not an option for her.

By narrowing their career options, these women felt more confident and less anxious. Rather than a diffuse feeling of confusion about the future, these women now had a plan of action and could see themselves more clearly in the future. These results suggest that when the students spent time thinking about themselves in the future, and were able to focus in on a few options, the concerns were less overwhelming and more manageable.

Expanding possibilities

Seven students specifically mentioned that they learned about the many options that they have in their fields. These students learned from the role models that there are a variety of possible paths within their fields. Their new awareness of multiple options helped them to feel more confident exploring options, and less trapped by their initial one choice. Often this initial choice may have been the only image in their minds of the career and possibly made them feel that they would have to sacrifice a great deal in other parts of their life. Knowledge of multiple paths freed them to make choices that worked for them.

For example, Josie learned about many different possibilities and that sometimes it is not a "straight" line. By hearing about the variety of paths taken by other women, she was reassured that the path that she takes will be okay; as she said, "the more I listened the more I understood that it's ok not to know." April was very concerned about her lack of an internship in her field, but over the semester, she learned more about the different paths that people in her field have taken. This reassured her that it was okay to be unsure, but she was more motivated to explore her options. Jeri's realization that there were other options for her helped her to become less focused on figuring out how to be a doctor and more focused on exploring what other careers were possible for her, including bio-medical engineering. Tiffany said that her concerns have not been resolved but she is beginning to address them. Lizzie was able to address some of her concerns through her contacts with several people. Corie and Abha, both in computer science, were looking into their options. Corie was a good example of this shift.

Corie was student in computer science who was concerned about a range of issues stemming from being a woman in a male-dominated field.

> Females in computer science are rare. I am worried about competition and being seen as an equal. I am also worried about balancing family life in my future, and if I will be able to succeed if I start a family. (Some companies will not hire if they feel you won't be dedicated, and feel if you want a family, then you won't be dedicated.) (pre-survey)

Through the semester, Corie was actively involved with looking into internship opportunities and learning about the variety of options within computer science. At the end of the program she reported:

> When I started, I didn't really know what I wanted to do. Now that I have options, I know there is something for me out there, I just don't know which one to pursue now. By participating in this workshop, I have been able to think about what I want to do with my career, and allowed me to voice my concerns and have my questions answered...I'll find a career that fits my personality. (post-survey)

Her interactions with role models helped her to deal with her concern about being a woman in a male-dominated work environment.

> I got a lot of answers to some of my concerns, like there was a couple of computer science people and they answered some of the stuff and they told me to be prepared about things that you're going to encounter. Those concerns are still there, I know they're going to happen but I now I can prepare myself more because of what they told me. (interview)

Although she was still concerned, she was reassured. This came from learning that there were various options and having the time to think about and discuss career issues with people in the program.

Initially, students struggled to make the "right" decision or look for the "perfect" choice for them. Now, students reconceptualized career choice as an ongoing process. In other words, their concern was refocused from making the right choice to learning how to make choices-- from making the perfect choice, to taking the next steps or identifying the most flexible choice I can think of now. No longer frozen by anxiety, they were freed up to explore these choices. They also realized they were not the only ones who didn't know the answer because their peers and the guests echoed their sentiments. They had a variety of options they needed to explore in a systematic way.

Seeing Clash as a Motivating Factor

Students were asked in interviews about the interrelationships of mentoring, motivation, and their future career concerns. They corroborated this view that concerns, when identified and targeting with mentoring, can be motivating rather than overwhelming forces. People often think of concerns as negative in nature. But, as Kate described in her

interview, "I think there are two ways you can handle concerns about the future, you can either get motivated and seek out help or you can switch your major." How one handles concerns can lead to different outcomes. Estrella explained this different way of looking at concerns.

> If I have some concerns about the future, if I look at someone and see they made it okay. Or this person didn't make it, why didn't they make it, and see what not to do. When I think of this concern I think negative, but I guess it could be positive. I think some concerns can be positive. (interview)

Students' concerns about the future motivate them because they want to try to address them. Carol described:

> I definitely think that the more motivated you are the more you will be able to seek out answers for your concerns and it will diminish your concerns. I'm worried about this so I'm going to go research it and look into it and that sort of thing. If you have a mentor who can help motivate you or help alleviate some of those concerns I think that can really help. Being concerned about something tends to motivate me because I don't like being not "in the know." (interview)

When students started to see clash as something that can be managed, rather than an obstacle they could not over come, they felt even more invested in the field. These women began to see themselves as people who were reshaping the field in new ways and led them to now view clash as a source of fuel, reminding them of their important place in the field. Robyn explained this perspective:

> It depends on what kind of spin you put on it. Because if you're concerned "I'm never going to make it", you probably will not work as hard, but if you are concerned because this person thinks they're better than me but they're not, then that would make me work harder. Actually your group is very interesting to me because I'm worried about these things and I want to figure out the answers. I told you this story once before [about my sorority sister]. This doctor said, "Do you want to go to med school?" and she said, "No, I think I want to go to PA school" and he said, "Oh, well that makes sense, there aren't very many pretty girls who go to med school." She was gung-ho about PA school and now she's going to go to med school. That person pissed her off so much that she's going to prove him wrong. It's funny how one person can set you off and you prove them wrong. (interview)

They did not see reshaping of the field as something they were doing alone. Students recognized the mentors in their environments (including peers and professionals) as being invested and part of the field as well. These sources of support could remind them about their desires to stay in the field when concerns started to take a negative spin. As Abha said:

> I think that mentoring definitely would put to rest my concerns about the future because my advisor would tell me that what I'm concerned about is really trivial. I think that motivation would be [tied] together with my concerns about the future because my motivation for staying in my field was I wanted to find a good job, and that was one of my concerns about the future. (interview)

Students connected their concerns to their experiences of mentoring, with mentors helped to motivate students to take on their concerns and push forward into the field.

Students' Changing Views of the Field

Students' views of the field had taken shape over the semester. As Josie wrote in her post-survey, "I feel the need to mention the impression of my field has taken a new shape since the beginning of the semester." Students had further articulated their views of the characteristics of the people who make up the field, and described their images of the field in their post-surveys. Words such as "genius", "cut-throat", "competitive", "old white men", and "bookworm" were used to describe the predominant images in their environments. There were other stereotypes too; students in the physical sciences saw most as lab-confined researchers, most pre-med students saw others as competitive, and computer science/engineering students perceived fewer rules but less gender and ethnic diversity. The combination of stereotypes and possibilities for change led students to report that they were excited, yet disillusioned and overwhelmed by their field at times. Their knowledge of who made up the field and what the field's expectations were grew and became more complex over the semester.

The field at large was now more likely seen as having some pockets of diversity or a space for them, rather than one homogenous and powerful being. Students like Zarah found that engineering was more broad than she thought and that she doesn't "have to go into automotive or steel industries" if she did not want to. Others, like Robyn, reported that she challenged the images in the field. She said, "Science majors are bookworms with no social life...I don't feel like I fit in but I don't want to...You can have fun and get good grades too." Kellie, a student in engineering, added to what Robyn had to say by highlighting that the students' differences can be a source of growth for the field. She said,

"In my field there are men with bad communication skills where I could be helpful to them." Having a social life and good communication skills could be values of the field in the future.

Two students' comments revealed the importance of seeing common values with their peers. Abha shared, "My impression of my field are vast and confusing at times...I do fit in well with people in my classes and they'll probably be the same kind of people I end up working with." This helped Abha to believe the field of computer science had fewer rules and more possibilities for change. Annie similarly reported, "Medicine is very out-for-themselves but it's nice to have a group of girls who want to help you succeed." This showed that Annie's views of the field had changed to include the peers in the program. This helped Abha, Annie, and other students to feel that there was more of a place for them in this diversifying field. As Jill concluded, "My field is what I've wanted to be part of for as long as I can remember. Sounds nice to call it my field since I've just decided that is really where I should be." These quotes help to illustrate that these changing views of the field helped them to see a place for themselves. After they began to see their peers as future colleagues, the diversity represented by the professionals they met, and imagined they own contributions, students were more motivated to move forward with these tensions about their futures.

Discussion

Professionals continue to struggle to combine personal and professional lives and manage it as an on-going tension. Students were able to learn this through their conversations with women (and men) in the field. This helped them to learn that they are not alone in their concerns about the future. However, rather than discouraging them more, they were motivated to try to manage their concerns, too. This was influenced by the students' perceptions that clash is an on-going tension regardless of field, leading them to feel that there is a place for them in science. In addition, the professionals they met were in

large part happy with their decisions to stay in the field and were managing these tensions in ways that the students deemed "successful."

Students reported that concerns are not always negative. When identified and targeted through mentoring, they can be motivating forces. Like other struggles or problems, clash can be seen as a catalyst for learning and development. It was clear in these cases that struggling with clash will continue to be a key source of development for women professionals, especially in science fields where they must progress without easily identifiable or accessible role models. Seeing themselves as in the company of other people, especially women, with similar values and struggles expanded their conception of clash as something individualistic to something more general to adult development. That is, their awareness of their own clash pushed them to learn more about their field, including what other images were out there and to consider who they wanted to become. Rather than being pushed out of the field, they staked a claim in the field and took more control in their career decision-making and in their own mentoring. Getting to know others in their field helped to place real individuals in their minds rather than vague images. By seeing the field in more complex terms also facilitated these changes.

Without self-awareness and a redefinition of mentoring, the role models may not have counted as images of possibility. By seeing the guests in the focus groups and professionals on the web site as viable mentors, the students listened to their stories and their advice. This helped students to make decisions about their careers-- whether to narrow in on choices or to explore possibilities-- and move forward with the support of others. These results suggest how important role models are throughout life and how important the time to reflect about one's field and one's own future image was to these changes. These results shows that clash is not just an individual issue but one for institutions to consider. Even if one becomes aware of clash and aligns herself with mentors, the daily struggle can be consuming. This is well captured by Carol's struggle in choosing a career that is "practical" for someone who wants to be in chemistry, have children, and marry a

doctor. Why must teaching be one of the only fields that comes to mind to students with these lifestyle choices? We must ask what kinds of changes can be made so that students (who are talented and willing to work hard) with all lifestyle choices can be scientists, engineers, or doctors. Perhaps such ambitions are lofty in nature but may be possible if placed as a priority. With more women entering these fields, and more men who envision themselves as sharing more in the child-rearing responsibilities, we may see more and more diverse images across individuals and institutions providing support for these images.

Chapter VI

RENEWED MOTIVATION TO STAY IN THE FIELD

Chapter Overview

Students reported a renewed motivation to pursue their fields both after the intervention and 16 weeks later, suggesting the promise of this intervention as a program to retain women in science. This suggests a relationship between students' changing conceptions of mentoring and their increasing motivation. When students began to see others as potential mentors and themselves as active seekers of mentoring, they started to feel supported and they began to see more value in staying in their fields. Program elements such as scaffolding students' thinking about mentoring and the on-going nature contributed to the success of the intervention.

When I originally envisioned the program, I thought of it as a complement to existing mentoring programs and an interesting space to examine these issues. When we look at the participating students like Corie, Robyn, and Genoveva, the growth in their ideas about mentoring and the way they worked through future career concerns are remarkable. The previous chapters offered an image of women in science, women who are not sure if the field was really for them. Across the board, students agreed that they had increased their awareness of options in their field and had gained more access to mentoring. The composite mentor was a motivating and productive model of mentoring for women in science.

Although the primary goal of the project was to help the women feel supported to making the best decisions possible for them, another way to measure the success of a program is its impact on student retention. In a successful program, students who had been struggling with their future images in science and had felt unsupported would, as a result of the program, feel more supported and would be more likely to stay in the field. This was the case in this intervention; most of the students renewed their motivation to stay in the science, medical, or engineering field. This elevated the program from being a possible complement to existing mentoring programs to being a model for mentoring programs in its own right. The program was highly successful, at least in the short-run, at retaining women in the field. We look at these motivational changes post-intervention and again 16 weeks after the conclusion of the intervention.

Renewed Motivation

Post-intervention

Students were asked on a post-survey if their motivation had increased, decreased or stayed the same. 26 students reported feelings of renewed motivation to pursue their fields, while 3 said their motivation remained the same (Jane, Keshia, and Lori), and 1 student (Estrella) said her motivation had initially decreased. This increase in motivation

was both short-term and long-term in nature. Corie described a mixture of motivation to finish her courses and to seek out mentoring and career-related experiences. She described how she felt week to week after the sessions:

> This program gave me the motivation. After leaving every Wednesday, I always felt inspired by the people I talked to, that what I wanted to do was possible. It motivated me to strive harder and gave me hope that all my hard work will pay off. People have come in and shown that it is possible to pursue our degrees and make them work for us. I know that whatever I decide I want to do there will be some aspect of my degree that will apply to it. (post-survey)

Georgia added:

> This program has influenced my motivation positively. It helped remind me of my purpose and kept me in focus. (post-survey)

This illustrates that students were motivated to pursue their fields, but that the program helped them to retain that level of motivation through difficult times.

Other students came into the program rather frustrated, but over the semester they became more excited and revitalized about staying in the field. This was largely due to their conversations with people in the workshops. Genoveva described her motivational changes and the impact of the role model web site.

> My motivation has changed a TON! I was really considering just getting my degree to prove I could do it, work a few years, and then settle into being a housewife. This semester I've struggled a lot, gotten tons of support, and come out on top. The web pages helped a lot! I think it was J. who said that one of her profs told her "if engineering were easy, everyone would do it!" That's seen me through a lot of tough times! It has also lit a fire inside. I can be a great housewife, and pursue my career goals too. I plan and hope to do both! (Genoveva)

Most of the 26 students whose motivation increased reported that their newfound support was a critical feature of their increased motivation. In addition, as illustrated in Chapter 5, students' views of clash as an on-going tension and a source of motivation to push forward helped foster their motivation toward their field.

Keshia and Jane reported their motivation had stayed the same, with its level in fluctuation, Lori said that she was still "paralyzed" in a struggling state to a certain degree and still was not sure about her motivation in her field. Estrella shared that her motivation had decreased since she began at the university but she had not lost it all.

> I feel like my motivation has decreased since I've been here at the U. Before I was doing really well in school and I had my mentor who encouraged me and made me excited (at the time I didn't look at him as a mentor)...But I do have some motivation left in me. The feeling that I don't want to quit and that at the end, I know I'll be so glad that I stuck to it and made the right choice. I think that my motivation will grow as I progress. (Estrella)

Thus, students' motivational changes ranged, with most students leaving more motivated than when they came in toward career choices in their fields.

16 week follow-up

Of the 30 students, 21 provided me with an update of their progress. Students were still thinking about mentoring; some thought about the composite model more explicitly while others thought about the idea of seeking out mentoring in a more general sense. In addition, students had continued to gain new mentoring and career experiences and had developed plans for the future. This sustained impact of the program provides more support for the changes illustrated and for regarding this intervention as a program in its own right.

Increased motivation. Lori, Estrella, Jane, and Keshia updated me on their progress. Lori had transferred to another midwestern university closer to her parents and located in a large city with many hospitals. The move provided greater family support and an environment more supportive of her career goals. She has been talking more with her professors and had gained two new work-related positions, one as a reader to blind students at the university and the other as a volunteer at a free clinic for the homeless near campus. Academically, she was doing well. She wrote, "I am enrolled in a biology class for science majors that is very challenging, which I seem to thrive on. I scored a 38/50 on the first test (40 being an A in that class), which may not seem all that great until you learn that over half of the class failed it." In addition, she was pursuing other opportunities, such as going to the American Medical Student Association's national convention and making new friends through such ventures. Estrella had increased her motivation to stay in the field, and her tone was much more enthusiastic than when she started the program or even when she completed the program. She wrote, "I've decided that I want to stay in Human

Biology and try to make it all the way. I've been really excited lately." She explained that she had become connected to the Dominican students on campus and the leader of the organization who has been a mentor to her.

Jane had plans to volunteer at the Red Cross and had shadowed doctors at the hospital. I did think about the composite mentor thing this semester...I'm always on the lookout for positive role models." Keshia had changed her major from medical technology to human biology. She shared that before the program, she was skeptical about whether to go to Physician Assistant or Medical school. She wrote, "After hearing the fears that other girls had that were in the program, it assured me that I was not alone. All I really want to say is that it helped me a lot. I gained help from the web site, visitors and my peers." Even though these 4 students did not report motivational increases at the end of the semester, 16 weeks later their motivation had increased, and they were committed to staying in the field. They shared that at this point, they were still thinking about mentoring and gaining new experiences throughout the next semester.

Sustained motivation. LaTisha, Rose, Ryan, Josie, Annie, Carol, Kate, Michaela, Robyn, and Genoveva shared their updates that their motivational increases from last semester had been sustained. LaTisha said she still planned on pursuing Medical Technology and was still in touch with her mentor R., who she met through the program. Josie was waiting to hear from several industry positions in the West for a job for next year in microbiology research or pharmaceuticals. Jeri reported that her thoughts about mentoring were more subconscious but she was still pro-active.

> I guess I haven't really thought much about finding a mentor, however I do go and visit my professors more often, ask questions in class and other things that I never used to do on a regular basis. Ever since all of those people came to visit, it is easier to see people in higher positions as real people and makes them more approachable to me. It also helps to see that ordinary people got to where they are in life, so it is entirely possible to become whatever I want to become.

The people from the program continued to represent possibilities for the students in terms of role models and as representing the approachability of professionals in general. Kate was in touch with several dentists, learning about the various paths to become a dentist and had lined up a chemistry research project for the summer. Both of these experiences, she reported, would help her to make further decisions about her career. Michaela was continuing to work with a researcher on campus and decided to wait to apply to vet school till after graduation. Annie was still seeing an advisor she met through the program and had lined up a student nurse position as per the advisor's recommendation. Robyn was planning to continue her research position and look into graduate programs.

Carol was planning to work one year in industry before pursuing her master's in chemistry, with the path more open toward high school or college-level teaching or even other possibilities. Ryan was attending professional conferences and Rose was shadowing a doctor and working in a research lab. Finally, Genoveva was still moving forward with the help of a few friends she had made in engineering this semester and looking into internship possibilities with her advisor.

Further investment in the field. Tiffany, Abha, Jill, Ebony, Zarah, and Brianna had made further investments in the field. Ebony was graduating and accepted a position in an automotive company, saying that "the mentor program had an impact" on her decisions. Tiffany had two offers for funded science research and mentoring programs in California and Florida. Jill was observing mammals in Kenya in the summer. After some initial frustration, Abha continued to supply her resume at career fairs and had recently been offered 4 internships this summer at computer science corporations. Zarah met with similar success and was offered 3 internships, accepting one with a large corporation. Brianna had landed a position at an area zoo, which she looked forward to this summer. These students' motivation in the field was sustained, and further evidenced by their investment in career-related internships and careers in the field.

Summary

After the program, and 16 weeks later, student were still motivated to pursue their fields of interest. This was a program where women could first think about their conceptions of mentoring and then be supported into the process of mentoring. The program shows promise in encouraging students to take advantage of the resources in their environments. The program offers a model for others who may be interested in integrating both the reflection about mentoring and the process of engaging in mentoring interactions. The following section helps to identify the important elements in the program that facilitated these changes.

Important Program Elements

In order to make sense of why this project was successful, I have re-examined the design of the project using the data gathered to highlight important aspects of the project. The curriculum helped to scaffold the changes we saw in this program. Students were introduced to a model of mentoring that they found to be productive and motivating. The assignments and group interactions scaffolded students' reflections about mentoring.

The Composite Mentor Model

First, providing a productive model of mentoring to the students and raising their awareness about mentoring. Students did not embrace the model in the same ways, but it gave them something to compare their current ideas to and an idea of how to expand. Many students raised that this may have been the first time they explicitly thought about mentoring and what role they had in the process and that helped them to imagine themselves as important actors in their own success.

Scaffolding the Mentor Selection Process

Second, scaffolding the mentor selection process was important and helped students to see what mentoring meant to them. Students on the whole completed the first assignment asking them to visit 3 role models on the web site and complete a worksheet asking them to explain why they visited the role model and to assess the similarity and

usefulness of the role models. Students visited an array of role models; initially students chose someone in their field or of their ethnic background or gender but also included people who shared their experiences as suggested through their "words of wisdom" or hobbies listed on the grid. Students found that they could learn even from role models who were dissimilar to them in important ways. I suggest that this assignment helped them to think about mentoring; they would begin to think about what questions they want to ask, what different kinds of people could answer those questions, and what other kinds of people they need to contact. Using the web site, students submitted comments into a database about role models who helped them in some way. What these responses suggest is that students felt connected to these role models because they said the models were "normal" and "balanced" and had struggled through similar experiences and had similar outlooks on life. These responses to the web site suggest that the web site succeeded in helping students learn more about what it can mean to be "similar" to another.

When introducing guests, students noticed that I highlighted several aspects of their experiences. As one student said, "You wouldn't just say this is M and she is a doctor. She is a doctor who was a social worker for 25 years first and she lives in a nearby town." The fact that students picked up on these subtleties supported that they were beginning to think in certain ways about mentoring. In addition, students noted that the surveys themselves helped them to think about mentoring and raises the possibility of using self-inventories as part of curriculum. The initial access to mentoring was important for two reasons. First, they were able to try out the ideas of cross field, race, and gender mentoring. Second, the guests were extremely enthusiastic and for possibly the first time or in a long time, students felt extremely supported. This encouraged them to move forward and to seek out others.

Focus Discussions with Women in the Field

The discussions provided a chance for students to ask questions and to learn more about the lives of women in the field. Students were in small groups with 2 graduate women for approximately 30 minutes, then in another group with 2 different graduate

women for another 30 minutes, and then engaged in an open-mixer for the remaining 30 minutes. The nature of the graduate women focus groups was more of a question-and-answer session with the graduate students in their group, with a few comments from peers who had some input on the conversation. It was clear that students had many questions about pursuing graduate school or getting good experiences. In this sample transcript, H and J are grad students and Kellie, Abha, and Robyn are students in the group.

H: When I was in undergrad, I got two jobs working for consultants when I was an undergrad. Just keep pushing.
K: When I was at the career fair, there was a consultant there. What do you do?
H: I have worked part time. They do civil and environmental engineering. Like designing land fills, water treatment plants, to things like ground water contamination. You have to play detective and figure things out.
K: So you have companies working for companies?
H: You have clients like GM or Paper mills. You have air pollutants, so the one I work for will go in and calculate what the controls have to be to fit the regulations. We apply for the permit. The client pays for that.
K: This lady tried explaining it. She said she explains engineering terms to people don't know how to do it. You have to be able to explain it.
H: For people who are way up the totem pole, they are more like salesmen. That is just skimming the service. They are designing the systems. I actually had to go out with a drill rig and take samples. Those with BS, they will take samples. After a while they know what needs to be done. At least you had that field experience. Eventually you become a salesman.
A: I don't want to study all my life.
R: Will you get a masters? Should I stay and get my masters?
A: I am a TA and I like it.
J: It isn't going to hurt you. Those of us with degrees, you can get a better job. If you have an advanced degree, you can get a job. Some say you are better off with the experience than the extra degree. That is my opinion.
H: I agree. I can't believe they let me out with my Bachelor's. I learned SO much in my Master's.
A: How long?
H: 2 years.
A: I've heard it is so much harder.
J: It depends.

In this exchange, both J and H provide information about what consultants do and why someone would want to get her Master's degree. The discussions with professional women were similar, with the focus of the conversation on the students getting to know the professional women. The professional women shared long narratives of their experiences and engaged in conversations with the students. In this exchange, M and J are professionals in a group with Brianna and Rose.

J: I have three children, all were at home when I was in school.
M: My first person I worked for was really tough. I worked 6 days. Some Saturdays were half-day. Worked every third Sunday. And being on Call.
R: Oh wow.
M: That was hell. It was too much. When I had my second child, I was ready to quit. Then he put the practice up for sale. I had been managing it for the past three years. It was well established. Now I am never going to get away from work. I have this unique opportunity to buy into a practice where I am already accepted into the clientele. Where will I be in 5 years? I still wonder if this was a good decision. I have control over my life, I run the risk of losing a client if I miss. But the option is there. I can hire someone to work for me, and make more money or make less money. One of the things I did—I took time off. I had 10 weeks with the first, and 8 with the second. I nursed both, the first for 5 months and the second for 6 months. So many women said they couldn't do it. I did everything to do it for the 6 months, it's what I could do to give what no one else could. Since I bought the practice, I have more weekends. After my third, I said that was enough. I take Thursdays off. It has gotten me into a bit of trouble financially because the practice cannot fully support two vets. But I can't do it any other way. I have a colleague who had a baby and came back to work 2 days later.
R: Wow.
M: She ended up with 4 children under the age of 5, her husband in vet school. Makes me feel inferior, but I couldn't do it. With my third child, I took some time at home, when I went back, I had a back pack, with her in it. I'd turn around and clunk her head on the door frame. She was with me till she was 8 months. My first daughter was daddy's girl. I nursed my 3rd for the full year, and we have the closest bond. I took advantage of that. I went back to my usual routines. I took all of Thursdays. I don't do emergencies. I just can't do it, get up at 2am, emotionally and physically. Nursing made me feel better.
R: Did you nurse your kids?
J: The first one for 2 years, the second for 1.5, and the third for 2.5. She was premature though.
M: Studies say that better educated women are more likely to nurse. Maybe it is overcompensation. I do have a husband who helps.
J: I didn't go back to school until she was 6. She was in school for a full day. I counted on people.
M: You do what you can.
J: My greatest ally was my father who was anti-women getting educated. When it came to I was doing it with or without family support, he was there to make sure his grandkids had support.
B: He stepped in and was the father figure.

In this interaction, M and J share their experiences of raising their children and the support they had and did not have from employers, spouses, and family. These exchanges were typical in the professional women focus groups, where students and professionals engaged in conversations about the difficult issues professionals were facing and the students anticipated facing.

On-going Support of Teacher

The on-going nature was important because students needed time to identify their concerns and to think about mentoring and to even get to know me or each other. As the teacher, I was very invested in helping the women in the program and offered specific help to students by making suggestions of outlets they may not have tried or encouraging them to follow-up. In interviews, students labeled my role in a range of ways: a host, caregiver, mentor, facilitator, and organizer. I do think another teacher or facilitator could have had the results here. It is important to acknowledge that students recognized that I was at least one resource that they had access to and that I cared about helping them through this career process.

Discussion

Students reported a renewed motivation to pursue their field. Although we will need more long-term follow-up to determine whether students continue into the field and for how long, these results suggest that students were making investments in the field through their mentoring and career experiences. More importantly, they were more motivated to seek out the experiences and support which could help them make informed decisions about their careers. Future iterations of the program can help to determine the relative value of each of these functions and help to understand where to best target program resources. For example, one version of the program could be peer-discussion only, while another version could have students use the web resources to learn about the composite mentor. It is probable that students at various levels of their college education and mentoring experiences would need different kinds of support and these future iterations could help to discern which factors are more important for various students.

While the current study has focused on college students, these ideas hold great promise for K-12 education. Helping students earlier on in their science education to develop "possible selves" in science can be supported by variations of this program and the use of the web resources. In addition, high school girls may have similar concerns (Eccles,

1987) as college women. Therefore, helping them to see clash as an on-going tension and learn from role models and mentors may similarly increase their motivation to pursue the field. This program existed as an extra-curricular feature of the students' experiences. Future work can examine the potential of integrating these ideas into science education, at the college and K-12 levels.

Chapter VII

CONCLUSIONS AND IMPLICATIONS

In this study, students' mentoring conceptions developed and expanded in the direction of a composite mentor. It was clear that students' redefinition of mentoring encouraged them to identify mentoring in their environments. This, in turn, appeared to help students to feel more supported by others. This study suggests that mentoring conceptions are flexible and that college students are capable of strategically constructing their own composite mentors in order to support their desired future image. At a practical level, this study suggests that targeting the student's role in mentoring may be critical to the success of mentoring programs.

Clash was a salient concern for students when they entered the program and after they left the program. However, they began to see this clash in a new light; rather than seeing clash as a reason to leave the field, they now saw clash as a challenge and as a motivating factor to stay in the field. This was influenced by their discussions with graduate students and professional across fields. Through these discussions, they began to see clash as an on-going tension managed by professionals across fields. This study suggests that not all concerns should be or can be "resolved" by students. Clash may be viewed as an on-going tension that needs to be managed by exploring one's career options and identifying mentoring and other types of support in one's environment. At a practical level, this study suggests that mentoring programs may explicitly try to make this clash visible in the experiences of role models and mentors who participate in their programs.

The composite mentor strategy was motivating to students. It offered a way to plan for the future, to select and initiate mentoring, and to address their concerns. The students connected the composite mentor to their experience of clash. No longer confined by gender, ethnicity, or field matches, the students started to think more strategically about the mentoring around them. They constructed composite mentors which helped them to target

the different aspects of themselves. This suggests that the composite mentor may be configured in different ways; some students sought mentors who combined career and family while others sought mentors who could help them to think how to contribute to society.

These results suggest that this intervention could function as a program on college campuses. These women who had felt so frustrated and isolated in the beginning of the semester reported renewed motivation to stay in their field. While these changes differed across students, it was clear that even the minimal planning to initiate mentoring or seek career-related experiences was evidence of increased motivation. This study suggests that future iterations of this program might employ mentoring "samplers" or other ways of introducing multiple mentors and multiple images of scientists to students. In addition, it would be important to help students to become resourceful in identifying mentors in their environments and the kinds of questions that students might ask these potential mentors.

This study raises the subjective nature of the mentor and role model selection process. The image of a "superwoman" is not very motivating for students, especially if they do not see themselves as perfect. Thus, interventions using mentors and role models need to provide to students with ways to think about what can be learned from mentors and role models who are less perfect and more human. For example, one could make explicit the many possible ways that students could connect to any mentor or role model and then help students to see how they might connect to those who they meet within the intervention. This especially important for students from diverse ethnic backgrounds and women, who may need to free themselves from gender, race, or field matches in order to find mentoring. I tried to do this in this program by the ways I introduced guests, showcased web role models, and provided assignments to help them to "visit" role models on the web site or follow-up with people they met. In the future, I plan to develop a hypermedia instantiation of the web site used in this project where students can more flexibly look across multiple models and career options. By assembling multiple models in

the hypermedia environment, students can see the diversity of images that do exist in the field even when they do not see this at their own institutions.

Future Research

This study left many questions to be pursued by future research. It is important to acknowledge that the influence of the composite mentor on students' progress was augmented (and complicated) by other important factors, which include: the sharing of experiences, the mentoring experienced, and the peer support within the group. First, it would seem that having students come together to tell their stories of frustration might have had a similar impact. I argue that the initial "venting" and on-going storytelling was helpful to students, but alone did not help the women progress in the ways they did. It was clear that students were thinking differently about mentoring and linked their progress to the composite mentor idea. Rather than reporting that they "felt better" after sharing their stories of frustration, there was a common feeling of empowerment and action among the group that appeared to be connected to the strategies learned in the intervention. Future iterations of the program can examine the importance of the peer sharing.

Second, students gained new mentoring experiences within the intervention. With the support of these guests, it is possible students could have come away feeling more supported without the benefit of the composite mentor strategy. To a certain degree, this was true; students were grateful and impressed with the support they perceived by the guests they met. However, I argue that if they had not expanded their mentor selection criteria and been more pro-active in initiating mentoring relationships, they may not have counted these new professionals as mentors. Future iterations of the program can examine the importance of having access to mentors.

Third, the membership of the group was important to the success of the program. Students were among peers with similar concerns which helped students realize that they were not alone in their concerns. It was important for students to not only learn that their peers experience these same concerns. Although we only met for a semester, each of the

evening groups appeared to function as a community. Students began to act in peer mentoring roles to each others, offering insights about possible internships and encouraging each other through exams. I want to emphasize that the meetings appeared to be a "safe environment" where students could come and talk about their concerns. This was most likely influenced by the way the group was advertised (i.e., similar to a self-help group) and the informal, comfortable nature of our meetings (e.g., we met over dinner in a comfortable room). In future work, I plan to look more carefully at this peer group/community element in their progress. It was clear that students' thinking about the composite mentor, the caring mentors who volunteered, the safe peer environment, and the teacher's guidance all mattered. Therefore, I would caution trying to completely disentangle all of these important factors but resolve to look more carefully at the value added of each.

The program included students from different backgrounds, but there was not enough information to gauge the impact of gender, ethnicity, and class on students' willingness or ability to construct a composite mentor. Possibly, students who are used to having to rely on limited resources or role models may be more flexible at adapting to new mentoring strategies. On the other hand, these students may become more frustrated and look to non-science fields where they see diversity increasing more apparently. In addition, future research can explore the generality of "clash" across a larger population of students. One approach to this would be to reconfigure and further test the survey instruments used in this study. In this study, I was able to use the survey items to examine pre-post changes. In the future, I would anticipate developing scales of items which would allow me to look at group data in more sophisticated ways.

Although this project helped provide a possible model for future interventions, this was still an extra-curricular program. Future work can examine ways to integrate future images and mentoring into science education, in the K-12 settings and at college level. Helping students to see the varied possible images for themselves in the sciences is important at all ages and can help promote science literacy and the recruitment of students

into the sciences. For example, teachers might use more biographies to introduce the people behind science ideas, and how scientists from an array of contexts use scientific ideas might promote a more diverse and complex understanding of scientific ideas and of science fields. That way, thinking about science people in context with science ideas becomes part of the every day class setting and can have many chances to try on a scientist self. This study suggests that students need support and time when imagining new images for themselves and how they can connect to images in their environments.

These future projects present valuable opportunities to learn more about the role of future images and how individuals create new images in a field. Research using a future-oriented perspective and creative uses of mentoring is promising. As educators, researchers, family members, and students, we can move forward to inform each other about the struggles in our lives and to improve the resources available to help all students make informed career and life choices. Together we can improve the experiences of women in science, students in our schools, and people in our society at large.

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Appendix A

Letter to Web Role Models

Dear Science Professional/Student:

You are invited to become part of a web site showcasing role models in science! I hope you will read this letter and think about becoming a "model" in the showcase. (You knew you would be "discovered" some day!)

I am building this web site for college women who are considering careers in the sciences. This fall, women will have access to this web site through their participation in a mentoring program I am implementing and studying for my dissertation. College women have many questions about what science careers are actually like—about future lifestyles in science—and the pros and cons of various career choices. Role models in the web site, by sharing their experiences, can help women to make an informed choice about pursuing or leaving science. I hope to continue to expand the site in the future to include various professions and for use with all students of various ages.

What do role models provide?

- A few photos of you: at work or school, at play, at home (you choose!)
- A general information sheet
- Your audio-taped responses to a few questions or e-mail response
- An e-mail or mailing address so you can encourage students to contact you with questions

A camera, a cassette with questions, and a general information sheet are included for your use. You may choose to view your spot in the "showcase" prior to students' use or remove yourself from the site at <u>any</u> time. Please contact me if you have any questions. Thank you very much for your help in this project!

Sincerely,

Becky Wai-Ling Packard

General Information Sheet

Please complete the following (and leave blank items you do not wish to complete).

1. Name:
2. Age or years out of college:
3. Gender:
4. Ethnicity:
5. Where are you from (city/state/country)?
6. Where did you go to school for college? (College, Degree)
7. Where did you go to school for any graduate work? (College, Degree)
8. Where are you currently working/going to school? (e.g., place, city)
9. What are you currently doing? (e.g., title, description)
10. What career are you pursuing?
11. Will you provide an e-mail or mailing address for students if they have further questions? Yes/No

If yes, e-mail or mailing address: _____

Questions for the audio-tape/E-mail Response

You can use the prompts to help you get started on the topic.

1. Introduce yourself: "My name is..."
2. Tell a story: "I thought about leaving science one time when..." or "I remember one struggle when..."
3. What your career choice is, and what you love about your work: "The pros of my career choice are..."
4. Sacrifices or difficulties: "The cons of my career choice are..."
5. Strengths/special qualities: "What I want you to know about me is..."
6. Keeping a personal life: "What I do to keep sane..."
7. Role of mentoring: "Let me tell you about the key people who have helped me..."
8. Words of wisdom: "Some rules that I live by..."

Appendix B

Curriculum Plan

Mtg.	Plan	Post-Reflections	Post-Meeting Homework
1	Surveys, Composite Mentor Idea, Overview of Program Web site intro	1. Concerns or questions 2. Feedback on session/ Composite mentor idea	1. Worksheet completed after "visiting" 3 role models 2. Questions you might ask graduate women
2	Discussion with Graduate Women	1. Usefulness or similarity of grad women 2. Remaining concerns/Feedback	1. E-mail grad women or web role models. 2. What images you have of science professionals
3	Web-site exploration: Pair or group exploration of role models on issues	1. What new was learned from this exploration?	1. Career options exploration 2. What to ask professional women
4	Discussion with professional women	1. Usefulness or similarity of science faculty/professionals 2. Remaining concerns/ Feedback	1. Follow-up with faculty and professionals or others 2. Peruse internship data base, explore work-related experiences
5	Explore other career/personal resources	Construct composite mentor	Surveys
6	Social/closure		

Appendix C

Sample Homework Assignments

Homework 1: Worksheet to visit 3 models

Visit 3 Role Models Your Name: _____ Tues/Wed?

1. Role Model's name: _____
2. What made you want to visit this role model?

3. This role model is (very/somewhat/a little/not) similar to me.
4. This role model is (very/somewhat/a little/not) useful to me.
5. Did you learn or gain anything from visiting this role model? If yes, what?

6. Would you want to contact this role model? Why or why not?

7. What would you ask this role model?

(NOTE: This task was repeated 3 times in the assignment.)

Homework 2

1. Take a minute to "visit" a few more people in the role model web site.
   a. Who did you visit? _____, _____, and _____
   b. What did you think about your visits?

2. Based on your concerns and questions, and the type of support you are looking for, who would you like to contact from 1) the role model site and/or 2) the graduate women?

Person	Topic

3. Send each person a short e-mail message. For example, you could let that person know that they helped you in some way by what they had to say, or you could ask them a question.

Appendix D

Curriculum and Research Alignment

Objectives of Intervention	Structures/Assignments	Research Questions/ Data Analysis
1. To have participants expand Conceptions of Mentoring to include multiple models.	• Creation of a multiple role model web site. • Focus of Workshops. (W1: introduce idea; W2: multiple graduate women; W3: work with web site to highlight multipleness; W4: discussion of multiple paths with faculty/professionals.) • Assignments to assess similarity and utility of role models	• Does the intervention influence Ss to expand their CM? (Are CM examinable or changable?) Use pre-post surveys, follow-up interviews, and assignments to assess changes within individuals and across the group (e.g., purpose of mentoring, structure, criteria, and student role).
2. To have participants negotiate (clash) concerns, including personal/family-related, personality-related, work-related, and field-related concerns. To be more informed about multiple paths and options within careers.	• Focus of Workshop discussions (W2: Graduate women from various fields; W4: Faculty and professionals included) • Assignments and activities to identify own identity-related concerns, explore role models' concerns, ask questions and explore spectrum of careers • Web site includes multiple geographic and professional sites (industry, engineering, med)	• How do CM influence *future selves* in science, perceptions of access, and motivation to seek out mentoring? Use pre-post surveys on identity-related (clash) concerns. Use follow-up interviews and assignments, possibly including email and audiotapes from meetings to support trends and to examine relationships among variables.
3. To increase Ss motivation to seek out mentoring.	• Workshops scaffold the process of accessing people (W1: importance of mentoring, start with web site, W2: graduate students, W3: web site, W4: faculty and professionals) • Assignments scaffold the process of accessing people and resources (visit site first, then work up to email, then contacting others in environment)	• How do CM influence future selves in science, *perceptions of access, and motivation to seek out mentoring*? Use surveys to assess change in access to and experience of mentoring. Use follow-up interviews and assignments to assess motivation (e.g., participation in assignments, contacting role models, others in environment).

Appendix E

Participant List

Name	Year	Major
Brianna	Junior	Zoology/Museum Sciences
Annie	Junior	Human Biology
Lori	Junior	Human Biology
Jeri	Senior	Physiology
Ebony	Senior	Manufacturing Engineering
Genoveva	Sophomore	Civil Engineering
Keshia	Junior	Medical Technology
Lizzie	Senior	Medical Technology
Robyn	Junior	Human Biology
Estrella	Sophomore	Pre-med
April	Senior	Computer Science
Georgia	Senior	Forensic Chemistry
Rose	Senior	Biochemistry
Corie	Sophomore	Computer Science
Abha	Senior	Computer Science/English
Jane	Sophomore	Pre-med
Josie	Senior	Microbiology/Botany
Kellie	Senior	Material Science Engineering
Missy	Junior	Medical Technology
Zarah	Senior	Material Science Engineering
Ryan	Junior	Bldg. Construction Mgmt.
Julie	Junior	Chemistry
LaTisha	Junior	Medical Technology
Tiffany	Junior	Microbiology
Carol	Senior	Chemistry
Jill	Senior	Zoology
Sunita	Junior	Human Biology
Kate	Junior	Chemistry
Michaela	Junior	Microbiology
Kayla	Senior	Physiology

Appendix F

Program Advertisement

To all women science, pre-med, technology and engineering students:
*Are you currently pursuing a science or engineering career (Research, Medicine, Engineering, Math, Computers, Technology)?
*Are you trying to decide if a science or engineering career is really for you? Would you like to have the chance to explore the multiple career options within your field?
*Would you like to meet, interact with, and discuss issues with a variety of science professionals, engineers, medical professionals, and graduate students in these fields?
*Do you have concerns about your future career path? (For example, having a personal life or family in the future, diversity in the workplace, wondering if your work will make a contribution?) Would you like the chance to work through these concerns?

If your answer is YES to any of these questions, you should take advantage of this opportunity to join other students who share future career concerns. In this program, you will develop strategies to use mentoring to address your future career concerns and will have access to a variety of people and resources. You will attend either a Tuesday session or a Wednesday session for this Fall semester program. Meetings will be held over a complementary dinner and refreshments from 6:00-7:30pm, usually every 2 weeks over the course of the semester.

Requested participation includes: attending and participating at workshops/meetings, participating in mentoring- and career-related activities between meetings, and helping to evaluate the value of the program.

SPACE IS LIMITED. If you are interested in learning more about this FREE program, *Please contact me by September 15th * to be considered. In your email, include the following information: 1. Name, 2. Year (e.g., Sophomore, Junior), 3. Major, 4. Career Plans, 5. If you can attend the Tuesday and/or Wednesday session, and 6. Why you are interested in participating. Please call if you have any questions (351-6882).

Sincerely,
Becky Packard (packardb@pilot.msu.edu)

Appendix G

Clash Survey

"Science" is a general term used to refer to your field of interest. Consider your future science-related career. Please use the 6-point scale to reflect your level of agreement (from Strongly Disagree[SD]=1 to Strongly Agree[SA]=6) with the statements. Circle one choice for each statement.

Statement	SD (1)	D (2)	MD (3)	MA (4)	A (5)	SA (6)
I am concerned about having a personal life and my science career.	1	2	3	4	5	6
I am concerned about having children/family during my career.	1	2	3	4	5	6
I am concerned about working alone or in isolation.	1	2	3	4	5	6
I am concerned about working long hours.	1	2	3	4	5	6
I am concerned about competitive, cut-throat behavior in the workplace.	1	2	3	4	5	6
I am concerned that my work may not directly impact or help others.	1	2	3	4	5	6
I am concerned that I do not feel similar to others in my field in terms of personality and lifestyle.	1	2	3	4	5	6
I am concerned that I do not feel similar to others in terms of gender or race.	1	2	3	4	5	6
I am concerned that I do not see people in my field who are role models-- or how I want to be in the future.	1	2	3	4	5	6
I am aware of the alternative career paths within my field.	1	2	3	4	5	6
I have considered pursuing a non-science career because of my concerns.	1	2	3	4	5	6
I have work experience in my field that has helped me learn about my career.	1	2	3	4	5	6
I have a clear picture of myself in the future career.	1	2	3	4	5	6
The field is open to changing lifestyles and practices.	1	2	3	4	5	6
The field can change you in a negative way.	1	2	3	4	5	6
The field requires that you be willing to make major sacrifices (e.g., family, personal time).	1	2	3	4	5	6

Do you have any comments? What concerns do you have about the career?

Appendix H

Conceptions of Mentoring Survey

Please read the following statements. Please use the 6-point scale to reflect your level of agreement (from Strongly Disagree [SD]=1 to Strongly Agree[SA]=6) with the statements. Try to answer honestly. Circle one choice for each statement.

When I think of mentoring, I think of:	SA (1)	D (2)	MD (3)	MA (4)	A (5)	SA (6)
Finding someone in the field whom you would like to model yourself after.	1	2	3	4	5	6
Becoming socialized by someone into the practices of an organization or community.	1	2	3	4	5	6
Myself-- being a mentor or role model to others.	1	2	3	4	5	6
The impact I can have on my field, even as a new-comer.	1	2	3	4	5	6
Accessing and selecting resources from people in the field to support my own development.	1	2	3	4	5	6
Mentors teaching students about the field, "taking them under their wings."	1	2	3	4	5	6
Mentors being able to anticipate the important questions students have.	1	2	3	4	5	6
Students approaching mentors to establish relationships.	1	2	3	4	5	6
Students defining mentoring relationships and asking for the help they need.	1	2	3	4	5	6
Mentors choosing to help students who show great potential.	1	2	3	4	5	6
Someone who is of the same background, race, and gender as me.	1	2	3	4	5	6
Someone outside of my field--but who offer support or insight.	1	2	3	4	5	6
A variety of different people who help provide various resources.	1	2	3	4	5	6
A long-term relationship that is developed between two people.	1	2	3	4	5	6
A series of on-going relationships, some short-lived, others long-term.	1	2	3	4	5	6
Multiple relationships occuring at one time, some closer than others.	1	2	3	4	5	6

What does the word "mentoring" bring to mind for you? (For example: What does mentoring look like? What kind of mentoring are you looking for?)

Appendix I

Experience of Mentoring Survey

Who has been influential in supporting your career pursuits during college?

Person	Yes (1)	No (2)
An academic advisor	1	2
A family member	1	2
Professor	1	2
Formal mentor (program)	1	2
A professional-- from work	1	2
Other-- please specify_____		

How have others (you named above) helped you? What kinds of experiences have you had with mentoring?