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Case Studies of Women in Academia: Challenges, Accomplishments, and Attributions to Success

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CASE STUDIES OF WOMEN IN ACADEMIA: CHALLENGES, ACCOMPLISHMENTS, AND ATTRIBUTIONS TO SUCCESS

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CASE STUDIES OF WOMEN IN ACADEMIA: CHALLENGES

ACCOMPLISHMENTS, AND ATTRIBUTIONS TO SUCCESS

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The purpose of this study was to investigate the factors in the life histories of women in academia in science and engineering that they perceive to have influenced their success and how these factors have influenced their success. Three broad areas were addressed: challenges, accomplishments, and attributions to success. This study employed a multiple-case design, and purposive sampling was used to select the participants in this study. Each of the seven participants held a Ph.D. and was employed at a doctoral-degree granting institution in a science or engineering field.

Four major themes emerged from the data with respect to challenges that influenced the success of the participants: (a) no perceived academic limitations during their years of elementary and secondary schooling, (b) no other challenges during the elementary and secondary school years that hindered achievement in their educational background or their path to academia, (c) no gender-related expectations in the family

background, and (d) no gender-related academic expectations or discrimination in graduate school that hindered success in graduate programs or the path to academia. Six of the participants attained at least one achievement-based accomplishment in high school, and four participants attained achievement-based accomplishments as undergraduates.

Five major themes emerged in the data with respect to factors to which the participants attributed their success: (a) parents or other family members held high academic expectations, (b) father served as mentor and role model, (c) had at least one mentor in the Ph.D. program, (d) at least one colleague or administrator served as a mentor during their academic careers, and (e) participated in collaborative research and publishing with colleagues in academia. These all contributed to success in various ways.

Recommendations for future research include: (a) replication of the current study, (b) multiple case-study research comparing the factors which influence the success of women in science and engineering who have entered and persisted in academia with those who have not been successful, and (c) research comparing the factors influencing success of women in academia in science and engineering disciplines with those in other disciplines.

DEDICATION

I dedicate this dissertation to my mother, Eva Tindall. She has always been my biggest fan.

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this study a reality. Each of them is truly a shining example of success in academia, and it was a privilege and honor to work with them.

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CHAPTER I

INTRODUCTION

The underrepresentation of women in academia, specifically in fields of science and engineering, is well-documented in literature addressing women in education, as are the challenges faced by women during their progression through their academic careers. Despite the superfluity of documentation related to the problem of underrepresentation and the challenges faced by women in science and engineering fields, the limited participation by women in the fields of science and engineering reflects the continued presence of the problem and the lack of long-term solutions addressing this underrepresentation. The current research adds to the existing knowledge of issues related to women in academia in science and engineering disciplines. In addition, this research takes a life histories approach to the progression of women in academia throughout their academic backgrounds and professional careers, revealing factors throughout the lives of women in academia that they perceive as having influenced their progression to, and success in, academia.

This chapter is presented in five sections. They are: (a) review of related literature, (b) need for the study, (c) purpose of the study, (d) research question, and (e) definition of terms. The review of related literature will provide the background knowledge needed to understand both the nature and importance of the current study.

Review of Related Literature

The purpose of this literature review is threefold. First, it establishes the problem of underrepresentation of women in fields of science and engineering in higher education, including in postsecondary education degree programs and in academia. Second, it discusses literature addressing the challenges faced by women in academia as they pursue their career goals. Finally, it presents literature addressing factors to which women attribute their success and other facilitators of success in academia.

The Underrepresentation of Women in Higher Education

The first line of evidence establishes the problem of underrepresentation of women in fields of science and engineering in higher education, including postsecondary education degree programs and academia. Areas addressed within this line of evidence include: (a) the overall status of women in postsecondary education, (b) women science and engineering degree recipients, (c) women in academia, and (d) selecting careers away from academia.

Overall Status of Women in Postsecondary Education

Women have made substantial gains in postsecondary degree attainment over the past three decades. In 1970, women earned 43.2% of all bachelor's degrees, 39.8% of all master's degrees, and 13.5% of all doctorates. In 2001, these percentages had increased to 57.4%, 58.6%, and 44.0%, respectively (National Science Foundation [NSF], 2004a). In education and health related professions, women have been well represented in bachelor's and master's programs for at least three decades, on average earning over half

of these degrees. In addition, the participation of women in doctoral programs in these disciplines has also increased significantly. In 1970, women earned a total of 19.8% of the doctoral degrees in education and 16.2% of those in health related professions. In 2001, women earned 64.9% and 60.9%, respectively (Freeman, 2004). These data indicate that overall women have made significant progress in postsecondary education in terms of degree attainment at all degree levels.

Women Science and Engineering Degree Recipients

Although the percentages of degrees earned by women, on average, have increased significantly, women are still underrepresented in some science and engineering fields at all degree levels (NSF, 2004a). Table 1 compares the percentages of degrees at all levels earned by women in science and engineering fields for the years 1970 and 2001. As Table 1 indicates, although the percentage of women degree recipients has increased significantly in most science and engineering disciplines, women remain underrepresented in some fields, especially the physical and math/computer sciences and engineering. For example, in 2001 women earned 16.9% of the doctoral degrees in engineering, 24.6% of the doctoral degrees in the physical sciences, and 23.5% of the doctoral degrees in math/computer sciences. The percentage of women earning bachelor's degrees in math/computer sciences has decreased, with women earning 36.1% of bachelor's degrees in math/computer sciences in 1970 and 31.8% of the bachelor's degrees in 2001 (NSF, 2004a). These data indicate that women are still underrepresented as degree recipients in science and engineering disciplines.

Table 1: Percentages of Degrees Earned by Women in Science and Engineering: 1970 and 2001

Academic Discipline	Bachelor's Degrees		Master's Degrees		Doctoral Degrees	
	1970	2001	1970	2001	1970	2001
Engineering	0.8	20.1	1.1	21.2	0.5	16.9
Physical Sciences	14.5	41.7	15.1	34.8	5.8	24.6
Math/Computer Sciences	36.1	31.8	25.5	35.2	6.3	23.5
Earth and Related Sciences	10.2	40.9	11.1	41.4	3.0	31.6
Biological/Agricultural Sciences	24.1	57.3	25.8	54.6	12.9	43.5
Psychology	43.6	77.5	37.3	75.7	23.5	67.1
Social Sciences	36.6	54.8	25.6	54.2	11.3	43.0

Note. From National Science Foundation, Division of Science Resources Statistics, *Science and Engineering Degrees: 1966-2001*, NSF 04-311, Project Officers: Susan T. Hill and Jean M. Johnson (Arlington, VA, 2004).

Women in Academia

The underrepresentation of women in some fields of science and engineering leads to their underrepresentation in academia in these fields. Figure 1 compares the numbers of male and female science and engineering doctoral holders employed at four-year colleges and universities. As seen in Figure 1, women science and engineering doctoral holders are underrepresented in all science and engineering occupations at four-year colleges and universities (NSF, 2004b).

Women science and engineering doctoral holders employed at four-year colleges and universities are less likely than their male counterparts to hold tenured positions, and female academic faculty are less likely to hold the rank of full professor (NSF, 2004b). This is indicated in Table 2, which compares the percentages of male and female tenured faculty and male and female academic faculty in each professorial rank at four-year colleges and universities. For example, of the total number of female science and engineering doctoral holders employed at four-year colleges and universities, 35.1% are tenured faculty. Of the total number of female science and engineering doctoral holders employed as academic faculty, 28.1% are full professors.

In addition to the aforementioned literature addressing broad academic disciplines for universities and four-year colleges, other studies have been conducted that exemplify the underrepresentation of women at particular universities. Nelson (2005) examined the status of women in the top 50 departments in 14 science and engineering fields. These departments were ranked in the top 50 by the NSF on the basis of research funds spent. Results revealed that male faculty made up the majority of faculty in all 14 fields, from

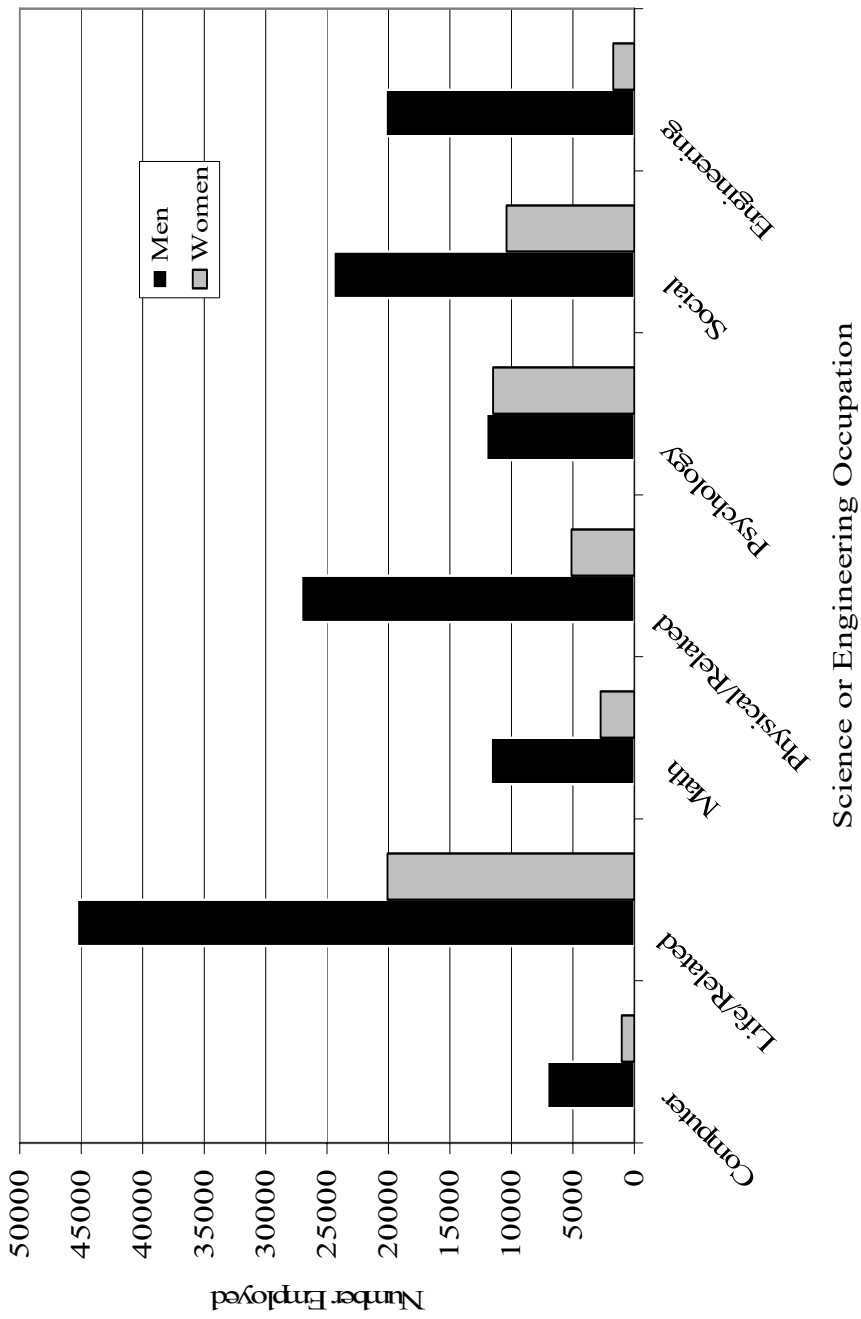

Figure 1: A Comparison of Men and Women Science and Engineering Doctoral Holders Employed in Science and Engineering Occupations at Four-Year Colleges and Universities. *Note:* From National Science Foundation, Division of Science Resources Statistics, *Women, Minorities, and Persons with Disabilities in Science and Engineering: 2004,* NSF 04-317, (Arlington, VA, 2004).

64.2% in sociology to 93.5% in electrical engineering. A comparison of recent doctoral recipients from these disciplines with the percentages of assistant professors in these disciplines revealed that women from seven of the disciplines were well-represented among recent doctoral recipients, whereas there were disparities in seven disciplines between recently hired faculty and the hiring pool. In political science, for example, the Ph.D. attainment by women between 1993 and 2002 was 36.6% and the percentage of female assistant professors was 36.5%, reflecting parity between recently hired faculty and the hiring pool. However, in computer science, Ph.D. attainment by women was 20.5% and the percentage of female assistant professors was only 10.8%.

Table 2: Comparison by Gender of Tenured Faculty and Professorial Ranks: 2001

Gender	% Tenured Faculty[a]	% Faculty According to Rank[b]		
		Assistant	Associate	Full
Female	35.1	39.0	32.9	28.1
Male	55.8	20.9	26.7	52.3

Note. The numbers of male and female faculty members were taken from: National Science Foundation, Division of Science Resources Statistics, *Women, Minorities, and Persons with Disabilities in Science and Engineering: 2004,* NSF 04-317, (Arlington, VA, 2004). The total number of female faculty and female tenured faculty is 69,520 and 24,400, respectively. The total number of male faculty and male tenured faculty is 175,530 and 97,920, respectively. The total number of female assistant, associate, and full professors is 18,580, 15,660, and 13,380, respectively. The total number of male assistant, associate, and full professors is 29,210, 37,260, and 73,020, respectively.

[a] For each gender, the percentage of tenured faculty was calculated by dividing the total number of employees by the total number tenured.

[b] For each gender, the percentage of academic faculty in a given rank was calculated by dividing the sum of academic faculty all three ranks by the number of academic faculty in a given rank.

Another disparity revealed by Nelson (2005) was between the percentages of female bachelor's recipients and the percentage of female faculty. In all departments examined by Nelson, the percentage of female bachelor's recipients was greater than the percentage of female faculty. For example, in sociology, 70.2% of the bachelor's recipients were female, whereas 35.8% of the faculty was female. In chemistry, these percentages were 47.3% and 12.1%, respectively.

A study even more narrow in focus concerning underrepresentation of women in science and engineering was conducted by the Massachusetts Institute of Technology (MIT) (1999). This study addressed the status of women faculty in the School of Science at MIT. In 1994, women made up only 8% of the faculty in the School of Science, and the findings of the committee in charge of this study revealed that this percentage "had not changed significantly for at least 10 and probably 20 years" (p. 4). In addition, in 1994 there were only 15 women holding tenured positions in the School of Science versus 194 men holding tenured positions.

In summary, the literature addressing the underrepresentation of women in academia includes both literature addressing the employment and status of women at four year colleges and universities on a national basis (NSF, 2004b) and literature addressing the employment and status of women at particular universities. Nelson (2005) examined the status of women in the top 50 departments in 14 science and engineering fields, and a study by MIT (1999) addressed the status of women faculty in the School of Science at MIT.

Selecting Careers Away from Academia

Women who do choose to obtain doctoral degrees in science and engineering fields sometimes select careers away from academia. Sears (2003), in a study addressing the career goals of math and science graduate students at the University of California, revealed that women were more likely than men to downgrade their career goals during graduate school, selecting away from research careers in academia. Changes in initial career goals occurred because of increased exposure to a variety of career opportunities, conflicts between research careers in academia and family life, and dissatisfaction with academia. Women were also more likely than men to list long work hours and tenure time limits as obstacles to success. In terms of location, women more often than men considered spouse and family as constraints on job location, whereas men were more interested than women in the climate and culture of a job location.

In a similar study addressing barriers faced by women in pursuing academic careers, van Anders (2004) found that concerns related to parenthood and mobility served as barriers to entry into academia more often for women than for men. In addition, Nelson (2005) noted, with respect to recent women Ph.D. recipients that "they do not perceive the academic environment as desirable, so they choose not to apply for faculty positions" (p. 4). The literature from this section reveals that there are a variety of reasons women select careers away from academia.

Summary

The first line of evidence established the problem of underrepresentation of women in higher education. First, the literature revealed that women have made great progress in degree attainment overall. Second, the literature revealed that women still remain underrepresented in terms of degree attainment in many science and engineering fields. Third, the literature revealed that women are underrepresented in academia in science and engineering fields. Finally, the literature revealed that women select away from careers in academia for a variety of reasons, such as conflicts between family and career and the perception that the academic environment is not desirable.

Challenges Faced by Women in Academia

The second line of evidence discusses literature addressing the challenges faced by women in academia as they pursue their career goals. Areas addressed in this line of evidence include (a) marriage, parenthood, and the tenure clock; and (b) discrimination.

Marriage, Parenthood, and the Tenure Clock

The nature of careers in academia is one challenge faced by women in academia. According to Grant, Kennelly, and Ward (2000), "The clockwork of this career is distinctively male. That is, it is built upon men's normative paths and assumes freedom from competing responsibilities, such as family, that generally affect women more than men" (p. 66). The study by Grant et al. provides documentation of the challenges faced by women in academia. This study employed a survey and subsequent interviews to

examine the relationships between marriage, parenthood, and productivity on 602 natural, physical, and social scientists teaching at American universities. Results suggested that scientists, especially women, struggle with decisions about marriage and parenthood. The decision to marry or remarry had often been forgone by women due to incompatibility with career obligations. Women who did chose to marry found that marrying scientists proved beneficial in balancing marriage with career because of convenience and the willingness of their spouses to accept career obligations and support their career endeavors. However, this study documents one case in which a marriage of two scientists ended in divorce in part because the woman's career surpassed that of her husband's career and she received more recognition in academia.

In the study by Grant et al. (2000), over half of the women, and all but two of the men, had children. Those women who chose not to have children attributed this decision in part to demands of careers and adjustments that parenthood would entail. Some of the scientists who chose to have children did so after their careers had become established. Women with children reported dealing with unclear departmental maternity leave policies, facing the possibility of penalties for becoming pregnant, and struggling with balancing parenthood demands with work demands.

Rosser and Daniels (2004) conducted a study investigating experiences of Professional Opportunities for Women in Research in Education (POWRE) and Clare Booth Luce (CBL) Professorship awardees. With respect to balancing work and family, they found that "the issue of balancing work with family responsibilities is the most pervasive and persistent challenge facing female science and engineering faculty

members, spanning the variables of time, type of institution, and discipline" (p. 144). Other challenges reported by participants as present in the lives of female scientists included the conflict arising from the tenure clock deadlines and having children, low numbers of female colleagues, lack of mentoring, gaining credibility from colleagues and administrators, lack of funding, and job location and salary restrictions. With respect to the laboratory atmosphere, participants reported a boys' club atmosphere, isolation, hostile environment, and establishing credibility as some of the challenges faced by female scientists.

A related study by O'Laughlin and Bischoff (2005) examined the impact of gender and tenure on parenthood and career experiences on 179 women and 85 men holding tenure-track positions in academia. Examples of areas addressed include age, average work hours of participant and spouse, household responsibilities, number of children, academic and family stress, and institutional and partner support. Results revealed that women were more likely than men to report that they had greater household and childcare responsibilities than their spouses, and they were more likely to comment on the negative impacts of their careers on family life. Women were also more likely than men to report limitations in travel due to parenthood, and academic stress and perceived spousal support served as significant predictors of family stress. Similarly, Xie and Shauman (2003) found that parenthood was disadvantageous to women scientists in terms of employment and geographic mobility. Women with children, for example, were much more constrained geographically than men by responsibilities associated with parenthood.

The study by Xie and Shauman (2003), published in a book entitled *Women in Science: Career Processes and Outcomes*, took a life course approach to studying factors influencing the status of women in science careers. This study utilized 17 nationally representative datasets to investigate such factors as attainment of science and engineering education, career transitions, mobility, and productivity. According to Xie and Shauman, "The life course approach has led us to recognize that science/engineering careers are multifaceted in nature and are affected by influences at the individual, familial, and social levels" (p. 207). Although this study does not focus exclusively on women in academia in science and engineering, it does provide insight into challenges faced by women in science and engineering fields.

Contrary to hypotheses that contribute gender differences in science and engineering careers to girls' underparticipation in mathematics in high school, Xie and Shauman (2003) found that girls exhibited parity in coursework participation relative to boys and made better grades. In addition, they found that most female science and engineering bachelor's recipients had actually entered college in other fields of study but had later changed to science and engineering fields. Children, but not marriage in itself, emerged as a major disadvantage to the careers of women in science and engineering, including the likelihood of employment and promotion in these fields. In addition, the authors cited individual choice as a reason for disparities with respect to career, but they noted that "we do not believe that choices are necessarily voluntary and/or perfectly rational" (p. 211). Xie and Shauman noted that these choices "reflect the broad social structure and as such reinforce the current gender segregation of occupations" (p. 211).

Findings related to mobility and productivity have been discussed in relation to other studies and will thus not be repeated here.

Research productivity with respect to marriage and parenthood aspects of women in academia is another issue addressed in the literature. Grant et al. (2000) argued that research showing no negative influences of marriage and parenthood on the productivity of female scientists has been characterized by biases, including sample selectivity. For example, they argue that elite scientists, among which women are underrepresented, have been the focus of much of this research. Evidence in favor of this argument can be found in a study by Stack (2004). In this study, data referring to 11,231 science and engineering Ph.D.s employed in academia were examined to investigate the relationship between gender, children, and productivity. The results revealed that the men in this sample published significantly more than women and that women with young children had relatively low productivity. In the social sciences, gender itself was not associated with productivity, but those with young children were characterized by low productivity. Xie and Shauman (2003) also addressed this issue, finding that sex differences in productivity declined between the late 1960s and the early 1990s, and that most of these differences "can be attributed to sex differences in personal characteristics and structural features of employment" (p. 210).

Discrimination

Discrimination has also been documented as a challenge faced by women in academia. A study conducted by MIT (1999) addressing the status of women faculty in

the School of Science, data revealed that, in some departments: "Inequitable distributions were found involving space, amount of nine-month salary paid for individual research grants, teaching assignments, awards and distinctions, inclusion on important committees and assignments within the department" (p.8). In the study conducted by Grant et al. (2000), one female participant reported that she was no longer invited to faculty meetings after her department head learned of her pregnancy. Discrimination in the form of societal attitudes, chauvinism, stereotyping, and being passed up for promotions at work have also been reported by successful women as barriers to success (Yewchuk, Aysto, & Schlosser, 2001).

A report published by the American Association of University Women (AAUW) (2004) entitled *Tenure Denied: Cases of Sex Discrimination in Academia* examines 19 legal cases of sex discrimination in academia. Although this report does not attempt to question the courts' rulings in these cases, it does discuss the various ways in which universities may discriminate against women. Examples of discriminatory practices described include stereotyping, sexual harassment, a hostile work environment, denial of tenure based on gender, pregnancy discrimination, and the undervaluing of feminist scholarship and women's studies publications.

In one case of alleged discrimination reported by the AAUW (2004), two women hired at a university in 1997 were assured by the university that they would be immediately considered for tenure. Upon applying for tenure, one woman had 84 publications, 63 of which were peer-reviewed, and "had published a book, founded a journal, and had a copyright and one patent" (p. 22). In addition, she had "secured almost

a half million dollars in research money" (p. 22). Although a male applicant with only three peer-reviewed publications, 16 publications total, and lacking some other qualifications of the woman applicant was awarded tenure, this woman and another female colleague were denied tenure. The university later denied the aforementioned assurance of tenure consideration and asserted that they denied her tenure because "she had not completed sufficient teaching, clinical practice, or research" (p. 23) at the university. She and her female colleague filed a lawsuit in 2000, but as of the publication of the AAUW report, there had been no trial.

An empirical study by Bronstein and Farnsworth (1998) employed a campus climate survey to investigate gender discrimination at a research university. Reports from the 556 respondents revealed that women were less likely than men to feel they could express themselves freely. For longer-term faculty, women were more likely than men to experience demeaning and aggressive behaviors from students, with 40% reporting experience with demeaning behaviors and almost 50% reporting experience with aggressive behaviors. Newer women faculty were more likely than men to report exclusion from social activities and policymaking committees. According to reports from participants, both newer and longer-term female faculty were more likely than men to experience demeaning and oppressive behaviors from their peers, with over half of the female faculty reporting two or more forms of each behavior. In addition, inappropriate sexual behavior was also more likely to be experienced by females than males.

Summary

The second line of evidence revealed that women in academia face challenges as they pursue their career goals. First, the literature revealed that issues surrounding marriage and parenthood are major challenges faced by women in academia. Second, the literature revealed that discrimination is a challenge faced by women in academia and that this challenge can take several forms, such as a hostile work environment and denial of tenure.

Attributions and Facilitators of Success

The third line of evidence presents literature addressing factors to which women attribute their success and other facilitators of success in academia. Areas addressed in this line of evidence include: (a) familial and institutional support and personal attributes, and (b) mentors.

Familial and Institutional Support and Personal Attributes

One study addressing attributions to success with respect to women was conducted by Yewchuk et al. (2001). They surveyed Canadian and Finnish women defined as highly successful because of their listing in a Who's Who publication for their respective countries. Although this study did not focus on women in academia, results of this study can help provide insights into possible reasons for success in women with successful careers in academia. The results of this study revealed that the participants attributed their success to their personal qualities, personal convictions, hard work, encouragement from parents and spouses, and luck. Encouraging persons other than

family included teachers, counselors, professors, and friends. Sadker and Sadker (1995) reported on the influence that parents exert over women in nontraditional careers: "Looking back on their childhood, women who have achieved in nontraditional careers point to the expectations and encouragement of parents as key to their success" (p. 257). They discuss one woman who attained a degree in chemistry and attributed her success to her father, who recognized her math and science ability, always believed she could get through her program, and encouraged her to try everything.

Rosser and Daniels (2004) reported the results of an interview with a Clare Booth Luce (CBL) recipient, Colleen, who discussed aspects of her life history that served as positive influences in her career. In both grade school and high school, Colleen believed herself to be good in math and science. Colleen's mother and father were scientists, both holding Ph.D.s. In addition, Colleen reported that her mother, as well as a woman with whom she studied in a postdoctoral position, served as role models for her. Her husband was also a Ph.D. mathematician and, although they both worked full-time originally, he eventually stayed at home with their two children. Another CBL recipient and interviewee in this study was Annelise, a biologist. She reported that, although she had never had any female mentors, her male mentors had been supportive of women. As an undergraduate, the level of confidence one professor and mentor demonstrated in her encouraged her to pursue her graduate education. Annelise's parents were also a factor in her success: "Enduring the struggles that all female scientists experience was possible because her parents encouraged her to do what she wanted" (p. 142). In addition, CBL recipients in this study reported that these professorships had resulted in increased respect

by their peers and increased professional opportunities, child care benefits, and flexibility of funding, all beneficial to them in their career progression. In addition to the results reported by Rosser and Daniels in their study, they suggested that a cafeteria of benefits which offers flexibility in a woman's career, alternate but equally valued paths to success, and more structure to the advancement practices of departments may also serve as facilitators to success.

Similar to reports of the CBL recipients in Rosser and Daniels (2004), Grant et al. (2000) suggested that scientific careers more conducive to family life and scientific workplaces that are female friendly can be beneficial to women scientists. In addition, Xie and Shauman (2003) named accommodations such as job-sharing, on-site child care, and flexible schedules as possible means of contributing to the work productivity of women in science and engineering fields.

Mentors

Mentors can provide a valuable source of support for women in science and engineering fields, as exemplified in the previous study by Rosser and Daniels (2004) documenting the report by Annelise that her male mentors had been supportive of women. Other research addressing mentors also provides evidence of their impact on women. In a survey of 1st-year and 4th-year undergraduate women addressing various aspects of mentoring among these two groups (e.g., sources of mentors, functions of mentors), Packard, Walsh, and Seidenberg (2004) found that 1st-year students were more likely to have family members and high school teachers as mentors, whereas 4th-year

students reported college faculty as mentors. Additionally, 4th-year students were more likely to have multiple mentors than 1st-year students. In addition, 4th-year students more often than 1st-year students reported that mentors had functioned in challenging students. However, both groups reported both psychosocial and career-related functions associated with mentoring.

Downing, Crosby, and Blake-Beard (2005) employed a survey "to test the assumption that women guides are especially important to young women majoring in the natural sciences, an area where women are traditionally underrepresented" (p. 421). Over 90% of the 207 women undergraduate science majors reported that they had at least one of three developmental guides: mentors, role models, and sponsors. Mentors were reported as the most influential developmental guides by 42% of the participants, and role models were reported as most influential by 34% of the participants. In this study, the authors found that "women guides were not uniformly significantly more prevalent than male guides" (p. 424), although these women students did have more women guides overall. In addition, they found that "women students ascribed more influence on their pursuit of science to their male guides than to their female guides" (p. 424).

Campbell and Skoog (2004) reported on the impact of an undergraduate science education program whose goal was to increase women and minority participation in the sciences through involving them in research experiences. In this program, mentors provided support and encouragement and stimulated women's interest in their research fields. The interactions these women experienced with influential persons such as mentors and peers were important in their decisions to pursue career in science.

A study by Dohm and Cummings (2002) also serves as evidence of the influences that mentors can have on women. In this exploratory study, female clinical psychologists were surveyed to investigate the association between research mentors and women's choice to conduct research and to serve as mentors for others. Results revealed that women who had research mentors were significantly more likely to choose to conduct research than those who did not have research mentors. However, the gender of this mentor was not significantly related to a woman's choice to conduct research. In addition, the presence of a mentor in the life of a woman who chose to conduct research was not indicative of whether the woman would herself become a mentor. The influence of a research mentor was further exemplified in that even women who chose not to conduct research, but had a mentor, were more likely to mentor others than those women who had not had a mentor.

A comprehensive study by Dodds (2005) investigated the nature and influences of mentors on physical education teacher education (PETE) faculty members from a life and career histories perspective. Although this study does not address women in academia in science and engineering, it does provide insights into the nature of mentors and influences that mentors can have within the life histories of women in academia. The 54 participants in this study held either a curriculum or instruction doctorate, represented all faculty ranks, and had a range of one to over 35 years of experience in higher education.

In this study by Dodds (2005), mentors in childhood and adolescence exemplified personal values that facilitated their success in their future careers. These mentors instilled the value of high standards and hard work, and displayed integrity and strength

in their own lives. For example, one participant credited her mother for displaying a good work ethic and instilling in her the drive to learn. Another participant named her uncle as exhibiting high expectations, making sure she reached her full potential in athletic performance. Some mentors named in this study also served as role models for successful professional behavior. Participants named K-12 teachers as mentors who modeled both positive and negative professional values. Older physical education majors served as role models for professional behaviors during initial teacher preparation.

Dodds (2005) reported that participants named parents and K-12 teachers as mentors who were influential in recognizing their potentials and in creating opportunities for their success. Many parents recognized the values of college educations. Teachers' assistance varied from helping participants search for colleges and providing letters of recommendation to leaving participants on their own. Once participants were training to become teachers, teacher educators often provided encouragement to participants in their aspirations to teach.

According to Dodds (2005), during various stages in the careers of participants, administrators and colleagues mentored participants in their career planning. Administrators sometimes provided participants exposure to new career opportunities. Colleagues often helped participants develop their next career steps and challenged them to become good researchers. The latter agenda was of particular importance to colleague mentors of participants working at research universities.

Within postsecondary institutions, Dodds (2005) found that mentors helped participants acclimate to postsecondary culture and displayed positive attitudes when

placing them into their new positions. Participants also received mentoring assistance for tenure and promotion, including suggestions about research and assistance in preparation of the tenure portfolio. Mentors provided assistance for writing and research activities as well. Some mentors included participants in joint projects, and some served as a role model for success in research. Mentoring assistance for teaching and advising were influential in shifting the participants' orientations to teaching and in understanding how to advise graduate students.

Summary

The third line of evidence revealed the factors to which women attributed their success and other facilitators of success in academia. First, the literature revealed that familial support, institutional support, and personal attributes are factors influencing the success of women. Second, the literature revealed that mentors serve to influence the success of women in academia in several ways, such as being influential in a woman's decision to pursue a career in a given field. In addition, the literature revealed that a wide range of persons, such as parents and professors, can serve as mentors.

Summary

The purpose of this literature review was threefold. First, it established the problem of underrepresentation of women in fields of science and engineering in higher education, including postsecondary education degree programs and academia. Second, it discussed literature addressing the challenges faced by women in academia as they

pursue their career goals. Finally, it presented literature addressing the factors to which women attribute their success and other facilitators of success in academia.

First, the review of the literature established the problem of underrepresentation of women in the fields of science and engineering. The review revealed that, although women have made great progress in degree attainment overall, they still remain underrepresented in terms of degree attainment in many science and engineering fields. In engineering, the physical sciences, math/computer sciences, and earth and related sciences, women are underrepresented at all degree levels. With the exception of psychology, women remain underrepresented as doctoral recipients in all science and engineering fields. In addition, the review revealed that women are underrepresented in academia in science and engineering fields. According to the literature presented in the review, women may select away from academia because of exposure to other careers, conflicts stemming from family obligations, and the perception that the environment in academia is undesirable. Within academia, women are underrepresented at the highest ranks of academia and in the population of tenured faculty.

Second, this review of the literature discussed challenges faced by women in academia as they pursue their career goals. Issues surrounding marriage and parenthood emerged as major challenges faced by women in academia. The decision of women in academia to marry and have children may be forgone or parenthood delayed due to potential conflicts with career. For those women in academia who do have children, conflicts between parenthood obligations and career demands serve as challenges to the progression of women in academia. The literature revealed that women with children

tend to publish less and are less mobile than their male counterparts. The literature also revealed that discrimination is a challenge faced by women in academia, and these challenges can take many forms. Some of these include a hostile work environment, denial of tenure, lack of credibility, pregnancy discrimination, exclusion from social activities, disparate assignment of space, and demeaning behaviors from students and peers.

Finally, this review presented the literature addressing factors to which women attribute their success and other facilitators of success in academia. Support from parents, spouses, and friends emerged as attributes to success for women. In addition, personal qualities, hard work, and luck were also reported as facilitators to success. The literature suggested that institutional efforts to make the academic more conducive to family life may facilitate success for women in academia. Research presented also provided evidence that mentors and role models can serve as sources of support and encouragement for women in their educational backgrounds and professional careers. Mentors and role models can also be influential in a woman's decision to pursue a career in a given field and in promoting their involvement in research. A wide range of persons can serve as mentors and role models, including parents, K-12 teachers, professors, colleagues, and administrators. In addition, women may have multiple mentors to facilitate their progression in their academic careers.

This review of the literature provided information necessary to understand the current status of women in academia, the challenges they face, and factors associated

with their success. This literature thus provided the background knowledge needed to understand both the nature and importance of the current study.

Need for the Study

Literature addressing women in science and engineering provides arguments for the need to address the underrepresentation of women in academia in the fields of science and engineering, and thus suggests that further research concerning women in academia is needed. According to Nelson (2005), the differences in the percentages of female bachelor's recipients and female faculty in science and engineering fields results in a lack of role models and mentors for female students. This can, in part, lead to the attrition of female students in these fields. In addition, Nelson argued that "the absence of women sends a message to men that women do not belong in these non-traditional environments and that it is acceptable for them to be marginalized, denied tenure, and given unequal resources" (p. 2).

Nelson (2005) also addressed security and economic issues that arise from this underrepresentation. She argued that "the representation of women and minorities in science and engineering generally is far below that needed to insure the national security, economic superiority, and scientific leadership of our country" (p. 1). Another argument related to the underrepresentation of women in science is that the utilization of women would lead to a broader range of research issues, such as those involving social challenges, being addressed ("How to Boost," 1999).

These arguments suggested the importance of continuing to address the issue of underrepresentation of women in academia. As reflected in the review of related literature, there are gaps in the research that can be addressed. Much of the literature addressing women in academia has focused on the problem of underrepresentation and the challenges faced by women in academia, but long-term solutions to this problem, both at the individual and university policy level, are fundamentally lacking. Although there are some stories of success, these are overshadowed by the documentation of continued underrepresentation and challenges faced by women in academia.

In addition to the aforementioned gaps in the literature and the arguments made in the literature that have suggested the need for further study of women in academia, the life histories approach that this study took in examining the challenges, accomplishments, and attributions to success of women in academia can also be further justified in terms of documentation of gender disparities with respect to girls. For example, the presence of bias against girls in schools (Sadker & Sadker, 1995), gender stereotypes (Koch, as cited in Shakeshaft, 1995), disparate expectations for girls and boys (Sadker & Sadker, 1995), and gender biased textbooks in schools (AAUW, 1992, 1998; Sadker & Sadker, 1995) are documented as factors that contribute to the gender disparities that exist in our society. This documentation thus suggests that environmental and societal factors influence the progression of females throughout their educational backgrounds. This, along with documentation of challenges and attributions to success found in the review of the literature, suggests that many factors in the life histories of women in academia may influence their success.

Purpose of the Study

Xie and Shauman (2003) approached issues surrounding women in science from a life course perspective. However, although comprehensive in nature, drawing upon numerous representative data sets, their study was quantitative in nature. Furthermore, Xie and Shauman addressed women in various employment sectors, and their study was thus not limited to women in academia in science fields. Unlike quantitative approaches, which are based on the assumption that "we inhabit a relatively stable, uniform, and coherent world that we can measure, understand, and generalize about" (Gay & Airasian, 2003, p. 8), qualitative approaches are based on "the view that reality is constructed by individuals interacting with their social worlds" (Merriam, 1998, p. 6). According to Merriam, "Qualitative researchers are interested in understanding the meaning people have constructed, that is, how they make sense of their world and the experiences they have in the world." (p. 6)

The purpose of this study was to utilize a qualitative, multiple-case study approach in order to investigate the factors in the life histories of women in academia that they perceive to have influenced their success, and how these factors have influenced their success. These factors included perceived challenges and barriers to success that women in academia have faced in their life histories, ways in which these women have overcome perceived challenges and barriers to success, accomplishments made during their life histories that may have contributed to success, and other perceived facilitators and attributions to success.

For the purposes of this study, a woman was considered successful simply by virtue of attaining an academic or research appointment in academia in a science or engineering discipline. However, challenges, accomplishments, and attributions to success up to the present were studied to provide insights into factors influencing to the continued success of a woman in academia. The current study adds to the existing literature on women in academia by using in-depth case studies to investigate the perceived challenges, accomplishments, and attributions to success of women in academia in science and engineering fields from a life histories perspective, thus taking into account factors throughout the lives of these women that may have influenced their success in academia.

Research Question

The research question posed in this study was: What factors in the life histories of women in academia do they perceive as having influenced their success, and how have these factors influenced success? In answering this question, six contributory questions were addressed. These included:

1. What perceived challenges have women in academia faced in their life histories that may have influenced their success?
2. How have the perceived challenges women in academia faced in their life histories influenced their success?
3. What accomplishments have women in academia made in their life histories that may have influenced their success?

4. How have the accomplishments made by women in academia in their life histories influenced their success?
5. What are the factors in the life histories of women in academia to which they attribute their success?
6. How have the factors to which women in academia attribute their success influenced their success?

Definition of Terms

There were seven terms in this study for which operational definitions were warranted. These terms were accomplishment, challenge, mentor, science and engineering fields/disciplines, success, underrepresentation, and woman in academia. Since these are broad terms, it was important to establish their definitions in order to delineate the meanings of these terms as they relate to the current study.

1. Accomplishment—any award or merit, degree attainment, job attainment or promotion, etc. that may influence the progression of an individual through her educational background and professional careers.
2. Challenge—any barrier to success in the educational and professional progression of an individual.
3. Mentor—any person that serves as a source of encouragement and support in the educational background and in the professional careers of an individual.

4. Science and engineering fields/disciplines—a broad term referring to the social sciences, behavioral sciences, natural sciences, physical sciences, mathematics, and engineering disciplines.
5. Success—a woman in academia is considered successful simply by virtue of her attaining a position in academia; success within academia refers to the continuance of a woman in her career in academia.
6. Underrepresentation—in undergraduate and graduate education, less than half of the degree recipients in a given field represented by women; in academia; less than half of the faculty in a given discipline or rank within that discipline represented by women.
7. Woman in academia—a woman holding a doctoral degree who has secured a position at a university in a science or engineering discipline.

CHAPTER II

RESEARCH METHODS

This chapter addresses five areas pertaining to the research methodology used during this study. First, the research design is presented. Second, the selection and recruitment of the seven participants are explained. Third, the methods of data collection are discussed. Fourth, the methods used for data analysis are described. Finally, methods used to establish reliability and validity are addressed.

Design

The purpose of this study was to investigate the factors in the life histories of women in academia that they perceive to have influenced their success. According to Merriam (1998), "Qualitative researchers are interested in understanding the meaning people have constructed, that is, how they make sense of their world and the experiences they have in the world" (p. 6). The case study design is one type of qualitative research (Fraenkel & Wallen, 2003). This type of design "is employed to gain an in-depth understanding of the situation and meaning for those involved" (Merriam, 1998, p. 19). This study investigated the factors women perceive to have influenced their success, and how these factors have influenced their success. Thus, a qualitative approach utilizing a case study design was appropriate for this study.

This study was both exploratory and descriptive in nature. According to Frankael and Wallen (2003), one purpose of an exploratory study is "to identify or discover important variables" (p. 464). Thus, this study was exploratory in that it sought to discover factors that women in academia perceive as having influenced their success and how these factors influenced their success. It was also descriptive in nature in that the results provided "a rich, 'thick' description of the phenomenon under study" (Merriam, 1998, p. 29). When a researcher incorporates several cases into a study, this is called a multiple-case study design. This study included seven cases and thus employed a multiple-case study approach. The incorporation of several cases, along with purposive sampling of participants to achieve variation among participants, increased the external validity of this study.

In qualitative research, the researcher serves as the instrument for the collection and analysis of data (Merriam, 1998). Therefore, I was the instrument used in this study to collect and analyze data (see Curriculum Vitae, Appendix A). I have taught school at the middle and secondary, junior college, and university levels. Subjects taught include Biology I and II, Anatomy and Physiology I, and Spanish I in the high school setting for one year. I taught eighth grade science in the middle school setting for two years, one of which I served as the regular education science teacher in a special education inclusion program. At the university level, my teaching load included Plants and Humans laboratory for two semesters, Biology laboratory for two semesters, and Teaching of Science one semester, all at Mississippi State University. I also team taught the Professional Seminar in Secondary Education at Mississippi State University. I am an

instructor at East Mississippi Community College, and have taught Biology I and Anatomy and Physiology I and II. In addition to teaching experience, I have worked as a graduate assistant in the Department of Curriculum and Instruction at Mississippi State University. My duties there included managing grant budgets and coordinating grant funded events.

Participants

The participants in this study were women in academia, each of whom held a position in a science or engineering discipline at a doctoral degree-granting university. Prior to the recruitment of participants and initiation of this study, permission was granted from the Mississippi State University Institutional Review Board for the Protection of Human Subjects in Research (IRB) to conduct this research (see Appendix B). According to Gay and Airasian (2003), qualitative research is usually characterized by small samples in order to gain the depth of data desired. Because of the small sample sizes and lengthy demands that some participants may not be willing to endure, qualitative research almost always employs purposive sampling. In addition, purposive sampling "is based on the assumption that the investigator wants to discover, understand, and gain insight and therefore must select a sample from which the most can be learned" (Merriam, 1998, p. 61). Purposive sampling was employed to select participants for this study.

In order to employ purposive sampling, criteria must be created upon which to select participants, and the importance of these criteria must be stated as well (Merriam, 1998). In this study, the criteria and the justifications for these criteria were as follows:

1. *The participant must be a female.* The literature provides evidence that women are underrepresented in academia relative to men.
2. *The participant must have a doctoral degree in a science or engineering field.* The literature provides evidence of the underrepresentation of women as recipients of doctoral degrees in science and engineering, and of the underrepresentation of women doctoral holders in science and engineering disciplines.
3. *The participant must hold a position at a doctoral-degree granting university in a science or engineering field.* The literature documents the underrepresentation of women at four-year colleges and universities, and thus the holding of a position at a university was a qualification for participation. The fields of science and engineering are the areas documented in the literature as being characterized by limited participation of women in academia and thus the participant held a position in an area of science or engineering.

In this study, public websites of departments, centers, and institutes within doctoral degree-granting institutions were accessed to determine women faculty present in those departments, centers, and institutes who held positions in science or engineering fields. The criteria for participant selection in this study were followed to select potential

participants. Women faculty chosen from the internet search were then mailed an invitation to participate, a letter of intent, a self-addressed stamped envelope in which to return the letter of intent, the interview protocol followed in this study, a list of possible archival data to be collected, and a statement of informed consent. Twenty women were chosen based on the criteria for participant selection, and seven of these women accepted the invitation to participate in this study. Therefore, there were seven participants in this study.

Data Collection

In case study research, data can be collected from a variety of sources (Merriam, 1998; Yin, 2003). The two sources used in this study were interviews and documents. According to Merriam (1998), "Interviewing is necessary when we cannot observe behavior, feelings, or how people interpret the world around them" (p. 72). In addition, it is "necessary to interview when we are interested in past events that are impossible to replicate (p. 72). This study took a life histories approach to factors perceived by women to have influenced their success. Since past events in the life histories of these women and their perceptions of experiences cannot be observed, interviews were necessary for the collection of data. .

The interview strategy employed in this study was that described by Patton (1990) as the "interview guide approach" (p. 288). In this approach, an outline specifies the issues to be covered, and the interviewer decides the sequence of the questions and how the questions are worded. This approach allows interviews to remain situational, but also

for the systematic collection of data, for data that is comprehensive in nature, and for the closing of gaps in the data. The interview outline in this study consisted of nine categories (see Interview Protocol, Appendix C). There were three to four interviews with each participant, varying in length from approximately 30 to 90 minutes. Each interview was audio-recorded and subsequently transcribed. According to Seidman (1998), audio-recording interviews preserves the words used by the participants during the interviews and thus provides the researcher with original data. Listening to audio-tapes can also help the researcher improve on interview techniques. In addition to audio-recording interviews, notes were taken during each interview. According to Patton (1990), taking notes during an interview can aid the interviewer in developing new questions within the course of the interview, serve as a means of pacing the interview, and can aid in the subsequent analysis of collected data.

Documents were also collected for analysis (see Examples of Archival Data, Appendix D). Participants were asked during the first interview session to submit documents not attainable by the public. According to Merriam (1998), documents provide a ready-made source of data that is both unobtrusive and independent of the cooperation of participants necessary for data collection during interviews. In addition, Merriam notes that documents "are a product of the context in which they were produced and therefore grounded in the real world" (pp. 126-127). Yin (2003) also cited the unobtrusive nature of documents as a strength and noted that documents provide for broad areas of coverage with respect to time, settings, and events.

In this study, curriculum vitas served to provide a picture of the educational, career, and service backgrounds of participants. Websites containing information about participants served this purpose as well. Certificates and awards received were not available for analysis, but some awards and other accomplishments were listed on the participants' curriculum vitas. Publications and unpublished papers which provided information about their experiences in academia were collected from a few participants. Not only did documents collected serve as a source of data in their own right, but data found within these documents were used within the context of interviews to generate interview questions unique to each participant.

According to Merriam (1998), a researcher should develop a system of coding early in the study in order to organize the data. Merriam also offers ideas for how to properly organize data. In this study, each participant was assigned a pseudonym which will serve as an identifier for the participant. A file folder for each participant was labeled with this pseudonym, and all data collected for that participant was kept in the assigned folder. The pseudonym, time, and date of each interview was placed on each interview transcript and corresponding field notes. The pseudonym was also placed on documents to identify the document as belonging to the participant.

Data Analysis

According to Merriam (1998), data analysis in qualitative research is conducted simultaneously with data collection. In addition, in studies involving multiple cases, both within-case and cross-case analyses are performed. With respect to within-case analysis,

"each case is first treated as a comprehensive case in and of itself" (p. 194). Following the analysis of individual cases, cross-case analysis is conducted.

In this study, the preliminary analysis of data, which occurred simultaneously with data collection, consisted of the initial categorization of data based on techniques discussed by Merriam (1998). The grouping of data into categories was guided by the three areas addressed in the research question: perceived challenges faced by women in academia, accomplishments made by women and academia, and attributions and facilitators to success. For transcripts of interviews, field notes taken during interviews, and documents, the following steps, adapted from suggestions by Merriam, were taken in developing categories:

1. Read the first source of data (e.g., transcript of first interview).
2. Make notes and comments alongside information that is potentially relevant.
3. After reading the entire document, go back and group notes and comments.
4. Repeat for other sets of data.
5. Compare notes and comments from each set of data to develop categories.

In addition to developing categories for the data, the review of interview transcripts and notes allowed for the identification of gaps in the data to be addressed in the subsequent interviews (Miles & Huberman, 1994). Similarly, the review of documents revealed topics of conversation within interviews. All topics of conversation followed the interview protocol for this study.

After all data were collected and categorized, further analysis of data was conducted by utilizing a strategy suggested by Miles and Huberman (1994) called

"stacking comparable cases" (p. 176). This is a mixed strategy for data analysis that combines case-oriented strategies and variable-oriented strategies of data analysis. The steps involved in the analysis discussed by Miles and Huberman include the following:

1. Write up each case, using a standard set of variables.
2. Use matrices to display data and perform an in-depth analysis of each case.
3. Stack each within-case matrix into a meta-matrix.
4. Condense the meta-matrix to permit systematic comparison.

Reliability and Validity

According to Yin (2003), the tests of construct validity, internal validity, external validity, and reliability are needed to establish the quality of case study research. Two of the tactics listed by Yin to address construct validity are "the use of multiple sources of evidence" (p. 36) and "to have the draft case study report reviewed by key informants" (p. 36). These two methods are also listed by Merriam (1998) as strategies to enhance internal validity. In addition, the use of multiple sources is listed by Merriam as a means of enhancing reliability. In this study, reliability and validity were increased by using interview transcripts, field notes from the interviews, and documents as sources of evidence. In addition, each participant was asked to read her case study to ensure the accuracy of information presented. According to Yin (2003), with respect to reliability:

> The objective is to be sure that if a later investigator followed the same procedures as described by an earlier investigator and conducted the same case study all over again, the later investigator should arrive at the same findings and conclusions. (p. 37)

In addition, Yin noted that "One prerequisite for allowing this other investigator to repeat an earlier case study is to document the procedures followed in the earlier case" (p. 38). In this study, all procedures that were followed during the course of the study have been documented and all recruitment materials necessary to conduct the study have been discussed. In addition, criteria for the selection of participants have also been presented.

External validity refers to the generalizabity of the findings of a study to other settings (Gay & Airasian, 2003). Two strategies listed by Merriam (1998) to enhance external validity were employed in this study. First, the descriptive nature of this study provided the "rich, thick description" (p. 211) necessary for readers to determine "how closely their situations match the research situation, and hence, whether findings can be transferred" (p. 211). Second, the use of several cases, along with purposive sampling of participants to achieve variation among participants, increased the external validity of this study.

CHAPTER III

RESULTS AND DISCUSSION

This chapter presents the results of this study in six sections. They are: (a) an introduction to the results, (b) case studies of the participants; (c) within-case data analysis, (d) cross-case data analysis, (e) discussion of related literature, and (f) chapter summary.

Introduction

The purpose of this study was to investigate the factors in the life histories of women in academia that they perceive to have influenced their success and how these factors have influenced their success. These factors included perceived challenges and barriers to success that women in academia have faced in their life histories, accomplishments made during their life histories that may have contributed to success, and other perceived facilitators and attributions to success. The results of this study reflect an investigation of these factors through interviews conducted with each participant and document collection on each participant in this study.

There are six terms used throughout this chapter that need clarification. First, academic background refers to schooling before employment in academia. Second, a professional position or professional career refers to any employment after schooling but

before employment in academia. Third, academic career refers to professional employment in academia and is synonymous with career in academia. Fourth, undergraduate career refers to schooling at the undergraduate level and is synonymous with undergraduate education. Fifth, graduate career refers to schooling at the graduate level and is synonymous with graduate education. Sixth, the term success is a broad term used throughout this section. It is used in many contexts in the discussion of life histories of participants prior to their entrance into academia and, in these contexts, simply refers to the result of achievements and accomplishments within a given context. When used in a context related to a participant's career in academia, success refers to achievements and accomplishments that contribute to her promotion, tenure, and continuation in academia.

Case Studies

Each of the following case studies consists of an introduction of the participant followed by her life history. Each case study focuses on the three areas addressed in the research questions: challenges, accomplishments, and attributions to success. The case studies were written with general descriptors and pseudonyms in order to maintain the confidentiality of the participants. Each participant was interviewed three to four times during the course of this study. During the last interview, each participant was asked to read and comment on her own case to insure accuracy.

Elaine

Elaine is a senior professor at a doctoral degree-granting university. She holds a Ph.D. in her discipline and has been in academia for approximately 30 years. Elaine

began her career in academia immediately after obtaining her Ph.D., serving first as an instructor at two different institutions and then securing a position as assistant professor at her current institution. She was promoted to associate professor with tenure during her sixth year at her institution and to professor 10 years later. Elaine's work responsibilities as a faculty member include teaching, research, and service.

Within her department, tenure and promotion depend upon publications and, to a lesser extent, obtaining grant monies and teaching. During her career in academia Elaine has secured well over half a million dollars in grant monies and has published numerous articles. Her teaching responsibilities include both traditional classroom courses and directing field projects. She has also been an active member and leader in her professional organizations. Elaine has two children, now adults. Her husband is a professor in a related field.

Elaine's parents both had college degrees. Her mother was a school teacher and her father was a scientist with a master's degree. She thinks that the firsthand experience her parents had with respect to college—to help her "get along" and to target her towards college—was a major reason she was not only able to go to college but to get a Ph.D. As a child, Elaine's parents read to her and her siblings, and encouraged them to go to the library. However, while her parents would help Elaine if she asked, they never pushed her academically or paid close attention to her school work. They were not "highly ambitious" for their children or worried about their futures in any way. They simply assumed, or expected, that all of their children would to go to college.

Elaine's mother, paternal grandmother, and aunt were all school teachers, and everybody always told her that she was going to be a school teacher as well. Elaine was fairly resistant to this idea. While Elaine was exposed to the gender-related assumption that she would follow the career path of these female family members, she does not believe her parents were at all rigid in thinking about what boys should do versus what girls should do. Elaine was allowed to explore her interests: "I was big into cowboys and horses and all that….I had a cowboy hat and a play gun and holster and all that stuff, and a hobby horse my dad made."

As a scientist, Elaine's father conducted a lot of field research, and would take her and her siblings out to the field with him. They took notes for him and he would explain to them his research: "It was really interesting and cool, and it was a good way to see how you really do learn things that you really couldn't learn any other way." Through these experiences with her father she was exposed to the way of thinking inherent to science, part of which is looking at things rationally and objectively. Her father was a major role model for her, and she was attracted to science as a result of her experiences with him.

Elaine went to a small school in a small town, and was fairly restricted there. She experienced no major problems in school, but was not especially happy. Elaine was very shy and did not consider herself a very social person. She thought that she was different from the others, like an outsider, and that she never really fit in:

> They [her classmates] were sort of going along with the local culture, never questioning it and never thinking of themselves as doing something that was very different from their parents did. And I guess I was probably different in that respect, looking back on it.

Elaine instead has a more global perspective on life, which she attributes largely to reading a wide range of literature and, in part, to having college-educated parents. Like her father, she preferred reading or doing something that interested her rather than being at a party or in a group. Elaine was intrinsically motivated to learn, finding great pleasure in reading and "engaging with things intellectually." Although she admits that it is always nice to get external reinforcement, it did not make much of a difference when she did not receive it from teachers or peers. She always considered herself a good student and always did well in school.

In school, Elaine encountered a few teachers who were outsiders themselves and took a more sophisticated approach to learning. One was an English teacher Elaine thought did a really good job of letting students explore the literature and read things that were of interest to them. This teacher showed Elaine that complex analyses of literature were possible, as opposed to the low-level analysis of short stories and poetry to which she had previously been exposed in high school. She was a great admirer of this teacher and thought that she was very effective. Another was a foreign language teacher who was very nice to Elaine and was open to recognizing people for who they were.

Elaine also had some "bad" high school teachers as well. She recalls a few social studies teachers who were coaches. She viewed them as "really conservative" teachers without a sophisticated take on life, and this did not appeal to her. Although she liked science, she also had some "really horrible" science teachers:

> Some didn't know their subject. Some of them knew it pretty well but couldn't explain. I had a chemistry teacher who I think actually was pretty good in terms of his own understanding but he was very bad at explaining it to us.

She thinks that her father and his profession as a scientist counteracted some of the possible averse influence the science teachers may have otherwise had. However, she does think that this influenced her away from the physical sciences, as both her chemistry and physics teachers were "bad." Regardless of experiences with bad teachers and not being especially happy in school, Elaine did well in all of her subjects, was in the honor's society at her school, was valedictorian of her graduating class, and received scholarships to college.

Elaine started college immediately after finishing high school. She went to a large university in a big city, and she enjoyed being anonymous: "It was really nice not to have that small town idea that everybody knows your business." Although she thinks that she may have been somewhat oblivious to the presence of gender discrimination, she never saw any real difference in the way she was treated in college because she was female and the way her male peers were treated.

Elaine spent the first two years of college meeting general education requirements and took an introductory course in her field as part of these requirements. Although she had a pretty poor teacher for this course, she found the subject matter very interesting. She decided then that she would study this discipline, a decision which she has never regretted.

During her undergraduate career she took courses under a professor who later served as her major professor in graduate school. He was "super-organized" and had a well-thought out, concept-oriented, intellectual approach to the field which appealed to her. For example, he would not use a specialized term without making sure he gave a

definition, and it was a well-thought out definition instead of something he "threw off the cuff." She also admired his intelligence and viewed him as above her in his sophistication of understanding things and his ability to grasp implications. Once she realized that he was a good teacher, she tried to take every course he offered.

Elaine was a member of a national honor organization in college and graduated with her bachelor's degree with high honors. After completing this degree, Elaine applied to graduate school at the same institution. She decided to stay there because this influential professor was "just an amazing person" and she wanted to study under him. He became her major professor in graduate school. Although Elaine's discipline, especially the hands-on aspect of it, is often thought to be male-dominated, she never thought that he made any distinction between his male and female students. She was intimidated by him intellectually, but considered him very approachable. When she was deciding on what to research for her dissertation and when she was writing, he would require her to come in once a week to discuss her progress and give her feedback on what she had written. His comments on her writing were always "highly critical" but constructive and for this she was very appreciative:

> I've talked to lot of people whose mentors never even read the stuff they wrote….That was part of what he believed his job to be, was not just to contribute brilliantly to the literature and all that but to bring students along, because he saw it as part of his legacy as being able to have Ph.D. students out there to carry on these ideas.

Elaine entered her first marriage as an undergraduate, and although now she thinks that she was too young to be married, this did not hinder her progression through college. Her first husband was supportive of her decision to go to graduate school and

supported her financially. Because he provided financial support for the family, she did not have to work during her Ph.D. program. During her Ph.D. program, Elaine also received a prestigious award that was based on the quality of her academic performance in graduate school. This award provided funding for supplies needed to complete her dissertation and for travel expenses incurred during her data collection process.

Elaine had her first child while working on her dissertation. This worked out very well for Elaine: "It's sort of good to have a little kid that keeps you at home so you don't have any choice but to work on your research. I didn't think it was a big burden." Elaine graduated with honors from her Ph.D. program, and taught as an instructor at two institutions before securing a position as an assistant professor at her current institution. She chose to work in academia because there were not a lot of other options in her field at the time. Her husband quit his job and moved with her as she pursued her career.

If Elaine could fault her major professor for anything it would be not pushing her to publish as a graduate student. More recently he has made his students publish, but was relatively new in his career when she was in school and was not clued into it himself. When Elaine entered academia, she had no one to help her learn to publish, and thus pretty much had to learn on her own. She also finds her approach to publishing is also a handicap: "I mean, truthfully, I'm slow but sure." Even after she has her data analyzed and understands what is happening, it still takes her a long time to "think through and then to think through again" to make sure she is going to say something that is useful and meaningful.

Grant funding is of some importance in Elaine's field, but not as crucial as in some of the other fields of science. In her field, grant monies are used to provide assistantships to graduate students and supplies for research, supplies that would otherwise not be available. Elaine also had to learn to write grants by herself, but did not consider this a difficult task.

Elaine had her second child a few years after becoming an assistant professor, and was responsible for much of the domestic work and child-rearing in the home. This included duties such as cooking, cleaning, and most of the "routine" childcare, such as taking her children to the doctor and picking them up from school. This also slowed the development of her publication record, but she did all she thought she could do with two small children.

Although her publication record was slow to develop, she does not think that this delayed her tenure and promotion to associate professor. This is in part because, when she was going through the promotion and tenure process, her institution was much less research-driven than it is today. Another reason she attributes to her tenure and promotions is that she has had good, solid work that has continued to be cited by people.

Elaine stayed at the associate professor rank for approximately 10 years before applying for professor. During this time she was focused on her work and going up for promotion to professor was not a concern. In addition, she had no one to mentor her or encourage her, and she was unaware of what point in her career she should apply for professor. Her interest in applying was stimulated when a male colleague who had been at the institution several years less than Elaine was promoted to professor. At the same

time, she also thought that it was important not to stay at the associate professor rank indefinitely.

Elaine entered her second marriage after she was an established professor at her institution. Her husband is also a professor in a related field, and they have worked together publishing papers:

> He is one of those people who can get a good idea, sit down, do the research, and in a few days he's got a draft of a paper. And its like wow, if only I could do that. But he tells me the stuff I tackle is harder and more long-term in its general nature so he's very supportive of my slowness. But, what we've done is co-authored some stuff and so I think that has been productive and useful in the sense that it's sort of played into both our strengths.

She and her husband also share responsibility in the household work. She told him when they married that she was tired of cooking, so he learned to cook and does most of the cooking. They also share other responsibilities, such as mowing the lawn. Thus, her responsibilities at home are much less "gender-dominated" than in her first marriage.

Throughout her career in academia, Elaine's major research interests have been concentrated in the geographic area, and there have been many opportunities for conducting interesting and needed research. She has come to know the local experts in her field outside academia, and has benefited both from their competency and expertise, and from their research suggestions. Some of the projects on which she has worked have been the result of these colleagues pointing out an area of research that has been neglected, but that they did not have the time to address. In addition, Elaine has directed for several years at her institution a field-based program for undergraduates in which students are exposed to research and conduct projects in the field. As the director, Elaine has had the liberty to choose research projects in this program conducive to her research

interests. The research that has resulted from these sources has resulted in a backlog of research on which she continues to work, and she has never gotten tired of conducting her research.

During her career in academia, Elaine has found it to be the case with several different instances with male administrators that they do not give her very much credit for her work. She thinks that this is in part because she is female and in part because she does not constantly point out her accomplishments to administrators: "I'm not putting it forward constantly as something great and it's easy to dismiss me as just being another female faculty member." She also thinks that her opinions are undervalued, and over time has perceived a pattern of the denigrating, or downplaying, of her ideas by administration.

Most of Elaine's encounters with administration have been pretty subtle, and she does not think that they are conscious of their actions toward her. She has not confronted many of these instances and does not think that anyone could make them admit that they were doing anything wrong. These encounters have been a source of frustration, but she does not think that these experiences with administration have had a significant influence on her progress in academia. This is because she is "not paying much attention" to what people outside her discipline think about the work she is doing and because she does not depend upon administration for reinforcement with respect to her work.

Elaine has stayed at her institution and focused on her work in part because she enjoys what she does:

> I'm pretty much inner-directed in the sense that I know what I want to do. I'm motivated by my own interest in things and my own belief that I'm contributing.

In addition, it takes time to establish a rapport with the local experts in the field, build a reputation as a scientist, and learn how the students are and what to expect from them. All of these things vary from place to place, and if she moved she would have to rebuild all of that knowledge. Elaine continues to find her career rewarding and has never regretted any of her career decisions.

In summary, both of Elaine's parents held college degrees, and they simply assumed that their children would go to college. Her father was a scientist, and she was attracted to science as a result of her experiences with him. Elaine had a global perspective on life and was intrinsically motivated to learn. In high school, she had some bad science teachers who influenced her away from a career in the physical sciences. Elaine was valedictorian of her high school class. As an undergraduate, Elaine took courses in her discipline under a professor who later served as her major professor in graduate school. During her Ph.D. program this professor continued to influence Elaine academically, and she received a prestigious award based on the quality of her academic performance in graduate school. Elaine graduated with honors from her Ph.D. program. During her early academic career, her publication record was slow to develop for several reasons. After Elaine was established in her career, she entered her second marriage to a professor in a related field. She and her husband have worked together publishing papers. In academia, she has found it to be the case in several instances that male administrators have not given her very much credit for her work. During her academic career, Elaine has established a rapport with local experts in her field and has had many opportunities for conducting interesting and needed research.

Pauline

Pauline is an associate professor at a doctoral degree-granting university. She has worked in academia for approximately 25 years. Pauline began her career in academia after completing her master's degree, and worked for several years as an instructor. After earning her Ph.D., she secured a position as an assistant professor at her current institution and was promoted to associate professor five years later. Pauline's duties as a faculty member include teaching, research, and service. In her department, tenure and other promotions depend heavily upon both the quality and quantity of publications, with teaching and service given less consideration. Pauline has published numerous articles in her academic career and has been awarded thousands of dollars in grant monies.

Pauline has received both achievement-based and teaching awards. She has been active in her professional organizations and in teaching and service at her university. Pauline has served on numerous committees, has taught a variety of courses in her field, and has directed student projects. She is married to a man who holds a Ph.D. in the same field. They have one child.

Pauline grew up in a two-parent household with two siblings. Her mother was primarily a homemaker, and her father was a master's level-educated teacher in the same field Pauline chose as her profession. The most important influence in Pauline's academic life was her father. She was very close to her father, and admired him greatly. He was very successful academically, a veracious reader, and was interested in a variety of things. This always impressed her. His love for the discipline, and her love and

admiration for her father, instilled in her a love for the discipline as well. She always wanted to be a teacher in her field, and never strayed from this aspiration.

Her father held high expectations for her academically, and pushed her in everything. As a child, Pauline did not perceive any gender-stereotypical attitudes or values. Pauline and her father went hiking, kayaking, running, and mountain-climbing together. She helped him dig in the garden and fixed things around the house. She said that he treated her like a boy, expecting her to do all the things that sons would normally do, such as painting the house and moving furniture. He never coddled her emotionally, and did not like to see her cry. Pauline attributes these childhood experiences with her father to being successful in functioning well in her male-dominated profession. She thinks that having stereotypically male interests has enabled her to get along with her male colleagues in the field.

Pauline's paternal grandmother exerted a similar influence on her. Pauline's family spent several years of her younger life overseas and, when they returned, her grandmother babysat her a lot. Although her grandmother was not formally educated, she was a veracious reader. She put in a lot of time with Pauline, always telling Pauline stories, reading to her, and playing games with her. However, she was always very critical, telling Pauline she was ugly, that her hair was always a mess, and that her room was too dusty. Pauline believes that these experiences, along with father's influence, helped to toughen her. This later became beneficial in helping her to deal with what she described as a "very critical group of people," referring to fellow colleagues in her field.

Pauline returned to the states when she was in elementary school. When she returned, she had trouble fitting in at school. It was somewhat of a "rough group," and they made fun of her accent. Although she was somewhat interested in academic achievement at the time, this experience made her delve into the books even more, seeing academics as a refuge. Pauline and her family later moved, and she went to a rural high school where she fit in much better. Here she had a math teacher who was a great influence on her academically. He was a very precise, rigorous mathematician who got her excited about the subject. She took other math classes that he taught, but when she took calculus her senior year she became very enthusiastic about math:

> When you're a teenager sometimes you get up and you're a little depressed, so that would happen to me occasionally. But then I'd think: "Well maybe I'm going to learn something exciting in calculus." So that really got me through my senior year.

Pauline was the valedictorian of her graduating class, and received several academic awards and scholarships. However, instead of taking scholarships to larger colleges in her state, her father wanted her to go to a small Christian college so that she would not get lost in the crowd. In addition, he was concerned about drugs and bad influences that she might have encountered in the larger colleges in their state. Because she trusted and admired her father so much, she chose to follow her father's wishes. Pauline spent her undergraduate career at this college, and was miserable the entire time. It was here that she recalls being first exposed to gendered messages: "I think I was treated sort of freakish because I was a female who was interested in math and science, and that doesn't go along with traditional Christian values." She did not know how to cook or sew, but was just very interested in math and science.

Pauline's father had been raised in a fundamentalist Christian family and went to a Christian college himself, but differed from the rest of the family in terms of his religious beliefs. Although he attended church, he was very strong into evolution and taught Pauline to think logically, which Pauline viewed as being in conflict with Christian values promoted by her college:

> As Christians they have to stop thinking logically for big parts of their lives, for example, how we came to exist in the world; how the universe came to exist. So they just block that off. They refuse to think logically about any of that stuff.

In addition to her father teaching her to think logically, those in her field are taught to think logically about everything, and so Pauline had a real problem with this aspect of Christianity.

Pauline was completely discouraged for her four years at the Christian college and completely lost her self-confidence, questioning everything about herself. She also left with a weaker background in her field than if she had attended a better school. Although she believes now that it was a mistake to stay, she persevered: "I tried really hard to put the pressure on myself and just do the best I could, even though I didn't have the classes or the professors I should have had." She had always wanted to go to graduate school, but by the end of her senior year in college she thought that maybe she was not good enough to do so.

During her undergraduate career Pauline had a male classmate with whom she took several classes, and she competed with him academically. She almost got married after finishing her undergraduate education, but her classmate encouraged her to apply to graduate school at the same institution he was going to attend. She was always just a little

bit better than he was in the classes they took together, and he thought if he could go to graduate school then certainly Pauline could. She applied to graduate school, was accepted, and her relationship with the man she planned to marry dissolved. Her first year in graduate school was difficult because she did not have the proper background coming from the small Christian college. However, the second year was better and she earned her master's degree.

In graduate school, one professor served as a source of encouragement for Pauline. Although she had completely lost confidence in herself due to her undergraduate experience, this professor never did. He encouraged Pauline to pursue her Ph.D., but because she had gone to school six years in a row she chose not to pursue her Ph.D. at that time. It was also at her graduate institution that Pauline met her husband, who was working on his Ph.D. in the same field. After earning her master's degree, Pauline stayed at this college and worked as an instructor while her husband finished his Ph.D. She then traveled with him as he pursued his career and worked as an instructor in her field.

Pauline worked at her current institution as an instructor several years before pursuing her Ph.D. During her time as an instructor, Pauline had a child. At the time, there was no full-time daycare available in her community and, because Pauline was responsible for the majority of the child care responsibilities in the home, balancing these responsibilities with work presented a challenge to her. Initially, she employed a woman who lived some distance away to care for her child full-time, but the drive to and from the sitter was tiring for Pauline, so she sought daycare in her community. For one or two years after this, she was only able to find part-time daycare, and had to keep her child

with her the remainder of the time. Sometimes Pauline brought her to work, and sometimes she worked at home. She also took her work with her when she took her child to various activities, such as horseback riding lessons. Eventually, full-time child care did become available in the community, but Pauline continued to have most of the child-rearing responsibilities in the family.

When her daughter was still a toddler, the institution at which she worked as an instructor established a Ph.D. program in her field. Until that time, she had put off getting her Ph.D. because there was no university close by that offered a program in her field. Thus, she would have needed to move away from her husband. The biggest motivation to pursue her Ph.D. was that she was unhappy with her job as an instructor. She was stuck teaching low-level classes and she had a rough time getting along with the students: "I wasn't pitching things low enough, and I was sort of miserable in my job."

During her Ph.D. program, it was hard on Pauline balancing work, school, and child-rearing responsibilities:

> I was actually an instructor getting my Ph.D. So, I was teaching four classes, getting my Ph.D., and raising my daughter….I think it did adversely affect me because I was exhausted all the time. I couldn't stay focused and so the class exams were very difficult for me. And the homework probably took me way longer than it normally would have if I hadn't been so exhausted.

Although it was tough balancing all of her obligations, her major professor held her to extremely high standards and kept pushing her, and she attributes this to her success in the program:

> If I just had someone who just let me go off and do my own thing probably I would not have done it because I wouldn't have thought I had the time….But he kept pushing me and meeting with me regularly and I really think that's what did it.

Her major professor was also influential in teaching Pauline how to publish. When she was a Ph.D. student she would try to read an article just to try and follow it. Her major professor, however, taught her that she could not just follow what other people had done but rather take what they had done and "push it forward," making new things out of it. She also wrote her first paper with her major professor and another colleague. Her major professor helped her learn how to write, editing her work and giving her constructive criticism of her work: "He's just amazing. He catches everything—every comma, every period every…extra space that's there. I mean, it's just amazing."

After Pauline earned her Ph.D. she immediately began to teach higher-level courses, and then shortly after secured a tenure-track position at the university. Pauline continued to struggle with balancing work and parenthood:

> I think academics has a problem in general with admitting that people have families. And so having to leave at 3:00 in the afternoon to pick your child up or…having to leave work because they're sick....academics doesn't account for any of that.

Because of the constraints on time due to parenting responsibilities, Pauline chose to work in groups when conducting research and publishing, resulting in very few publications by herself. Pauline applied for tenure during her fourth year as an assistant professor, and was denied promotion. She got criticism from the committee because she had published with others and they were not sure how much was actually her work and how much was the work of her colleagues who published with her. The next year she applied again, and was promoted to associate professor with tenure. This was despite the fact that her qualifications were essentially the same as the previous year:

> So, it was a bit confusing that…the one year it was a problem and the next year it wasn't a problem….I hadn't really changed. So that's just academics. I mean, they always seem to find something. Even for men there's something that they always seem to be able to criticize.

In addition, a major turn of events happened in between her first and second attempt at being promoted to associate professor. Her former advisor was a full professor in the department, and thus it was important that he support her for tenure. Before she applied for tenure the second time she went to him in desperation, unsure whether or not he supported her in her career efforts. Pauline "laid it all out," telling him how hard it had been on her finding daycare and raising a child while she was in the Ph.D. program and working. After this, he started showing his support for Pauline, and continues to do so. Pauline believes that he simply lacked knowledge of the struggles she was facing, that he had no idea how hard it was on her balancing school and work with parenthood.

Pauline's husband, now a professor in her department, has been influential both in the pursuit of her Ph.D. and in her academic career. Although she did have most of the child-rearing responsibilities, he helped with other domestic duties such as cooking and cleaning. This helped Pauline in balancing work with family. In addition, he has been "nothing but supportive" with respect to the pursuit of her Ph.D. and her career in academia. When she was in the Ph.D. program he helped take care of their daughter sometimes when she was studying for different core exams. In addition, he already had his Ph.D. in the field when she began her program, and was always willing to answer questions pertaining to her school work. She has also published with her husband and, since publications are a major consideration with respect to tenure, this has helped to

promote her success in academia. Pauline greatly admires her husband. He is older, she considers him more knowledgeable of their discipline, and she looks up to him.

Being married to a professor in the same field and at the same university has presented a challenge, however. Pauline has contemplated going up for full professor, and if she decides to do this it will be "a real huge fight" because there would be two full professors in the department that are married. At least one professor does not like the fact that they are married: "He's worried that we'll become too strong of a force." This professor is from a culture that promotes more traditional female roles. In a related issue, Pauline also perceives a cultural problem in her field from male professors that are from cultures of this nature:

> They don't even understand why us American women even want to work. That's sort of an anomaly. They don't understand it and I think they resent it on many levels….So deep down I think that's why they don't really want to give us [women] a break because they don't even understand why you're doing it.

Pauline may go up for full professor. Part of her wants to "do it for the women." However, a part of her is not sure whether she wants to go through the struggle because she has a good situation, is happy, and does not want to be hurt again. She is sure she will face the same issues faced in her efforts to be promoted to associate professor, and believes she will probably have to go up twice again. Still, she thinks that she should probably go ahead and do it anyway and just "be tough." Last time she was not "philosophical" about the issue because her job was at stake. This time, since she will still have a job even if she does not get promoted, she is going to try and be more philosophical: "I'm going to try not to be hurt again, and just realize it's a tough crowd. I mean, it's a tough group."

In addition to the aforementioned influences in Pauline's life, she credits her female aerobics instructor as exerting a positive influence over her. Although she had hiked and jogged in the past, there "is always this pull in academics away from the physical." When her child was very young, she joined the aerobics class of a woman in the community. She thought as a young mother she needed to be physically stronger and healthier. Without this influence she would not have had the physical capability to do everything she had to do. Pauline continues to attend aerobic sessions today.

In summary, the most important influence in Pauline's academic life was her father, who was a teacher in the same field that she chose as her profession. Pauline's grandmother also influenced her success. Pauline attended a small Christian college during her undergraduate background. She was miserable during her four years at this institution, and completely lost her self-confidence. A male friend with whom she took several classes encouraged her to apply to graduate school, and she earned her master's degree. Pauline worked several years as an instructor before pursuing her Ph.D. When a Ph.D. program in her discipline became available in her discipline at her institution, she pursued her Ph.D. Her major professor held extremely high standards for and taught Pauline how to write and publish. Pauline began teaching higher-level courses after finishing her Ph.D., and secured a position as an assistant professor. Balancing work with child-rearing responsibilities was a major challenge during her academic career. When she applied for associate professor, she received criticism from the committee because she had published with others. She was denied promotion the first time, but applied the next year and was promoted to associate professor with tenure. Pauline's husband is now

a professor in her department, and has been influential in several ways. In addition to the other positive influences in Pauline's life history, she credits her female aerobics instructor as helping her to be physically strong and healthy.

Jane

Jane is a senior professor at a doctoral degree-granting institution. She holds a Ph.D. in her discipline, and has been in academia a total of 17 years. Jane began her career in academia later in life, holding various professional positions before pursuing her Ph.D. in her current discipline. During her career in academia, she worked as a master's level-educated instructor for several years before pursuing her Ph.D., and then secured a position as an assistant professor at her current institution. She was promoted to associate professor during her fifth year at her institution and to professor six years later.

Jane's work responsibilities as a faculty member include teaching, research, and service. Within her department, tenure and promotion are based heavily upon publications and, to a lesser extent, upon the attainment of grant monies and teaching. During her career in academia, Jane has been awarded several million dollars in grant monies and has published numerous articles. She is a member of several professional organizations and has been active in service at the university and department levels, serving on numerous committees and as a mentor to new faculty members. Jane has received awards during her educational background and as a professor. She is married to a man who holds a Ph.D. in a different discipline and has two grown children.

Jane grew up with loving, supportive parents who were very ambitious for the education of their children. Although they were not college-educated, they read the

newspaper daily and kept up with current events. They always held high academic expectations for Jane and her sister, and showed a genuine interest in their academic achievement. Her parents were very active in school activities, serving as club leaders, working at basketball games, and helping to raise money for different events. Jane's parents were quite poor, but it never seemed to her that money and financial matters were important. Her parents wanted an easier and better life for their children, and thought that would be achieved through education. There was never any doubt the she and her sister were going to college.

Jane's family lived on a farm, and only Jane and her sister were available to help with the farm work. Although her father always talked about wanting feminine daughters, this is not the way he raised them. From an early age Jane could drive a tractor, and had a lot of roles that she thinks boys would usually have, such as milking cows, rounding up cattle, and raising calves. This influenced her in that she never thought that there was something that she could not do because she was a girl.

Jane went to a very small, rural school, which had its pros and cons: "I think coming from a small school you get a lot of recognition because there's not much competition. But, on the other hand, there are very limited opportunities also." Her high school did not offer chemistry or physics, and very little advanced math. Although her parents were quite poor, they paid for her to take college algebra as a correspondence course when she was in high school, and encouraged her in this endeavor. She also had a female science teacher who gave Jane a lot of exposure to and promoted her interest in science through her instructional methods. This teacher had a very sophisticated

laboratory design, and had her students perform genetics experiments and dissections. These were "things that you might not expect in such a small, very poor, high school," and Jane believes this teacher probably paid for many of her teaching supplies herself.

In high school, Jane's mother forced her to take two years of typing, bookkeeping, and shorthand: "From her point of view of work, a secretarial job would have been easier. She never would have thought about me getting to be a college professor." Jane also took two years of home economics. There were, however, no differences based on her gender in the nature of math or science courses that she took in high school. Jane received as much recognition as any male student in high school because she was one of the best students there. She always won several subject awards given at the end of every school year, and she viewed herself as a capable student. She was valedictorian of her graduating class, and went to a university immediately after finishing high school.

Jane started college as a math major, but quickly realized she was not interested in abstract mathematics. She decided to major in a branch of science, a decision made in part due to the influence of her high school science teacher. Another influence in this decision was a science professor under whom she took a course as part of the general education requirements. He was a wonderful lecturer, and made the subject very interesting. When Jane first began college, her limited high school background in math and science made some of her classes more challenging. This was especially true in chemistry, which was very "tough" at the beginning of the semester. The math and science classes had very few women in them, and the women all knew each other. They all studied together, and encouraged and supported each other.

In college, Jane worked as a work-study student within her department, and received a lot of individual attention and support from the faculty members. As a work study student affiliated with the department, she also had several research opportunities as an undergraduate. These opportunities helped her learn how to conduct research and, more importantly, really stimulated her interest in research. During this time she published her first paper based on research she had conducted as a work-study student. Near the end of her undergraduate career, Jane was inducted into an honor society. This honor reinforced her belief that she was a capable student.

Jane married while still an undergraduate, but she does not believe that this hindered her progress as an undergraduate in any way. When Jane was in college, women who were "good" in a subject such as math or science were encouraged to major in education, so Jane also obtained a teaching certificate and taught school for a few years after obtaining a bachelor's degree in her initial discipline. During her last year as a teacher, she taught four subjects, the students changed rooms only once a day, and there were racial tensions in the school. Overall it was an unpleasant experience for Jane and, after this, she decided that she "would find an easier way to make a living." Although she very much supports and admires teachers, she decided that this is not what she wanted to do the rest of her life. She then moved frequently with her husband, who was then in the military, and she did not work for several years.

During the years Jane did not work, she gave birth to two children. When her first child was still a toddler, she had the opportunity to return to school and earn her master's degree in her initial discipline. Although she did not have a "firm" idea as to how she

would utilize this degree, her interest in the field and her desire for a career other than teaching motivated her to pursue this degree. Jane published one paper based on the research conducted during this master's program. During her program, her parents babysat her child while she studied. She never viewed having a child while pursuing this degree as a hindrance, and she does not believe this obligation hindered her academic progress in any way.

When Jane returned to work, she secured a position in a laboratory setting working with a university professor. Here she was again exposed to research in her initial discipline and, although she had published one paper as an undergraduate and another based upon her master's program research, it was under the guidance of this professor that she really learned how to write papers and publish. He knew how to "crank out" publications and, although many faculty at that time did not give laboratory technicians co-authorship on publications, he did. Jane had a lot of input into the results of the research and her assistance in writing the publications was beneficial to the professor in that they turned out many publications together during her time there.

After Jane returned to work, she had the opportunity to take a graduate class in another discipline. Initially she did not plan on pursuing a degree in this discipline, but thought that the knowledge gained from taking this course would be beneficial in her finding a job should she and her husband move to a different geographic location. She enjoyed the course so much that she decided to get a master's in the new discipline, and afterwards taught as an instructor for several years. She then decided to get her Ph.D. in this discipline because she was limited as an instructor in the work that she could do and

considered it a “dead end” job. She was limited to teaching lower-level undergraduate classes, she had no opportunities to conduct research, she could not have a voice in decision-making within her department, and there were no opportunities for advancement. Both the male department head and some of the women faculty in her department encouraged Jane to get her Ph.D. She believes that the women faculty, with families themselves, knew how hard it was to balance work with family. Seeing these women faculty successful in their work helped her realize that she could be successful as well.

Jane and her husband, who had recently earned his Ph.D., relocated their family so that she could pursue her Ph.D. at another institution. Her husband got a very nice job in their new location. Jane’s husband has always been very supportive of her academic and career endeavors, proud of her accomplishments, and willing to experience disruptions in his own career to support hers. He has also provided financial support for the family as she has pursued her education and career goals.

During her Ph.D. program, she was part of a group of male and female students working with a major professor who “was not very helpful.” These students formed their own group and “pulled one another through.” The group would meet each week and one group member would pick a piece of literature relevant to his or her area for the entire group to review and discuss in detail. From this experience Jane got an in-depth look at other areas of her discipline that she may otherwise not have learned. The group also discussed landmarks in their dissertation work, and gave each other feedback and ideas for their work, including reading and discussing each other’s rough drafts.

When Jane finished her Ph.D., the family moved to a different location so that her husband could pursue his career. Here she secured a position as an assistant professor at her current institution. When Jane was first hired, a female colleague served as a mentor for her and has been influential and helpful throughout Jane's career. This colleague has supported her, given her advice, and served as a friend. Jane and her mentor have worked collaboratively writing proposals, conducting research, and publishing. Jane did not have much experience writing grants before entering academia, and writing grants with her mentor helped her enormously in learning how. In Jane's department, external grant funding is necessary to buy equipment and supplies for research, to fund graduate student to assist with the research, and to supplement faculty salaries.

Jane has conducted collaborative research with other colleagues in academia as well. For example, she has worked with one male colleague who is well-known in the research community, and is skilled at establishing and maintaining connections with other researchers. These connections in the research community have been important in establishing research collaborations with other people in the field. Working with colleagues on research projects and proposals has increased her research productivity:

> People working together on research projects and strengths of the different people fill in the gaps, and so you get papers written that you wouldn't otherwise write. You get proposals out you wouldn't get otherwise.

Throughout her career in academia, Jane has been asked to take on larger service roles and teaching responsibilities than her male counterparts. Service roles have included chairing committees, curriculum revisions, and big advising roles. Jane believes that she was asked to perform these duties because people thought that she would be good at

them. She also considers herself a good teacher and enjoys this aspect of her job. Looking back, however, she thinks that she should not have been asked to perform these responsibilities and should not have agreed to do them: “I would have had a much stronger publication record and stronger research record without some of those responsibilities.” Although she had enjoyed performing these roles, this was “maybe not the best thing” for her career. Jane’s department had made efforts to reward her and other faculty for their work performance. One example of this is an award Jane received for excellence in teaching, research, and service. Jane was nominated for this award by her department head, and it has provided Jane with a salary stipend as a reward for her commitment and performance in all areas of her work.

For several years during her academic career, Jane had the responsibility of caring for her elderly parents. She would go everyday after work to visit them, and on the weekends she would spend a lot of time with them. Her parents were in and out of the hospital frequently, and the responsibility of caring for her parents was both difficult and time-consuming. She believes that this responsibility resulted in her being less productive in her research than if she had not had this responsibility.

Throughout Jane’s marriage, she has had the majority of the domestic duties and child-care responsibilities, such as cooking, cleaning, and taking the children to and from school and to practice and play sports. This was in part because her husband has traveled with his job. Since Jane did have a family when pursuing her graduate education and career in academia, balancing school and work with family has been harder. However, she has never considered her family as a hindrance to her educational or career

aspirations. In addition to the support of her husband, her children have also been very supportive of her endeavors. She taught them to be independent at an early age and expected them to take on responsibilities in the home, such as washing and ironing their own clothes. Entering academia when she was older has also made Jane much more serious about and focused on her work than if she had pursued this career earlier in her life. Jane does not believe she has ever consciously suffered from gender discrimination, but thinks that this may be in part because she was not looking for occurrences of discrimination.

In summary, Jane grew up with supportive parents who always held high expectations for her. In high school, Jane had a science teacher who provided exposure to and promoted her interest in science. Jane was valedictorian of her graduating class. During her undergraduate background, Jane's limited background in math and science made some of her classes challenging. As an undergraduate she was exposed to research, and also took a science course under a male science teacher who made the subject interesting. Jane taught school for a few years after completing her undergraduate education, and later earned a master's degree in her initial discipline. In one professional position she held prior to entering academia, she was exposed to research, and the professor for whom she worked helped her learn to write and publish. Jane later earned a master's degree and Ph.D. in her current discipline. During her career in academia, Jane has benefited from research collaborations with colleagues and from a female mentor. Jane's husband has always been supportive of her educational and career endeavors. In academia, Jane has taken on larger service roles than her male colleagues, and believes

she would have a stronger publication record if she had not taken on these responsibilities. For several years in her career, Jane cared for elder parents, and this took time away from her work.

Caroline

Caroline is an associate professor at a doctoral degree-granting university. She holds a Ph.D. in her discipline, and has been in academia for approximately 15 years. She entered academia as an assistant professor, and was promoted to associate professor with tenure during her sixth year at her institution. Her work responsibilities as a faculty member in academia include teaching, research, and service. Within her department, promotion and tenure depend heavily on the attainment of grant monies and publications. During her career in academia, Caroline has been awarded hundreds of thousands of dollars in grant monies and has published numerous articles in journals. External grant funding is necessary in order to buy supplies for research, to pay graduate students, and for traveling expenses. Her teaching responsibilities include both traditional classroom courses and directing student research projects outside the classroom.

Within her educational background and academic careers combined, Caroline has been associated with several professional organizations and has received numerous awards, honors and distinctions. During her academic career, she has been active in service in the research community, at her university, and in the public sphere. Caroline has served in leadership roles in her professional society, has served on numerous committees and councils, and has provided information about her field to the public. Caroline is married with two children, and God and family take priority in her life.

Caroline grew up in a very stable and supportive family. Both parents were educated at the master's degree level, and held high academic expectations for all of their children. Her parents always made sure that homework was complete, and made sure their children were reaching their academic potentials. Her parents were also a presence at the school, always attending school functions and extracurricular activities. There was never an option of whether or not Caroline or her siblings would go to college. It was an expectation of her parents that they go, and none of the children ever considered any other option.

> We all knew we were intelligent enough to achieve something and there was an expectation that we were going to do what we could do, and we all did. All of us went to school and everybody has been pretty successful.

Caroline does not recall being exposed to any gender-specific academic expectations, and she was never told directly or indirectly that there was something that she should or could not do because she was a female.

> In fact, it was the other way. I think my parents saw me as the scholar of the house. Now my brothers are all smart. They were not as scholarly as I was, and as a result of that I think they really pushed me toward choosing something that was not easy.

In addition to the expectations of Caroline's parents, her father also exerted an influence on her academically. He was a high school science teacher for many years, and Caroline always admired his intellect and interest in science. As a child she was around her father in the school science laboratory, and being exposed to the laboratory surroundings and watching her father work stimulated her interest in science.

Caroline went to a small school during her elementary and secondary years. Although her high school did not offer as wide a variety of courses as were offered in

some larger high schools, she did receive a quality foundation in most of the core courses. The science background she received in high school was not tremendously good, as she did not have "super strong" science teachers, but she still enjoyed science, and was always interested in, and fascinated by, the subject.

Although most of the teachers who influenced her academic progression were at the college level, two teachers in high school stand out as having influenced Caroline academically. The first was a high school English teacher. Caroline credits her for teaching her how to write proficiently, and Caroline was so good at writing that this teacher encouraged her to major in writing in college. Because being efficient at writing grant proposals and papers for publications is necessary to be successful in her field, Caroline credits this English teacher as contributing to her later success, as she provided Caroline with a strong foundation in writing skills. The second teacher who influenced Caroline academically in high school was a math teacher, under whom she took four years of math. This teacher was a no nonsense woman who impressed Caroline with her ability to lecture: "She just got in there and did it, and she just impressed me." This teacher was no nonsense and, although she was not unfriendly, she was not going to be a student's best friend. However, she expected the best from her students and showed disappointment when a student did not reach his or her potential.

Caroline always considered herself pretty scholarly in school, and was always right at the top of her class. She and her two best friends competed in a friendly way for scholarly awards at the high school level, and all graduated with perfect 4.0 grade point averages on a 4.0 scale. Through this competition with her friends, there was always the

desire to be the best, and Caroline was co-valedictorian of her graduating class. She began her undergraduate career immediately after finishing high school, and received an academic scholarship to college.

Throughout most of her junior high and high school years Caroline thought she would go to medical school. However, a few factors during her undergraduate career steered her away from pursuing this profession. The first was the misconception that she could not go to medical school with a degree in her major, as it was not the major that students planning to go to medical school typically declared. She also realized the difficulties that it would place on a family for her to go to medical school. In addition, going to medical school would have meant moving, which would have been problematic because her husband had a secure job at their current place of residence. At the same time, some of the most influential professors during her undergraduate career were in her major field of study. She enjoyed the way they taught, and began to see herself in an academic role.

There were two professors in particular who served to influence Caroline academically during her undergraduate career. The first was a young male professor who taught a course that she now teaches. Caroline was impressed with the way he constructed a lecture and that he was extremely organized. He really understood whether or not his students comprehended the material. He taught it in such a way that made her realize that, even though it was difficult material, it was very understandable as long as it was presented in a way that students could grasp. This professor inspired Caroline to teach the way she does now, and she attributes his influence as serving to promote her

interest in the field. The second professor who impacted Caroline was one that impressed her as a researcher: “He had a great personality and was fun to be around, and at the same time you accomplished a lot in lab.” This served to encourage her to want to conduct research in her academic career. Caroline was inducted into an honor society toward the end of her undergraduate career and graduated with high honors from her undergraduate institution.

Caroline began her graduate education immediately after completing her undergraduate education. Throughout Caroline’s graduate career, her husband served as a source of support financially. Although she received stipends during her master’s and Ph.D. programs, they did not pay much, and his income provided a great deal of support for the family during her graduate academic career. For her master’s degree, she decided to stay at her undergraduate institution due to the lack of mobility that came along with her marriage. Because she stayed at this institution, she had to work on a thesis project addressing an area slightly different from her area of interest, but enjoyed it nonetheless.

During her master’s program another professor served as a mentor for her, providing encouragement and serving as a role model. This professor grew up near the same small town and knew her family. One of the things that most encouraged Caroline was that that he was “very real and normal” but at the same time was successful and able to get a lot accomplished. As a deeply religious individual, Caroline values humility in people and has no tolerance for elitist attitudes and arrogant academics. This professor showed her that a person can be a normal, regular individual and still be a successful scientist. In addition, he was a very good researcher and she enjoyed working with him in

the laboratory. Caroline's relationship with this mentor continues to this day. He has always been an advocate for her, and she has no doubt that if she needed something she could call upon him.

During her undergraduate and master's programs, Caroline attended a small teaching college that, at the time, was not considered a research intensive institution. When she entered her Ph.D. program at another, more research-oriented institution, it was a rude awakening. She had always been at the top of her class, but this changed when she was in her Ph.D. program. She was, however, still a good student and continued to enjoy learning science. Her major professor in the Ph.D. program served to influence her academically in a few ways. Caroline had tremendous respect for his work ethic, his organizational skills, and his ability to extract work out of people in the laboratory setting. However, he could be belittling in his efforts in this, and Caroline did not like this aspect of him. In hindsight, she realizes that it was probably just his brusque personality and his way of trying to motivate students, but her experiences with him led her toward being somewhat of the opposite with her students:

> I think it has made me a little too much the other way with my students because I do not want to hurt them to motivate them, and he could be that way at times.

At times his approach and actions were hard, and there were times Caroline was discouraged, but she prevailed nonetheless:

> I can remember thinking I don't know if I can do this. I don't know if I can do this. But at the same time I think it made me hard-headed enough to realize I *am* going to accomplish this.

This professor was also influential in that he helped her learn how to write scientifically. Although her high school English teacher was influential in giving her a

strong foundation in writing, scientific writing is much different: "You have to be almost didactic when you write scientifically, and definitely brief." Caroline had little trouble with the transition, but when she did he helped her learn how to "put things down in a scientific way."

During her Ph.D. program, Caroline was married and had about a 45 minute commute to work. Her family has always come first, and the drive and commitment to her marriage made it difficult to maintain "weird" hours at school. She would go in if needed on the weekends, but tried to maintain relatively regular hours. This made it difficult to excel in research, but it was a choice she made for the sake of her family: "I will not compromise my family for my research. I'm not going to do it." Near the end of her Ph.D. program, Caroline had her first child. She took about two months off from her research and then returned to finish her dissertation. She had intended to do a lot of writing at that time, but the time it took for her to care for a newborn was overwhelming and she just did not feel like doing anything at that time but being a mother. During this time, she experienced the first and only occurrence of gender discrimination that she ever recalls in her academic and professional careers.

> I guess I didn't get accomplished at that point what I wanted to or what he [her major professor] had expected me to, and he made some comment about having it both ways, wanting to be a woman and doing things and at the same time trying to be a mama….I told him flat out: "I have never spouted feminism to you. This is who I am." And that shut him up. He respects me for that I think.

Caroline's professor later told her that she had finished her dissertation faster than just about any of his students, and she attributes this fast turnover in part to her ability to write.

In Caroline's field, securing a postdoctoral position was a necessary prerequisite to obtaining a job and conducting research at the university level. She secured a postdoctoral position near her home to keep from moving her family, and remained there three years. During her postdoctoral fellowship, she learned a lot, but was not as productive as she could have been. Her older daughter was an infant when she began her fellowship, and she had her second child at the end of her stay there. Caroline continued to put her family first, and this hindered her research productivity.

> It keeps you from being able to spend enormous amounts of time in the lab…. you are not super-focused on just what is going on at work. You are also concerned about what's going on with your children. I just think it is a reality. I don't think that it is bad either. I just think that is the way it is.

Throughout her married life as a student, Caroline experienced a general lack of mobility due to family obligations. However, this changed when the time came to gain employment in academia. Caroline searched long and hard for a position near their place of residence. Her husband had a secure job and future, and considered their place of residence home, but there was simply no desirable jobs available near their home at the time. She admits that she could have taken a job as a technician, but would have been very unhappy. Although it was a huge sacrifice for Caroline's husband, he recognized the financial benefits of moving so that Caroline could work in academia, and agreed to relocate. This move increased her salary significantly, and it was thus a tremendous financial boost for the family. Her husband has certainly not been a trailing husband, as he took the opportunity that moving provided to earn an advanced degree, and has been extremely successful in his profession as well.

During her 15 years in academia at her present institution, Caroline has encountered several influential persons who have served as sources of support and encouragement. In general, she has formed relationships in her department with various persons who have served as advocates and friends:

> Anytime there has been something that has gotten me down, they've lifted me up. They see the intrinsic worth in people I think, but also they are just loyal friends….It's hard to say anything specific. It's just knowing that there's loyalty there and encouragement there for what I do.

There are a few colleagues she can talk to about anything, and they would do anything in the world for her. Outside the department, in an affiliated discipline, Caroline has received support in her job from a few male colleagues. Since Caroline came to academia, the nature of her discipline changed and grew, and these colleagues helped her learn new areas of the discipline. They shared their expertise and talents in a friendly and helpful way, and even helped Caroline's graduate students with procedures and techniques with which Caroline was unfamiliar. She has also published with them, which has served to promote her advancement in academia.

Caroline has never experienced any major problems with administration, at the departmental level or otherwise. At one point in her career she was encouraged by the department head and higher administration to explore the possibility of administration. One administrator in particular was extremely supportive, and encouraged her to go into administration if she chose that route. He was an uplifting individual "who liked to build people up rather than tear them down." He was always aware of any problem that Caroline was having, and was willing to support all her endeavors. She has looked into a few administrative positions, and he has always been willing to help. However, her

administrative aspirations are limited to her current institution, as her family obligations make her immobile.

Caroline believes that everyone has talents and gifts, and hers is teaching. The intrinsic rewards she receives from her rapport with students has been and continues to be a great source of encouragement for her in her profession. She believes this rapport comes from her students seeing her as a person to which they can relate, and considers the interactions with students that result from establishing this rapport "amazingly uplifting." One of her lowest points in academia was when some students in one of her classes were caught cheating on a test. Although she went through the proper channels to address the issue, she believed it was mishandled, and this depressed her for quite a while. However, a simple comment from a former student one day while walking down the hall gave her encouragement in this difficult time.

> I walked down the hall one day just feeling absolutely depressed, and some student just out of the blue stopped me and said, you know…your classes have really meant a lot to me, or something along those lines…it just perked me right up.

Although Caroline has received many awards and distinctions in her academic background and academic career, the teaching awards she has received stand out in her mind as most encouraging because they are based on her performance as a teacher.

As a deeply religious person, Caroline attributes her religious values and convictions as having influenced her career as well. She always tries to put 100% into everything she does, both in the classroom and in her research. The integrity that comes along with these values has also influenced her work in publishing: "One of the things

that is very important is to realize that a scientist has nothing without their integrity, because it is basically your word. You are publishing your word."

Caroline has never perceived any form of gender-based discrimination or harassment against her during her academic career. Although the majority of faculty members in her department are male, she attributes this in part to a lack of mobility with women and in no way to gender discrimination. Balancing work with family has clearly had an influence on Caroline's career in academia. Her family comes first, and she has been adamant about keeping regular hours at work. She rarely misses a class, but does leave early occasionally to attend events in the lives of her children that take place during the work day. She has chosen to be there for her children when they are sick and to be present in other aspects of their lives:

> It's a trade off, and there's a myth that you can be a superwoman. It is not going to happen. Everyday when I go home I have my other job to do, and always my children come first.

Although Caroline does have the majority of traditional duties within the home, such as cooking, cleaning, and laundry, she feels in no way put upon, as her husband does all the outside home maintenance and helps with the children when needed. She admits that if she worked seven days a week she would publish more papers, and the tradeoff between work and family has resulted in lower productivity than if she worked longer hours. Caroline continues to enjoy her work and plans to continue in academia.

In summary, Caroline grew up in a supportive family, and her parents held high academic expectations for their children. Her father was a science teacher for several years. Caroline went to a small school and there encountered an influential English

teacher and math teacher. Caroline was co-valedictorian of her graduating class. During her undergraduate career there were two male professors who served to influence Caroline academically. Toward the end of her undergraduate career, Caroline was inducted into an honor society. Caroline got married during her undergraduate career, and balancing family obligations have presented challenges to Caroline both during her graduate career and in academia. In her master's program, Caroline was influenced by a professor whom she considered a real and normal person, and at the same time very successful. In her Ph.D. program, her major professor had a brusque personality that sometimes discouraged Caroline, but he did help her hone her writing skills and learn to write scientifically. After her postdoctoral work, Caroline's husband agreed to move so that she could pursue her career in academia. Within academia, Caroline has had colleagues and administrators who have served as sources of support and encouragement, and she has benefited from research collaborations with two male colleagues in a related discipline. She also finds teaching rewarding, and has gained encouragement from the teaching awards she has received. Caroline attributes her religious beliefs as having influenced her career as well.

Cindy

Cindy is a research professor at a doctoral degree-granting university. She holds a Ph.D. in her discipline, and has been in academia approximately 10 years. Cindy entered academia with her master's degree, having worked several years in other professional positions before pursuing her career in academia. She earned her Ph.D. after securing a

research position at her current institution. Cindy's work responsibilities include securing external grant funding for research and publishing the results of her research.

During her career in academia, Cindy has secured millions of dollars in grant monies and has written numerous publications. Within her professional and academic careers combined, Cindy has directed several programs and research projects in her field, and has become internationally recognized for her research and contributions to her field. She is also an active member of several professional organizations. Cindy is not married and had no children.

Cindy grew up in a loving and supportive family. Both of her parents were college graduates, and demonstrated the value of lifelong learning in their own lives. They were both avid readers, watched the news, and kept up with current events. Cindy's parents read to their children and had a library of books for their children to read. They made a commitment to send all of their children to college, and there was always the expectation that both Cindy and her siblings would go to college. The family atmosphere was such that Cindy and her siblings knew that they were good, smart, and with a little work they could do anything they wanted to do.

Cindy's father was driven, outgoing, and persistent. He had his pilot's license, so from the time Cindy was a child they could "just hop on a plane and fly someplace." He was an adventurer, and would plan extravagant trips such as flying cross country or over the mountains, and invited his children to go with him. As a result, Cindy's family was well-traveled and was exposed to different cultures. She learned through traveling that change was nothing to be afraid of, that it was "just something you adapt to" in life.

Cindy's father was also a role model for her. He taught himself how to coach various sports, and encouraged his children to participate in individual sports. In addition her father demonstrated to her through his actions that: "You have a goal, you develop a plan, and you carry it out. And you deal with situations that arise." Cindy does not recall being told by anyone at anytime that there was something that she should not or was unable to do because she was a female: "We were always encouraged to pursue whatever."

Cindy spent her elementary school years at a school that was relatively "poor" in its academic expectations. In middle school, her family moved to a different geographic location, and the schools were better, harder, and bigger than her previous school. Her parents got tutoring for their children, and she knew from traveling and being exposed to different cultures that change was not to be feared. Cindy also changed high schools several times, but viewed it simply as something that had to be endured. Throughout her elementary and secondary school years, she was influenced by the expectation of her parents: "There was always that expectation that you can do it, that you are smart enough. Yeah, you may need a little extra help. But there was always that expectation that I could succeed."

Cindy entered college immediately after graduating from high school. She chose her undergraduate major based on her interest in the discipline, and made good grades in college. After graduating, she worked briefly in her field in a bachelor's level position, and quickly realized that she would need a master's degree to really make an impact in her field. She then earned her master's degree at another institution, but had no desire to

earn a Ph.D. at the time. She was ready to begin her professional career and make money. Cindy does not recall being exposed to gender bias or any gender-related assumptions during her educational background.

Cindy's path to academia was characterized by a series of events in her professional career that led her to pursue a career in research. When Cindy began her career she initially changed jobs several times, exploring her options in the field. She then began directing a program funded by a grant which had to be renewed annually. This job was not in the university setting, but it did introduce Cindy to the process of grant writing. She was interested in making the most of the grant money provided and in utilizing the program effectively, so she kept up with the literature related to her program and collected data reflecting the effectiveness of the program even though this was not required by her funding agency. During this process, Cindy happened upon another grant related to her program field of interest, and applied for and received it as well.

During the time Cindy was directing her program, she met a female university professor and researcher who served as a mentor for her. This mentor was very nurturing and supportive, and saw potential and talent in Cindy. Cindy expressed to her an interest in conducting research and shared an idea for a research project. This mentor encouraged her to apply for a research grant and helped her write and edit the proposal. This grant was funded, and Cindy then sought a position in academia to manage her grant project. Her mentor suggested to her an institution where she would receive the institutional support she needed to be successful, and recommended her for a position at that institution. Cindy secured a research position at her current institution, and the experience

she had gained directing programs, and in writing and managing grants "transferred easily" to her career in academia.

During Cindy's professional and academic careers, she has been "blessed and fortunate" to have worked in environments where she has had good bosses that have not only hired her but also trusted her to do her job without interfering: "I need to be in an environment where I am encouraged and supported and left alone." Her bosses, both male and female, have also shown appreciation for her work, recognized her skills, and encouraged and supported her in the workplace. Her current boss, along with her funding agency, also encouraged her to pursue her Ph.D. for the advancement of her career. Because she managed her own projects and her own time, and because the institution would pay for her to go to school, she decided to enter the Ph.D. program at her institution.

During her Ph.D. program, her professors treated her as a colleague instead of a student, and a few male professors were of particular help to Cindy in her program of study. In one class, her professor gave the class regular writing assignments with a lot of constructive feedback, and this helped Cindy improve her writing skills. Another professor helped her overcome her fear of statistics by teaching her to stop, think about the problem, and to not get overwhelmed. Cindy also worked on projects and articles with professors and other colleagues. This was beneficial for Cindy in learning to publish, as they were experienced in publishing and taught her some of the "inside things" that are not taught in graduate courses. Through her work with these colleagues she learned such skills as how to write a cover letter, how to set up a paper in journal

article format, and how to respond to reviewer's comments about journal articles submitted for publication.

In addition to the other influences in her life, Cindy's personality has also contributed to her success. Like her father, she is driven and persistent. She is very focused on her goals, and always puts a lot of energy and effort into her work. She tends to be controlling and, although not necessarily a perfectionist, always tries to do her best. She is not easily discouraged and, if she encounters a barrier to her progress, asks herself: "What's plan B, or how can we solve this problem and get on with it?" In addition, Cindy is internally motivated to succeed: "It is just a force in me to want to do well."

In her personal life, Cindy surrounds herself with intelligent people who have professional goals, are very passionate about what they do, and who have a global perspective as opposed to simply focusing on the goings on in their own geographic area. The mutual reinforcement and encouragement characteristic of her friendships and other personal relationships also serves to promote her success.

Cindy does not recall experiencing any form of gender bias in her professional or academic careers. She has had male bosses, but has also worked in environments with female management and many female colleagues. She also considers her profession one that is tolerant and open to human diversity. In academia, she works in a research area and not an academic department, and there is no competition between colleagues for the obtainment of external grant funding. She and her colleagues work together on projects because they want to, not because they have to, and they support one another and applaud the accomplishments of their fellow colleagues.

In summary, Cindy grew up in a loving and supportive family, and the atmosphere was such that she and her siblings knew they were good and smart. Cindy's father was a role model for her. Through his actions, her father taught Cindy how to carry out her goals. Cindy went to an elementary school with poor academic expectations, and moved during middle school. The schools were harder there, but her parents obtained tutoring for her siblings. After high school, Cindy earned a bachelor's degree and master's degree, and then pursued her professional career. During Cindy's professional career she was exposed to grant writing, and obtained a grant that influenced her decision to enter academia. A female professor she met during her professional career was influential in Cindy obtaining this grant and in her securing a job in academia. During Cindy's professional and academic careers she has been fortunate to have worked in environments where she is supported and left alone to do her work. Cindy pursued her Ph.D. at her current institution. During her program, she worked with male professors and colleagues that influenced her success. Cindy's personality has also played a role in her success. She is not easily discouraged, and is internally motivated to succeed.

Minnie

Minnie is an assistant professor at a doctoral degree-granting university. She holds a Ph.D. in her discipline, and has been in academia for approximately three years. She entered academia as an assistant professor and is working toward tenure and promotion to associate professor. Her work responsibilities as a faculty member include teaching, research, and service. Within her department, tenure depends heavily upon research, with teaching and service given much less consideration with respect to tenure.

External grant funding is necessary in Minnie's department in order to purchase equipment and supplies for research. During her three years in academia, Minnie has been awarded hundreds of thousands of dollars in grant monies, and has published several articles.

Within her educational background, Minnie received numerous honors and awards, including undergraduate scholarships, and graduate and postdoctoral fellowships. During her educational background and academic career combined, she has been active in professional organizations and in university activities. She takes seriously her teaching responsibilities, and serves as a mentor for both undergraduate and graduate students in her field. Minnie is single and has no children, but is close to both her immediate and extended family. She also enjoys an extensive network of friends, some of whom serve as mentors for her as she adapts to life in academia.

Minnie grew up in a loving and supportive family. In addition to her father, who served as an influence in her childhood, she was also very close to her extended family. Her father was a military man, and pushed her to be independent and to think logically. Although he had no more than two years of college education, he was very good at math. Minnie excelled in school early on, and her family pushed her academically and held high academic expectations for her. Although it was acceptable for the other school-aged children in her extended family to come home with poorer grades or rush through homework without doing it correctly, the family expected Minnie to do better. To this day, her cousins still consider her "the smart one."

During Minnie's childhood, she was not exposed by her family to gender-specific academic expectations. She was expected to excel academically, and socially she considered herself a tomboy:

> I was always playing kickball in the street….I hated lace. I hated pink….And most of the cousins my age were all boys, so I wanted to ruff and tumble with them….And I grew up on an army base so…knowing whether the pulley would turn this way or that way, that kind of seemed second nature.

She does recall not being allowed by her family to roam the neighborhood freely like her male cousins, but this was out of concern for her safety, as they lived in a dangerous neighborhood.

Because her father was in the military, Minnie attended a variety of schools growing up, and she excelled academically through the middle grades. In high school, she attended a school whose admission and continued attendance was based on student achievement. Although she had a rough start during her first year at this school, she maintained the necessary academic requirements to remain enrolled, and spent her entire high school career there. The bar was set pretty high at her school, and everyone attending that school was expected to excel academically.

During high school Minnie was very involved in the humanities classes and planned on majoring in English in college. However, during the latter part of high school a few things influenced her away from this field and toward a career in science. First, she received an achievement-based science and engineering award, and this encouraged her to consider a career in one of these fields. Second, she had the opportunity to receive hands-on experience in a branch of the sciences, which also stimulated her interest in pursuing a profession in science. Gender-stereotypical academic expectations were, in

general, absent in high school. The bar was high for everyone, and both the valedictorian and salutatorian of her graduating class were female. However, at Minnie's high school all students had to take an army entrance test, and there was one incident when she overheard some teachers commenting on how girls did not score well on this test. Minnie scored very well on this test, however, and did not consider the test a big deal.

Minnie began her undergraduate education after completing high school. She received scholarships, was in the honors program, and lived in the honors dorm. Her friends in the dorm would study together, play games together, and go to class together. She attributes going to a high school with high academic standards and the environment provided by the honors dorm as motivating her to excel academically, as she was around a lot of people with her same mindset—the mindset that they were going to do well and work hard. In addition, the honors dorm provided her with the structure she needed to excel academically: "If I had been in a general freshman dorm where they were partying every night I probably would have flunked out my first year in college." The financial support she received from her scholarships was also beneficial in that she did not have to work through school and had more time to concentrate on her studies.

During her undergraduate career, several factors served to influence her academic success and career outlook. Minnie began college thinking she wanted to go into medicine, but a few factors led her away from this. The first was the consideration of the time it would take to be a medical doctor. Another was a male professor who inspired her to pursue her Ph.D. in her major rather than go to medical school. When she went to him to talk about her career options, he said:

> Do you want to spend the next eight years of your life studying what other people have done, or in eight years do you want people to study what you have done? You want a Ph.D.

At this point she decided not to pursue medicine. In addition to influencing her career decision, this professor influenced her academically as well. He had a very strong personality, was very demanding, and was a very strong character. He sat the bar high, and pushed his students academically.

There was also a female professor who served as a role model for Minnie during her undergraduate career. She was a very distinct and proper woman, always in skirts and heels and very ladylike. Minnie always respected her for that, and this professor showed Minnie that a woman could be feminine and ladylike, and still be successful in the field. This professor also exhibited high expectations for students in her field both academically and with respect to conduct, and promoted an atmosphere of mutual respect.

Minnie worked for a semester between the conclusion of her undergraduate career and the beginning of her graduate career, but quickly decided to return to pursue a graduate degree in the same field as her bachelor's. This decision came both from the realization that she would not be happy with a bachelor's level position in her line of work and from the encouragement of some of her co-workers at a job she held while out of school. She soon entered a Ph.D. program in the same field as her undergraduate major, and received a graduate fellowship that supported her financially though her graduate career.

Upon her return to college, she met several people who influenced her success. One was her major professor, who was supportive, flexible, and understanding with

respect to her work in the laboratory, but at the same time expected a lot from his students. Minnie had a family crisis at one point in graduate school, and had to be out of the laboratory at times to attend to family matters. Although he still expected her to make up for the time she missed, he was very flexible and understanding concerning this matter. Later in her graduate career, when Minnie was deciding upon which career path to take and expressed an interest in academia, this professor gave her exposure to various aspects of the job, such as grant writing.

Minnie considered herself a good writer before entering graduate school, and always enjoyed writing. She believes that she picked up her basic writing skills during high school and honed them in graduate school. The first paper she wrote in graduate school was in collaboration with a female professor in an affiliated discipline and with her major professor. This female professor provided Minnie with "good critical analysis" of her writing, and Minnie attributes the feedback from this professor as helping her to "sharpen" her writing skills in graduate school.

Another influential person in her graduate career was a female professor who continues to serve as a mentor and role model for Minnie. This person is a well-rounded, well-integrated woman who is very feminine, but still one of the "sharpest" people Minnie knows in her field. She has shown Minnie that "you don't have to check your gender at the door" but can just be who you are and still be successful. This role model has also shown Minnie that it is possible to be a well-rounded woman in academia: "I always think that there's my job and then there's my family, and then there's this other, and how do you juggle it all?....I really respect that about her." In addition, Minnie

describes her as “a fantastic and encouraging person” and she always has a positive outlook.

After graduating with a Ph.D. in her field, Minnie secured a postdoctoral position and afterwards entered academia. During her academic career, Minnie has faced challenges from various sources. One major challenge surrounds issues with one member of administration. He has discounted her ideas, has failed to address issues of concern, and has shown a general lack of support for her. She attributes this in part to a lack of knowledge about issues women face and a lack of knowledge and experience as an administrator, but believes his actions towards her are heavily influenced by her gender. Minnie asserts that “if one of the male faculty walked in and said they had a problem or something that needed to be changed he would immediately do it.” Sometimes she finds this discouraging, and during really low periods may want to leave work early or not even come in. Thus, it sometimes serves to hinder her productivity at work.

Another challenge Mini has faced in academia is lack of respect and support from the staff. They constantly question her in terms of paperwork or procedural requests, and Minnie believes that she has to do more of her own paperwork than the male faculty. In addition to her gender, she believes that her young age plays a role in this lack of respect and support by faculty. This hinders her productivity because she spends time doing paperwork when she could be performing her professorial duties.

There have also been some instances where students have posed a challenge to Minnie in her career. In one instance, a male student interrupted a meeting she was having with a colleague and persistently requested the use of her stapler. She asserted that

"there is no way in the world that same male student would have walked in to two men talking, interrupted, and kept insisting on a stapler." She also gets called "Miss" rather than "Doctor" more often than not. She thinks this is possibly because the students have not had enough practice addressing a woman in her field as "Doctor." There was also one male student who Minnie believed to be an emotionally fragile individual, and he tended to be "a little too familiar." Although he never caused her any harm, his actions made her feel very uncomfortable and concerned for her own protection. Although these instances have not significantly hindered her success in academia, they have nonetheless been a nuisance for her.

Minnie has found encouragement and support from various female colleagues at her institution. Two women, one an administrator and one a fellow professor in a related discipline, have been particularly influential in helping Minnie to realize that the challenges she faces as a woman in academia are not personal, that it could be any other woman in Minnie's shoes and she would be dealing with the same issues. The female administrator has shared different stories with Minnie about rising up in the ranks and dealing with gender issues along the way. The fellow professor is a friend with a husband and small children. As with the other female figures, Minnie finds encouragement in seeing her friend balance work with family. They also share stories about work and support each other. Minnie has faced challenges as a new faculty member and a woman, but finds encouragement from her colleagues and from serving as a mentor to her students, and plans to continue in academia.

In summary, Minnie grew up in a supportive family. Her father pushed her to be independent and think logically, and both her father and extended family pushed her academically and held high expectations for her. In high school the bar was set high for everyone. She received a science and engineering award that encouraged her to consider a career in one of these fields, and she received hands-on experience in a branch of science. As an undergraduate Minnie received scholarships to college and lived in the honors dorm. In this environment she was around people with the mindset that they were going to work hard and do well. Minnie encountered a female professor during her undergraduate career who served as a role model for her. She received a graduate fellowship that supported her financially through her program. During her program her major professor was supportive and held high expectations. Minnie also had a female role model who influenced her success, and a female professor who helped her hone her writing skills. During her career in academia, Minnie has faced challenges from various sources, such as a lack of support from one male administrator, disrespect from students, and lack of respect and support from staff in her department. Minnie has found encouragement from a female administrator in her department and from a fellow female professor.

Brittany

Brittany is an assistant professor at a doctoral degree-granting university. She holds a Ph.D. in her discipline, and has been in academia for approximately three years. She entered academia as an assistant professor and is working toward tenure and promotion to associate professor. Her work responsibilities as a faculty member include

teaching, research, and service. Within her department, promotion and tenure depend heavily upon publications and obtaining external grant funding, with teaching and service given much less consideration. External funding is necessary to purchase equipment and supplies for research, to fund graduate students, and for travel expenses. During her three years in academia, Brittany has been awarded hundreds of thousands of dollars in grant monies, and has published several articles.

Within her educational background, Brittany received numerous honors and awards. During her academic career, she has been active in professional organizations and mentors students in her department. Brittany is married to a man who holds a master's degree in a related discipline, but he is not employed in an academic setting. They have no children.

Brittany grew up in a single-parent household, her mother serving as the parental figure during childhood. Her parents divorced when she was an infant and she barely knew her father. Both her parents held Ph.D.s: her father in mathematics and her mother in a branch of science. Brittany has one older brother. Brittany's mother worked in academia first as a professor and later in administration. She was not a nurturing individual, and was very critical of laziness. Her mother's parents were farmers and worked "from sun up 'til sun down." Brittany's mother practiced this ethic of hard work in her life, and expected Brittany to work hard in all her endeavors as well. As a child, Brittany's mother always had a garden. She recalls one Saturday her mother finding Brittany inside reading a book and yelling at her because she was not outside, working in the garden. Through the work ethic displayed by her mother and her mother's

expectations for her to work hard, Brittany was taught to work diligently in all of her endeavors.

Brittany's mother also taught her to make good grades in school for Brittany's own satisfaction, and not to seek external approval or rewards. Brittany recalls coming home from school with her report card and asking her mother if they could go out to eat to celebrate her high marks. Her mother would not agree to this, and told Brittany: "You get those grades for you. You do not get grades for anybody else." In addition, Brittany's mother was knowledgeable of the underrepresentation of women in science and engineering disciplines, and applied this knowledge in her parenting:

> What she [her mother] had read at one point and time is that women did not go into science and engineering because, when girls were growing up, the tendency of parents was to always solve problems for them but to allow boys the time to figure it out on their own. My mother says that she did the exact opposite; that if she erred on any side it would be to leave me to try and figure it out on my own.

Brittany's mother also served as a role model for her, and provided her with hands-on experience in conducting scientific research. As a professor in academia, Brittany's mother would go to conferences, present papers, and work in the field on grant-funded projects. Sometimes she would take Brittany out to the field with her and allow Brittany to help with the field work. When Brittany was in high school, her mother had her to read parts of her manuscripts and would discuss them with Brittany: "She had little bits of wisdom along the way about how to do it [write publications], and [that] you get better at it with time." Although Brittany chose a different scientific discipline than her mother, this gave her exposure to practices inherent to science and to the work involved in a career in academia.

Brittany had an older brother who played tricks on her and made fun of her when she lost at the board games that they played together. She was very sensitive with respect to his treatment of her, and sometimes "felt stupid" when her brother would make fun of her. As a result she became very competitive with him, and always wanted to "go on and do better than he had done." Brittany always had to have one of the highest grades in classes, in part because of her desire to surpass her brother's accomplishments. She always wanted to be the best at everything she did, and tried to "show everybody up."

Brittany does not recall experiencing gender-stereotypical expectations or attitudes as a child. She participated in sports such as soccer and tether ball, and many of her friends were boys. She enjoyed building things, and loved math: "You couldn't be wrong at math. On penmanship they could argue that you didn't have this round enough or that round enough, but they couldn't argue over math. It was an absolute. I liked that." Once she asked her mother to buy her a popular girl's toy with which she had seen other girls playing on the playground at school. Her mother refused, telling Brittany that she never played with girl's toys and always left them sitting around. Brittany did not experience gender discrimination until many years later after she secured her first faculty position in academia.

Brittany attended a military school during the latter part of high school. She was attracted to this school because it was ordered, disciplined, and structured, and she "could predict everything that was going on." On her first day at this school, Brittany got in trouble because she argued with an officer who was yelling at her for not following the dress code. Here the majority of the students, and her friends, were male. She graduated

from high school with high honors, and then took some college courses at the same school. She always knew that she wanted to pursue a career in her discipline, and chose this as her undergraduate major. When she entered a university, the structured schedule to which she had grown accustomed in this military school was beneficial in adapting to life at her university:

> When I got to regular college I still got up at 5:30 [or] 6:00 in the morning and I kept trying to go to sleep at 10:30 at night. So I'd come home and actually start working on homework because that was the only time you had [in the military school].

When she began at her undergraduate institution, Brittany's mother advised her that, if she was interested in going to graduate school, she needed to get involved with research. Her mother told her to go to the main office in the department, find out what types of research were conducted by professors in that department, and figure out what research she was interested in practicing as an undergraduate.

During her undergraduate career, two male professors served as sources of support and encouragement for Brittany. The first was a professor under whom Brittany took a class. She viewed him as a very good instructor, and as very personable and encouraging. He also helped her choose possible graduate schools, and later was influential in helping her secure her current position in academia. Brittany was also impressed with how this professor treated others in the profession: "What's always impressed me about him is, regardless of how nasty this profession gets sometimes, he's just unwavering and nice and [has] good intentions towards others." Even though people have "crossed" him, he has never turned bitter, and Brittany considers him an impressive role model.

The second influential professor in Brittany's undergraduate career was a man under whom Brittany worked as a research assistant. He provided her with the opportunity to gain experience in research, and also served as a source of encouragement. He was always available when Brittany needed to talk about problems she had in her classes, and also helped her choose possible graduate schools. Brittany graduated in the top five of her undergraduate class in her major, and entered graduate school the following semester.

Brittany was engaged to be married during the latter part of her undergraduate career, and got married right before she began her Ph.D. program. Her husband graduated with his bachelor's degree in a related field at the same time Brittany received her bachelor's degree, and he wanted to attend graduate school as well. They applied to schools that had programs in both of their disciplines, and entered their Ph.D. programs at the same time. Brittany was awarded a graduate fellowship that provided financial support for her during her graduate career.

In graduate school, Brittany's major professor was very critical, rude, and sometimes verbally abusive to her. He was from another culture, and his conduct was "particularly bad with the American students." Another doctoral student who was established in the graduate program took Brittany "under his wing," and they became good friends. He had the same major professor and thus could relate to her bad experiences with him: "He [her friend] just would listen; when I was struggling with something he'd already been through it and could empathize." This fellow student also

helped Brittany learn how to utilize computer technology necessary to master certain aspects of her discipline.

When her friend graduated, she felt alone and did not know whether or not she would complete her program. One thing that "saved" her was her graduate fellowship, which paid her tuition and stipend as a graduate assistant:

> If I hadn't of had external funding, I think I would have been a liability for him [major professor]. As a vocal American, I would argue, which didn't go over so well because a lot of the Chinese or Russian [students] would just say "okay" and then do the stuff. But I would say "no, it's not going to work because of this" and I'd argue.

Brittany thinks she would have eventually been a liability to him without her fellowship because he would have had to pay for her stipend and tuition. With her fellowship, she essentially became a "free student" for him, as he benefited from her work in the laboratory without paying for it himself. Despite some "really hard times" with her major professor, it was with him that she published her first article. He gave her feedback on her writing and advised her to follow the format seen in other articles when writing manuscripts for publication.

Brittany struggled academically in some of her graduate classes. Although mathematics is not her discipline, she was required to take math classes in her graduate program. Her undergraduate institution was known for being an applied school, and they only taught mathematics up to a certain point. Although Brittany always viewed herself as being good in math, she left her undergraduate institution with a gap in knowledge with respect to an area of mathematics important in her discipline. Brittany and her graduate classmates would work in groups on their class assignments, and during these

group sessions two students from foreign cultures with strong backgrounds in mathematics would help the other group members learn mathematics.

When Brittany entered her Ph.D. program, she was the youngest student in her class. As she progressed through her program, she became a role model for Ph.D. students who entered the program in subsequent years. This gave Brittany a sense of purpose, and helping other students helped her to realize how far she had progressed in her program. Serving as a role model for other students and the realization that she had made significant progress in her program motivated Brittany to finish her Ph.D.

Brittany and her husband graduated from their Ph.D. and master's programs, respectively, and Brittany had the option of securing a faculty position right away or working in a postdoctoral position before entering academia in a tenure-track position. Although she had been invited to interview for a postdoctoral position and was excited about the prospect, her husband was not enthusiastic. He told her that she could choose that option if she really wanted to, but he did not want to have to move to one location for her postdoctoral position and then again to another location for her faculty position. He was ready to get settled and find a home. Brittany chose to forgo a postdoctoral position and, after graduation, secured a faculty position at her current institution. In retrospect, Brittany believes that securing a postdoctoral position before entering academia as a faculty member could have resulted in her getting a job at a "higher-ranked" institution.

During Brittany's three years in academia she has faced considerable challenges. In her department, there is a "privileged group" of male faculty, and believes that it is the mindset both of the staff and the department head to accommodate this privileged group,

even if it is disadvantageous to other faculty. She was once asked to teach a class normally taught by a member of this group simply because he wanted to teach a different class, even though this class was out of her area of expertise. In another instance a student without proper credentials applied for graduate school, and the department "bent the rules" so that this student could be admitted into graduate school because this privileged group wanted him in the program. The conduct of this graduate student was "horrific," and at one point he yelled at one of Brittany's graduate students and called her stupid. However, the department did not address this situation.

Brittany has also experienced a lack of support from fellow colleagues and administration. During the first year at her institution she had several adverse encounters with male students. She had some students heckle her in class and others who were physically intimidating, standing over her desk and pointing their fingers at her. She also had a student to stalk her and yell profanity at her in class. It has not been the occurrence of these events, but rather the lack of support of her colleagues and the "institution's inability to deal with any situation" that have been damaging and frustrating to Brittany. She believes that both the adverse treatment of her by the department and by the students have been partially due to her gender. She also believes that her petite stature and relatively young age have been factors as well.

Brittany believes that the early influence of her mother, specifically the expectation of hard work and her intolerance for laziness, plays a role in the way that she functions in her career in academia. When Brittany has a clear objective in front of her, she is very good at working towards that objective. She also tends to be intense in

performing her duties: “I’m always stressed and work all the time….If I try to sit down and just relax for a period of time, I feel guilty.” However, when she encounters a problem that does not have a solution, such as the “animosity” and “sexism” at her institution, she keeps trying to find a solution. She obsesses over the situation and it keeps her diverted from her work.

After her first year in academia, Brittany contemplated applying to other institutions, but she had no new publications and did not think she could secure a position at a comparable institution. The next year she thought about it again, but still had no new publications. She attributes this lack of productivity to getting “defeated” and depressed as a result of her experiences in academia. Brittany has also experienced a decrease in self-esteem during her career in academia, which has aversely influenced her performance:

> When you write a grant proposal…in some ways you’re blowing smoke… You’re saying I can do this, and this is the greatest thing that’s ever happened. But when your self-esteem is knocked down to that level, trying to do that—trying to convince yourself that you’re qualified to do a new, unproven technique—it’s quite hard.

Brittany was involved in a grant project as a graduate student, but she performed mostly secretarial work during this project. She believes she is still in the learning process with respect to writing grants. She has received some advice about how to write grants from people at her graduate institution and from a female colleague at her current institution. This colleague, who has had several grant proposals funded, sat down with Brittany and gave her advice on how to write proposals. This colleague has also been a person with whom Brittany can talk about the problems she has faced in academia.

Brittany has been successful in securing several grants, one for hundreds of thousands of dollars and several smaller grants. In addition to the advice of the female colleague, the obtainment of the large grant was influenced by a male administrator. This administrator offered Brittany advice on how to write the grant and wrote a persuasive letter of support to the funding agency of one grant for which she applied and was awarded. Brittany has also received support from this administrator in addressing the challenges she has faced in academia. He has been an advocate for her, and is working to address the issues faced by women in their discipline at her institution. He has not dealt with her issues specifically, but rather is advocating the implementation of policies addressing the issues that women in Brittany's discipline face. One example of this advocacy is his support for a new paternity leave policy for both men and women faculty in their discipline. This policy would stop the tenure clock for one year for faculty who give birth to or adopt a child.

Brittany has considered moving to an academic institution where the emphasis is on teaching, and not publications and grants, but after her experiences with students at her current institution she does not want to spend the rest of her life teaching. She has also considered moving to industry or seeking a position at a comparable institution. She does realize, however, that she must gain the expected publications and grants at her current institution before securing a faculty position at a comparable institution.

In summary, Brittany's mother was influential in several ways. She expected Brittany to work hard in all her endeavors and let her try to solve problems on her own. She also served as a role model for Brittany, and provided her with hands-on experience

in conducting scientific research. Brittany had an older brother who played tricks on her. She became very competitive with him, and always wanted to be the best at everything she did. During her undergraduate career, two male professors were influential in Brittany's success. Brittany received a graduate fellowship in her Ph.D. program. Her major professor was sometimes rude and verbally abusive, and a fellow graduate student took Brittany under his wing. As she progressed through the program, she gained a sense of purpose from serving as a role model for other graduate students. During Brittany's career in academia she has faced considerable challenges. Her department head and staff accommodate a certain group of male faculty. She has had some adverse encounters with male students, and has experienced a lack of support from colleagues and administrators with respect to addressing these instances. Brittany has received advice from a female colleague on how to write grants, and has received support from a male administrator.

Within-Case Analysis

This section consists of a within-case analysis for each of the seven cases presented in this study. The analysis of each case will be divided into five parts. First, a summary of the case study of the participant will be presented. Second, the perceived challenges faced by the participant in her life history that may have influenced her success, along with how these challenges have influenced her success, will be presented. In addition, potential challenges faced by the participant and the reasons these did not hinder her success will also be discussed. Third, the accomplishments made by the participant in her life history that may have influenced her success, along with how these accomplishments have influenced her success, will be presented. In addition, some

participants had accomplishments that, although they did not directly attribute to having influenced their success, nonetheless served as evidence of their capability for being successful. Thus, these accomplishments are also noteworthy of discussion. Fourth, the factors in the life history of the participant to which she attributed her success, and how these factors influenced her success, will be presented. Finally, a summary of the analysis of each case study will be presented.

Elaine

Summary of Case Study

Elaine is a senior professor who has been in academia approximately 30 years. Both of Elaine's parents held college degrees, and they simply assumed that their children would go to college. Her father was a scientist, and she was attracted to science as a result of her experiences with him. Elaine attended a small school. She was very shy, and had a more global perspective on life than her peers. In high school, Elaine encountered two teachers that took a more sophisticated approach to learning. Elaine had a few bad social studies teachers, and some bad science teachers who influenced her away from a career in the physical sciences. She was valedictorian of her high school class.

As an undergraduate, she took an introductory course in her field and found the subject matter interesting. She also took courses in her discipline under a professor who later served as her major professor in graduate school. During her Ph.D. program this

professor continued to influence Elaine academically. While in her program, she received a prestigious award based on the quality of her academic performance in graduate school.

Elaine entered her first marriage as an undergraduate. She had her first child while working on her dissertation, but did not consider this a burden. Elaine graduated with honors from her Ph.D. program, and her husband quit his job and moved with her as she pursued her career in academia. After earning her Ph.D. Elaine worked as an instructor at two institutions, and then secured a position as assistant professor at her current institution. Her publication record was slow to develop and had the majority of the home duties, but she does not believe these factors delayed her tenure and promotion to associate professor.

Elaine was promoted to associate professor during her sixth year at her institution, and stayed at this rank for 10 years. After Elaine was established in her career, she entered her second marriage to a professor in a related field. She and her husband have worked together publishing papers, and they share household responsibilities. During her academic career, Elaine has had many opportunities for conducting interesting and needed research. She has found it to be the case in several instances that male administrators have not given her very much credit for her work. She has remained at her current institution in part because she enjoys her work and because relocating to another institution would mean establishing rapport with experts at another location and rebuilding her reputation as a scientist.

Challenges

Her mother, grandmother, and aunt were all school teachers, and everyone always told Elaine that she was going to be a school teacher as well. Elaine was resistant to this idea, and her global perspective on life contributed to her being open to other disciplines and professions within those disciplines. Other than being exposed to the assumption that she would be a school teacher like her female family members, Elaine was not exposed to gender-related academic expectations at home or at any point in her educational background.

Elaine was not especially happy during her elementary and secondary years, and thought of herself as an outsider. She never really fit in, and was shy and unsociable. While this may have presented a challenge to Elaine socially, it did not hinder her academic performance or progression in school. This may have been in part because she was internally motivated to succeed and did not depend upon the acknowledgement of her achievement by teachers and peers for reinforcement. Her social status in school may have actually contributed to her success in school in that she was fully engaged in learning as opposed to being involved in the extracurricular activities that could have taken time away from learning activities.

In high school, Elaine had some bad science teachers. Some did not know their subject matter, while others (e.g., her chemistry teacher) knew their subject matter, but not how to explain it to their students. Elaine believes that some of the adverse influences these science teachers may have otherwise had on her interest and learning of science may have been counteracted by her father and his profession as a scientist. However, she

considered both her physics and chemistry teachers bad teachers, and believes that this influenced her away from a possible career in the physical sciences. Although the influences of these teachers may not have hindered her choice to go to college and eventually pursue a career in academia, it may have influenced her choice of professions.

In college, Elaine faced no major challenges that hindered her academic performance or progression through her undergraduate and graduate degree programs. However, her major professor in graduate school did not encourage her to publish as a graduate student. This resulted in her entering academia without a publication record and without even knowing how to publish. Elaine does not believe her major professor made and distinction between his male and female students, so his lack of encouragement was not due to her gender. When she entered academia, Elaine did not have anyone to help her learn how to publish, so she basically had to learn how on her own. She also finds her approach to publishing a handicap. Even after she analyzes and understands her data, it takes her a long time to think through her research and make sure that she is going to say something useful and meaningful.

Elaine was married as an undergraduate, and although being married did not hinder her progress in college, her family obligations did serve as a hindrance in her academic career. She had most of the domestic and child-rearing duties in the home, and this took time away from her research and from working on publications. These family obligations, along with her lack of experience publishing as a graduate and her approach to publishing, resulted in her publication record being slow to develop. She does not believe, however, that her publication record delayed her tenure and promotion to

associate professor. This is in part because when she was going through the tenure process her institution was much less research-intensive than it is today. In addition, her publications reflect good, solid work that has continued to be cited by people in her profession.

Elaine remained at the associate professor rank for 10 years. This was due in part to her being focused on her work and not especially concerned about applying for promotion to professor. In addition, Elaine had no one to encourage her to apply for promotion, and she was unaware of what point in her career she should apply for professor. The lack of encouragement from colleagues and administration, and the lack of knowledge concerning what point in her career she should consider applying for promotion to professor, hindered her success in academia in that she may have otherwise applied and been promoted to professor earlier in her academic career if she had been knowledgeable of the process. In addition, she was focused on her work and did not seek out knowledge about this process, which also contributed to her remaining at the associate professor rank longer than if she had sought out this information.

During her career in academia, Elaine has found it to be the case with several instances with male administrators that they do not give her very much credit for her work. She also believes that her opinions are undervalued by these administrators and has, over time, perceived a pattern of the downplaying of her ideas by administration. This has been a source of frustration for Elaine, but she does not believe that her experiences with administration have significantly hindered her progress in academia. This is because she does not pay attention to what people outside her discipline think of

her work and is not dependent upon reinforcement from administration to be successful in her work. It may be the case, however, that if administration had encouraged to her to apply for professor earlier in her career, she would have been promoted earlier in her career. Therefore, this lack of support may have actually hindered her success, but did not delay her eventual success in academia.

Some of the challenges and potential challenges faced by Elaine, and the possible consequences of these challenges, may have been counteracted by her intrinsic motivation to succeed. In school, she was internally motivated to learn, and did not depend upon the reinforcement of her teachers or peers for motivation to excel academically. The potential challenge that being an outsider in her school may have had on her academic performance may have been a non-issue due to her intrinsic motivation to learn, the pleasure she found in reading, and her desire to do things that interested her instead of being a part of a group. In academia, the adverse influence of the perceived lack of support by administration on her success has been minimized because she is motivated by her own interest in her work and belief that she is contributing to her discipline. She is not dependent upon others, including administration, for reinforcement or motivation. However, the lack of support from administration may have delayed her promotion to professor.

Accomplishments

Elaine was a member of her high school honor society and was valedictorian of her graduating class. These accomplishments serve as evidence of her capability to be successful both in her subsequent college career and during her career in academia. As a

result of her academic achievement, Elaine received scholarships to college, which promoted her success as an undergraduate by providing financial support for her education.

As an undergraduate, Elaine was a member of a national honor organization and graduated with high honors. These accomplishments serve as evidence for her capability to be successful in her graduate career and her career in academia. In graduate school, Elaine received a prestigious award that was based on the quality of her academic performance in graduate school. This award promoted the completion of her Ph.D. in that it provided funding for supplies needed to complete her dissertation and for travel expenses incurred during her data collection process.

Elaine graduated with honors from her Ph.D. program. Graduating with honors serves as evidence of her capability to be successful in academia, and the attainment of her Ph.D. was necessary in order for her to secure a tenure-track position as an assistant professor at her current institution. During her career in academia, Elaine has published numerous articles and has been awarded well over half a million dollars in grant monies. Since tenure and promotion in her department are based on publishing and, to a lesser extent, securing external funding, the attainment of grants and the publication of articles have served to promote her success in academia.

Attributions to Success

Both of Elaine's parents had college degrees. Elaine's paternal grandmother was also college-educated, making Elaine and her siblings the third generation in their family to attend college. Elaine believes that the firsthand experience her parents had with

respect to targeting her towards college was a major reason she was not only able to go to college, but to also obtain a Ph.D. Her parents expected that their children would go to college. As a child, Elaine's parents read to her and her siblings, and encouraged them to go to the library. These actions by her parents may have contributed to Elaine's intrinsic desire to learn and the pleasure she found in reading.

Elaine's father was a scientist who held a master's degree in his field. As a scientist, he conducted field research and would take Elaine and her siblings out to the field with him. They took notes for him and he would explain his research to them. Through her experiences with her father, she was exposed to a way of thinking inherent to science, part of which is looking at things rationally and objectively. She may not have otherwise had the opportunity to gain these hands-on experiences in science, especially given the fact that some of her science teachers in high school either did not know their subject matter or how to explain it to students. In addition, her father was a major role model for her, and these experiences with him in the field attracted her to science.

Elaine has a global perspective on life, which she attributes largely to reading a wide range of literature and having college-educated parents. Unlike her classmates in school, who never questioned the local culture or considered following a path different from their parents, Elaine's global perspective may have been influential in her choosing a career path different from her mother, grandmother, and aunt. Even though everyone told her she would follow the path of these relatives and be a school teacher, she chose a different career path. Her career does involve teaching college students, but includes research and service duties as well.

During her elementary and secondary years, Elaine was intrinsically motivated to learn, not depending upon external reinforcement from teachers or peers in order to perform well in school. Elaine always considered herself a good student, and always made good grades. She preferred reading or engaging in other intellectual activities of interest to her rather than being a part of a group. Elaine's internal motivation to learn, likely promoted by her early exposure in the home to reading and encouragement from her parents to read, contributed to her success in school because she was reinforced by learning in and of itself and not acknowledgement of her achievements by others.

Elaine considered herself an outsider in her small school, and the teachers she recalls as being influential were also considered outsiders who took a more sophisticated approach to learning than some of her other teachers (e.g., social studies). One of these influential teachers was a female English teacher who allowed students to explore their interests in the literature. This teacher also showed Elaine that complex analyses of the literature were possible, as opposed to the low-level analysis of short stories and poetry to which she had previously been exposed. Another teacher was a male foreign language teacher who was very nice to Elaine and recognized people for who they were.

These high school teachers are perhaps better classified as memorable rather than influential. Elaine displayed academic excellence in school despite some of the bad teachers she had in school and even though she was not especially happy. These factors, along with her desire and ability to learn, provide evidence that Elaine would have still been successful in high school and college, regardless of the actual teaching skills of the English teacher or kindness of the foreign languages teacher. Because these teachers were

outsiders, however, Elaine remembers them fondly because she could probably relate to them more so than her other teachers or peers.

As an undergraduate, Elaine took an introductory course in her current discipline because it was required to meet her general education requirements. She found the subject matter very interesting and, even though she had a very poor teacher for this introductory course, chose it as her discipline. She earned a bachelor's degree and Ph.D. in this discipline and has studied it for 30 years in her academic career. This once again reflects that her interest in her field serves as her motivation, as opposed to relying upon others for reinforcement or support.

During her undergraduate career, Elaine took courses under a male professor who served as a contributor to her success during her college career. This professor was well-organized and had a concept-oriented, intellectual approach to her discipline. She admired his intelligence, and viewed him as above her in his sophistication of understanding the discipline and his ability to grasp implications. When she realized he was a good teacher, she tried to take every class he offered. She was so impressed by this professor that she decided to stay at her undergraduate institution for her Ph.D. program so that she could study under him. His knowledge of the field and teaching abilities contributed to Elaine's knowledge of the field, and her admiration of him led her to pursue a Ph.D. program at her undergraduate institution with him as her major professor.

As her major professor in graduate school, this man required Elaine to come to his office once a week to discuss progress on her dissertation research, and to give her

feedback on her writing. His feedback was highly critical, but constructive, and his direction during her dissertation research facilitated her progression through the program.

Elaine entered her first marriage as an undergraduate. Her husband supported her decision to attend graduate school and contributed to her success in the program by supporting her financially. Elaine did not have to work while working on her Ph.D., which gave her more time to concentrate on her studies. Near the end of her program, while working on her dissertation, Elaine had her first child. She attributes this event as facilitating her progress on her dissertation, as having a child to care for kept her at home, focusing and working on her dissertation. When she finished her degree, her husband quit his job and moved with her as she pursued her career. His willingness to move facilitated the pursuit of her career in a different geographic location. Elaine chose to work in academia because there were not a lot of other options in her field at the time. Therefore, the lack of other options was one reason she chose to enter academia.

During her career in academia, Elaine's publication record was slow to develop. However, she has numerous publications, and she attributes her tenure and promotions in part to good, solid work that has continued to be cited in the literature. Although she has a slow but sure approach to publishing, taking her time to make sure she is publishing meaningful and useful work has resulted in this solid work, and has contributed to her success in academia. Her second husband, a professor in a related field, has also contributed to her success. He can write a publication in a short period of time, but recognizes that Elaine's work is harder and takes more time. They have played on each others' strengths, and have co-authored some publications. Because publications are an

important consideration in tenure and promotion within Elaine's department, collaborating with her husband in publishing has promoted her success in academia. They also share responsibility in the household work. Because of the sharing of responsibilities, and because her children are now grown, she has more time to devote to her research.

Throughout Elaine's academic career, research opportunities in her area of interest have been plentiful. Her major research interests have been concentrated in her geographic area, and she has established a rapport with local experts in her field. Some of the projects on which she has worked have been the result of these colleagues pointing out an area of research that had been neglected, but that they did not have time to address. The field-based program she has directed for several years has also been beneficial, as she is able to choose research projects for her students that are conducive to her interests. The research that has resulted from all of these sources combined has resulted in publications of some of the research, and a backlog of research that can be used for future publications. These publications have been important considerations in Elaine's tenure and promotions within her academic career.

Summary of Analysis

Elaine faced no major challenges in her family background. She had bad science teachers in high school that may have influenced her away from a career in the physical sciences. In academia, her publication record was slow to develop for several reasons, such as her approach to publishing. Elaine stayed at the rank of associate professor for 10 years in part because of a lack of knowledge concerning at what point in her career to

apply for promotion to professor and a lack of encouragement from administration and colleagues. Elaine has found it to be the case with male administrators that the do not give her much credit for her work and that they undervalue her opinions.

Elaine has attained accomplishments such as being valedictorian of her high school class and receiving a prestigious award in graduate school. She was also a member of a national honor society in high school and as an undergraduate.

Elaine believes that the firsthand experience her parents had with respect to targeting her towards college was a major reason she was not only able to go to college but to get a Ph.D. Her father was a scientist, and her experiences with him in the field attracted her to science. During her elementary and secondary years, Elaine had a global perspective on life, and was internally motivated to learn. As an undergraduate Elaine decided to major in her discipline when she took an introductory course in the discipline. She was so impressed with one male professor under whom she took courses that she stayed at her undergraduate institution for her Ph.D. so that she could learn under him. This professor became her major professor, and gave her highly critical and constructive feedback on her writing. Within academia, Elaine attributes her tenure and promotions in part to good, solid work that has continued to be cited in the literature. She has collaborated and published with her husband, who is in a related field. Throughout her academic career, research opportunities have been plentiful, and she has a backlog of research.

Pauline

Summary of Case Study

Pauline is an associate professor and has worked in academia approximately 25 years. The most important influence in Pauline's academic life was her father, who was a teacher in the same field that she chose as her profession. His love for the discipline, and her love and admiration for him, instilled in her a love for the discipline as well. Pauline's grandmother also influenced her success. Pauline lived several years overseas, and upon returning she had trouble fitting in at school. This made her delve into the books more. Pauline's family later moved and she went to a rural high school at her new residence. Here she encountered an influential math teacher. Pauline attended a small Christian college during her undergraduate background. She was miserable during her four years at this institution, and completely lost her self-confidence. A male friend with whom she took several classes encouraged her to apply to graduate school at the same institution he was going to attend, and there she earned a master's degree in her discipline. It was at her graduate institution she met her husband, who was working on his Ph.D. in the same discipline.

Pauline worked several years as an instructor before pursuing her Ph.D. During this time she had a child, and was responsible for most of the child care responsibilities in the home. As an instructor, Pauline was unhappy teaching low-level classes and, when a Ph.D. program in her discipline became available in her discipline at her institution, she pursued her Ph.D. Her major professor held extremely high standards for and taught Pauline how to write and publish. Pauline began teaching higher-level courses after

finishing her Ph.D., and secured a position as an assistant professor. However, balancing work with family continued to present a challenge to her career. Because of time constraints due to parenting responsibilities, she chose to work in groups when publishing. When she applied for associate professor, she received criticism from the committee because she had published with others. She was denied promotion the first time, but applied the next year and was promoted to associate professor with tenure.

Pauline's husband is now a professor in her department, and has been influential in several ways. She and her husband have published together, and he has been supportive with respect to the pursuit of her Ph.D. and her career in academia. Pauline perceives a cultural problem in her field from male professors that are from cultures that promote more traditional female roles in that she believes that they do not understand why American women want to work. In addition to the other positive influences in Pauline's life history, she credits her female aerobics instructor as helping her to be physically strong and healthy.

Challenges

Pauline did not perceive any gender-related challenges in the home during her childhood. She does not recall being exposed to any gender-stereotypical roles or values in the home or during her elementary and secondary years that might have influenced her away from her discipline. After she returned from living overseas, she did not fit in at her elementary school. However, this resulted in her delving more into the books and seeking academics as a refuge. Therefore, her reaction to this potential challenge actually contributed to her success in school.

Pauline faced a major challenge upon entering college. Her father wanted her to attend a small Christian college so that she would not lost in the crowd at a larger college. Even though she received scholarships to the larger schools in her state, she followed her father's wishes. She was miserable and discouraged during her entire four years at this college, and was here exposed to gendered messages. She believes she was considered freakish because she was a female interested in math and science, and did not know how to perform the traditionally female activities such as cooking and sewing. Her father had taught her to think logically and believed in evolution, and these values were in sharp contrast to those promoted by her college.

Her experiences at this college resulted in her completely loosing confidence in herself, and she questioned everything about herself. She also left her institution with a weaker background in her discipline than if she had attended a better school. Therefore, her loss of self-confidence and weak background could have resulted in her not pursuing a graduate degree. If it had not been for her male friend who expressed confidence in her abilities and encouraged her to apply for graduate school with him, she may have never pursued a graduate degree. When she did enter graduate school, her poor background in her discipline made the first year difficult on her, but she did not allow this to hinder her progress, and she earned her master's degree.

When Pauline finished her master's degree, she had been in college for six consecutive years. Although she had a professor who encouraged her to pursue her Ph.D. at that time, she chose not to do so. She met her husband at this institution, and worked as an instructor there for one year while her husband finished his Ph.D. She then chose to

travel with her husband while he pursued his career, and worked as an instructor in her field. Her choice not to pursue her Ph.D. after completing her master's degree meant that she was limited in academia to working as an instructor. Her choice to move with her husband as he pursued his career also resulted in her remaining as a master's level-educated instructor for several years, as opposed to possibly pursuing her Ph.D. This was because when she and her husband moved to their current location, her institution did not offer a Ph.D. program, and she was not willing to move away from her husband to pursue this degree. It was only after the institution at which she was employed as an instructor offered a program that she chose to pursue her Ph.D.

During Pauline's time as an instructor, she had a child, and was responsible for the majority of the child-rearing responsibilities. For several years after the birth of her child, she could not find full-time child care in her community. She initially employed a woman that lived some distance away from her home to care for her child full-time, but her drive to and from the sitter became was tiring, so she sought day care in the community. Initially she could only find part-time day care, and kept her child with her the remainder of the time. Sometimes Pauline took her child to work, and sometimes Pauline took her work with her as she carried the child to various activities. As an instructor, Pauline did not have the obligations of research and publishing for the purposes of advancement in academia. Therefore, balancing these responsibilities with work before she entered the Ph.D. program at her institution may not have hindered her advancement in academia. However, it was tiring for Pauline and a struggle for her nonetheless.

When Pauline entered the Ph.D. program, it was hard on her balancing work, school, and child-rearing obligations. She was exhausted all of the time, could not stay focused on her school work, and the homework took her longer than it normally would have because she was so exhausted from fulfilling her other obligations. This may have resulted in her not completing the Ph.D. program if it had not been for the influence of her major professor.

After she earned her Ph.D., child-rearing obligations continued to pose a challenge to Pauline. This time, the time these obligations took away from her work did hinder her success in academia. Because of the time child-rearing obligations took away from her time at work, Pauline chose to work in groups when conducting research and publishing. This resulted in Pauline having very few publications by herself. When Pauline applied for promotion during her fourth year as an assistant professor, she was denied promotion. She received criticism from her committee because she had published the majority of her work with others, and they were unsure how much of the work was hers and how much was her colleagues who published with her. The next year she applied again and was promoted and tenured, although her qualifications were essentially the same.

Pauline believes that she may face more challenges in the future because her husband is a professor in her department. One professor from a culture that promotes more traditional and restrictive female roles does not like that she and her husband are married and in the same department, and is worried that they will become too strong a force. She believes that men from these cultures do not even understand why women

want to work. She believes that the objection of this professor, along with the publication issues she faced in her efforts to be promoted to associate professor, may hinder her progress in becoming professor. Although she is probably going to apply, she believes there will be a huge fight, and she will probably have to apply twice again.

Accomplishments

In high school, Pauline received several subject awards based on her academic excellence, and was valedictorian of her graduating class. She also received scholarships to college. These accomplishments serve as evidence of her ability to be successful both in her college career and during her career in academia. Pauline earned a bachelor's and master's degree, and later a Ph.D. in her discipline. The attainment of each degree was an accomplishment that provides evidence for her capability to be successful in academia. Although Pauline lacked self-confidence during college, her accomplishments serve as evidence that she was intelligent, although she may not have always considered herself as such.

Pauline's master's degree qualified her to be an instructor in academia, and she worked as an instructor for several years at her current institution. However, she would have been limited in her opportunities for advancement if she remained an instructor. The attainment of her Ph.D. meant that she could advance in academia as a tenure-track professor in her discipline. During her career in academia, Pauline has published numerous articles. Since tenure and promotion in her department are based primarily on publications, the attainment of these publications has served to promote her success in academia.

Attributions to Success

Pauline attributes her father as being the most important influence on her academic background. He was a master's level-educated teacher in the same field Pauline chose as her profession. She loved and admired her father very much. His love for the discipline, and her love and admiration for her father, instilled in her a love for the discipline as well. She always wanted to be a teacher, and never strayed from this aspiration.

Her father held high academic expectations for her, and pushed her in everything. Pauline said that her father treated her like a boy, and expected her to do all of the things that a son would normally do. She was expected to perform such duties as painting the house and moving furniture, and helped her father work in the garden and fix things around the house. Her father was physically active, and she went with him hiking, kayaking, running, and mountain-climbing. Pauline believes that these childhood experiences with her father contributed to her ability to function well in her male-dominated profession , as having stereotypically male interests has enabled her to get along with her male colleagues.

Pauline's father did not coddle her emotionally, and did not like to see her cry. Her grandmother, with whom she spent a lot of time, did not coddle Pauline either, and was very critical of her. She told Pauline that she was ugly, that her hair was always a mess, and that her room was too dusty. Pauline believes that the manner in which she was treated by her father and grandmother helped toughen her up, and this later became

beneficial in successfully dealing with her colleagues in her discipline who she describes as a very critical group of people.

In high school Pauline had a very precise, rigorous math teacher for several classes who contributed to her interest in mathematics. When she took calculus during her senior year she became very enthusiastic about mathematics. During her senior year, sometimes Pauline would wake up a little depressed, but looking forward to what she might learn in calculus helped ease this depression that teenagers sometimes face.

Pauline does not have many fond memories of her undergraduate college experience. However, during college she had a male classmate with whom she took several classes, and she competed with him academically. Pauline was always just a little better than he was in the classes they took together, and this friend thought that if he could go to graduate school, then certainly Pauline could as well. He encouraged her to apply at the same institution as he was going to attend, and she earned her master's two years later. Because Pauline was so discouraged and lacked confidence in her abilities, the encouragement she received from this friend and the confidence he expressed in her abilities contributed greatly to her decision to attend graduate school and earn her master's degree.

Pauline worked as an instructor for several years after she earned her master's degree. When her current institution established a Ph.D. program in her field, she entered the program. The biggest motivator in her decision to pursue her Ph.D. was that she was unhappy with her job as an instructor. She was teaching low-level classes and had trouble getting along with the students because she could not seem to present it in a way they

could understand. During her Ph.D. program, her major professor was influential in facilitating her progress through the program. He held extremely high standards, pushed her academically, and met with her on a regular basis. Pauline attributes his influence to her success in the Ph.D. program. She believes that is she had had a professor that allowed her to do her own thing she would not have made it through the program, as she would not have thought she had the time to devote to the program.

Pauline's major professor also helped her learn how to write and publish. He taught her that, instead of reading an article to follow what other people had done, she should push their ideas forward and make new things out of these ideas. He also edited her writing and gave her constructive criticism of her writing. Tenure and promotion in Pauline's department depend heavily upon both quantity and quality of publications. Therefore, the influence of this professor in teaching her how to write and publish contributed to her ability to be successful in academia.

When Pauline first applied for tenure and promotion to associate professor, she was denied this promotion. Between her first and second attempts at being promoted, she went to her former advisor and shared with him how hard it had been on her balancing work and school obligations with child-rearing responsibilities while she was in her Ph.D. program and working. She believed that it was important for her to have his support for tenure and promotion, as he was now a full professor in the department. After this, he started showing his support for Pauline in her academic career. Pauline believes that this colleague had no idea how hard it had been on her balancing all the obligations in her life. If this is the case, his realization of the struggles she faced as a working mother may

have resulted in this showing of support for Pauline that he did not prior to this enlightenment. This might help explain why she was promoted and tenured during her second attempt, although her qualifications were essentially the same as the first time she applied for promotion and tenure.

Pauline's husband has also been influential in both her Ph.D. program and her career in academia. He is older than Pauline, and she considers him more knowledgeable of their discipline. He supported her decision to enter her Ph.D. program, and was always available for her if she had questions about her school work. He also helped care for their child during her Ph.D. program when she was studying for major exams. They have published articles together and, since publications are a major consideration with respect to tenure and promotion, this has promoted her success in academia.

Another influential person in Pauline's life has been her female aerobics instructor. Pauline believes that there is a pull in academics away from physical fitness, and when she was a young mother she believed that she needed to be physically strong and healthy. Pauline believes that without the influence of the aerobics instructor, she would not have been physically capable of accomplishing all that she had to do. Pauline still attends these aerobics sessions.

Summary of Analysis

Pauline experienced no major challenges in her family background. She attended a small Christian college as an undergraduate, and was miserable and discouraged her entire four years at this college. Pauline worked as an instructor several years after earning her master's degree because her institution did not offer a Ph.D. program in her

discipline and she was not willing to move away from her husband to pursue this degree. She was responsible for the majority of the child-rearing responsibilities in her family and these responsibilities posed challenges to her success.

Pauline attained accomplishments such as receiving subject awards in school and graduating as valedictorian of her high school class. The attainment of her Ph.D. provided the opportunity for advancement in her academic career.

Pauline attributes her father as being the most important influence on her academic background. He held high expectations for her, and pushed her in everything. Her father did not coddle her emotionally, and did not like to see her cry. Pauline's grandmother was influential to her success as well. Pauline had a math teacher in high school and a classmate in college who influenced her success. She also had a major professor or in her Ph.D. program who held high standards for her and helped her learn how to write and publish. Pauline's husband has influenced her success in several ways. She also attributes her aerobics instructor as influencing her success.

Jane

Summary of Case Study

Jane is a senior professor at her current institution and has been in academia 17 years. Jane grew up with supportive parents who always held high expectations for her and her sister. Jane went to a small school where she received a lot of recognition, but there were limited opportunities. She had a high school science teacher who provided exposure to and promoted her interest in science through her instructional methods. Jane

received several subject awards each year in school and was valedictorian of her graduating class.

During her undergraduate background, Jane's limited background in math and science made some of her classes challenging. Her math and science courses had few women in them, and they all studied together and encouraged and supported each other. As an undergraduate she was exposed to research through her work-study position in her department, and also took a science course under a male science teacher who made the subject interesting. Jane married while still an undergraduate, and graduated with honors from her undergraduate institution.

Jane taught school for a few years after completing her undergraduate education, and then did not work for several years. She gave birth to two children during her years at home. Jane also had the opportunity during this time to earn a master's in her initial discipline. Upon returning to work, she was once again exposed to research in her work setting, and the professor for whom she worked helped her learn to write and publish. She took a graduate class in another discipline and decided to pursue a master's in this discipline. After working as an instructor in this new discipline for several years, she pursued her Ph.D. in this discipline. Jane's husband relocated their family so that she could pursue her Ph.D. He has always been very supportive of Jane, and proud of her accomplishments.

During Jane's Ph.D. program some of the students in Jane's program formed a group and supported each other during their program. After Jane finished her Ph.D. she moved with her family and later secured a position as assistant professor at her current

institution. Here a female colleague served as a mentor to her, and they have worked together on research. She has also conducted collaborative research with other colleagues in the field.

During her academic career, she has taken on larger service roles than her male counterparts, and she thinks that she would have a stronger publication record if she had not taken on these responsibilities. Her department has tried to award faculty for taking on these roles, and Jane has received an award based on her teaching, research, and service roles. For several years in her career, Jane cared for elder parents, and this took time away from her work. Jane has had a majority of the child care responsibilities and domestic duties in the home, but has never considered her family a hindrance to her academic career. She also believes that entering academia later in life has made her mores serious about her work.

Challenges

As a child, Jane was not exposed to gender-related expectations with respect to her roles in the family. However, her mother did force Jane to take two years of typing, and shorthand in anticipation of Jane becoming a secretary. This did not, however, serve as a hindrance to Jane's pursuit of a career in science. In her school, there were no differences based on her gender in the nature of math and science courses she took, but the opportunities for taking advanced math and science classes were limited. Her limited high school background in math and science did make her undergraduate math and science classes more difficult. However, the women in these classes supported and encouraged each other, so this contributed to this limited background not serving as a

significant hindrance to Jane's progress as an undergraduate. Her academic abilities also likely helped counteract the possible influence of this limited background.

During the time Jane was an undergraduate, women who were good in science and math were encouraged to teach these subjects as opposed to pursuing other professions in these fields. Jane was interested in science, was exposed to research as an undergraduate, and her accomplishments in high school serve as evidence for her capability to be successful in math and science careers other than teaching. A career in academia is one such profession. Therefore, the expectation of women at that time to teach math and science instead of pursuing other professions in these fields and the lack of encouragement to pursue these professions may have served to delay her entry into academia.

Jane married as an undergraduate and had two children before she pursued a master's and Ph.D. in her current discipline. She was also responsible for most of the domestic and child-rearing duties in the home. She admits that it was hard balancing her work and family obligations, but never *perceived* it as being a hindrance to her career. Caring for her elderly parents several years during her academic career did take a great deal of time, and she does believe the time this took away from work did result in her being less productive in her research than if she had not had this responsibility.

During her academic career, Jane has taken on larger service roles and teaching responsibilities than her male counterparts. She believes she was asked to perform these responsibilities because people thought she would be good at them. Service roles have included chairing committees, curriculum revisions, and big advising roles. Although she

enjoyed these roles, she now believes that she would have had a much stronger publication record and stronger research record without some of those responsibilities. Although Jane never perceived gender discrimination during her academic career, she believes it may have been in part because she was not looking for occurrences of discrimination.

Accomplishments

Jane received several subject awards in high school based on her academic performance, and was valedictorian of her graduating class. During her undergraduate career, Jane was inducted into an honor society. These accomplishments in high school and college serve as evidence of her capacity for being successful in a career in academia, and being inducted into an honor society reinforced her belief that she was a capable student. Jane has earned a bachelor's degree, two master's degrees, and a Ph.D. within her educational background, and all of these accomplishments serve as evidence of her capacity for success in academia.

The attainment of her master's in her current discipline qualified Jane to teach as an instructor in academia. However, if she had not earned her Ph.D. she would have been limited in her opportunities for career advancement. The attainment of her Ph.D. provided Jane with the opportunity for advancement in academia, as it gave her the qualifications for a tenure-track position as an assistant professor. Jane has been awarded millions of dollars in grants and has published numerous articles during her career in academia. In her department, tenure and promotion depend heavily upon publications and, to a lesser extent, the attainment of grant monies and teaching. Therefore, the

attainment of grants and the publication of articles during her career in academia have served to promote her success. In addition, grant money is required to fund graduate students that aid in conducting research, and to buy equipment and supplies necessary for research. The attainment of grant money has thus been necessary to conduct the research necessary to contribute to her tenure and promotion.

During her career in academia, Jane has received an award based upon her performance in teaching, research and service. She was nominated for this award by her department head, and this award reflects the excellence of her work in academia and the knowledge of administration of her contributions to her discipline.

Attributions to Success

Jane grew up with loving and supportive parents who were ambitious for the education of their children. They always held high academic expectations for Jane and her sister, and showed a genuine interest in their academic achievement. There was never any doubt that she and her sister would go to college. Jane lived on a farm and was required to perform duties that she thinks boys would usually have done. She milked cows, rounded up cattle, and knew from an early age how to drive a tractor. She believes this influenced her in that there was never something she thought she could not do because of her gender.

Receiving a lot of recognition in her small school for her academic achievement, Jane always viewed herself as a good student. In high school, Jane had a female science teacher who gave Jane a lot of exposure to science through her instructional methods. This teacher had a sophisticated laboratory design and had her students perform genetic

experiments and dissections. The influence of this teacher promoted Jane's interest in science and was a factor that led to her decision to major in a branch of science as an undergraduate.

Jane initially majored in math as an undergraduate, but she decided that she was not interested in abstract mathematics. Along with the influence of her high school science teacher, a male science professor influenced her decision to major instead in a branch of science. Jane took a course under this professor as part of her general education requirements, and considered him a wonderful lecturer who made the subject matter very interesting. During her undergraduate career, Jane worked as a work-study student and received a lot of individual attention and support from the faculty in her department. She also had several research opportunities as a work-study student, and published her first paper based on research she conducted as a work-study student. These opportunities helped her learn how to conduct research and stimulated her interest in research.

After Jane finished her bachelor's degree, she taught school for a few years. Her last year teaching was an unpleasant experience for Jane, and after this she decided that teaching was not the profession she wanted to work in the rest of her life. This dissatisfaction with teaching school led her to eventually pursue other career options. If she had been satisfied with her career as a teacher, she may have never pursued her advanced degrees or considered any other career options, including her career in academia.

Jane pursued a master's in her initial discipline because of her interest in the field and her desire for a career other than teaching. Her first child was a toddler when she

began the program, and her parents kept her child while she studied. She also used the knowledge gained from this degree when she returned to work as a laboratory technician. During her career as a laboratory technician, Jane was again exposed to research, and the male university professor under whom she worked taught her how to write and publish. This knowledge would later be beneficial in promoting her success in academia, as publishing is important in her department with respect to promotion and tenure.

After Jane returned to work, she had the opportunity to take a graduate class in another discipline, and liked it so much that she pursued a master's in this discipline. After earning her master's degree in her new discipline, she worked as an instructor for several years. Her job limitations as an instructor motivated Jane to pursue a Ph.D. in her new discipline. She was limited to teaching low-level undergraduate classes, had no opportunities to conduct research, and could not contribute to decision-making processes in her department. In addition, she was encouraged by her male department head and women colleagues within her department to pursue her Ph.D. Witnessing these women as successful in the field while balancing work and family helped Jane realize she could do this as well.

Jane pursued her Ph.D. at a different institution than she had worked as a laboratory technician and received her second master's degree. Her husband was willing to interrupt his career and move the family to the location of her new institution, and his willingness to move meant that she could pursue her Ph.D. at this institution. During her program, her major advisor was not helpful, and several male and female graduate students in her discipline formed a group which encouraged and supported each other

during their program. They met once a week to discuss literature relevant to their discipline, discussed landmarks in their dissertation research, and read each other's rough drafts. Since Jane's major professor was not helpful in guiding Jane through her program, the support and guidance she gained from this group was especially important in promoting her success in the program. Without the influence of this group, she may not have had the support and academic guidance necessary to complete her program.

From the time Jane entered college to the time she decided to pursue her Ph.D. in her current discipline, there was a series of events leading to her decision to pursue her Ph.D. Jane did not begin college or her career with the goal to be a professor, or even pursue a Ph.D. During her undergraduate career, Jane started out as a math major, but after taking a science class as part of her general education requirements, changed her major to a branch of science. Her dissatisfaction in the teaching profession led her to pursue a master's in her initial discipline, and her credentials received from her education made her qualified for her job as a lab technician at the university where she took a graduate course in her current discipline. Although her intentions in taking this course may not have initially been to pursue a master's in this discipline, this course stimulated her interest in this discipline, and she decided to pursue her master's degree because of this interest. Her qualifications as a master's level-educated instructor left her with limited opportunities for advancement, so she pursued her Ph.D. so that she could advance in academia. Therefore, in Jane's case, several events over many years paved her path to academia, and along the way she acquired the knowledge and expertise to be successful within her career in academia.

After completing her Ph.D., Jane secured a position as assistant professor at her current institution. When she was first hired, a female mentor supported Jane, gave her advice, and served as a friend. She and this mentor have worked together writing proposals, conducting research, and publishing. This mentor also helped Jane learn how to write grants. Jane has also worked collaboratively with other colleagues in her field as well, and working collaboratively with colleagues has increased her research productivity. She and her colleagues have benefited from each other's strengths, and have gotten proposals and papers written that they would not have otherwise. Since publications and securing grant funding are important with respect to tenure and promotion, working collaboratively with her mentor and other colleagues has served to promote her success in academia.

Another influence throughout Jane's married life has been her husband. He has always supported Jane's educational and career endeavors, and has always been proud of and bragged on her accomplishments. He has provided financial support for the family as Jane pursued her educational and career goals, and has been willing to experience major disruptions in his career to support her endeavors.

Jane taught her two children to be independent from an early age and expected them to take on responsibilities in the home. This helped Jane to balance work and family because they were not dependent upon Jane to take care of them, giving her more time to focus on her work. Jane also believes that entering academia later in life has made her more focused and serious about her work than if she had pursued this career earlier in life.

Summary of Analysis

Jane went to a small high school with limited opportunities, and this made some of her undergraduate classes more difficult. Women who were good in math and science were encouraged to teach these subjects. Jane conformed to this expectation and taught school a few years. In academia, Jane has taken on much larger service roles than her male counterparts. Caring for elderly parents for several years during her academic career took time away from her work.

Jane received subject awards in high school and was valedictorian of her class. She was inducted into an honor's society as an undergraduate. In academia, she has received an award based on her teaching, research, and service. The attainment of her Ph.D. after entrance into academia made possible her advancement within academia.

Jane grew up in a supportive family, and her parents were ambitious for their children. There was never any doubt she would go to college. In high school, Jane had a female science teacher who stimulated her interest in science. The influence of this teacher, along with that of a male undergraduate science professor, influenced her decision to major in a branch of science. Jane was exposed to research as an undergraduate through her work-study program. Jane was again exposed to research during one of her professional positions, and the professor under whom she worked taught her how to write and publish. She had the opportunity to take a class in her current discipline, and liked it so much that she pursued a master's degree in this discipline. Upon realizing her limitations as an instructor, she pursued her Ph.D. in this discipline and secured a position as assistant professor at her current institution. In her Ph.D.

program she benefited from the support of a group of colleagues. In academia, she has benefited from research collaborations with colleagues. Jane's husband and children have also been influential in her success.

Caroline

Summary of Case Study

Caroline is an associate professor who has been in academia at her current institution approximately 15 years. Caroline grew up in a stable and supportive family, and her parents held high academic expectations for their children. Her father was a science teacher for several years. Caroline went to a small school and there encountered an influential English teacher and math teacher. Caroline was co-valedictorian of her graduating class, and received an academic scholarship to college.

During her undergraduate career there were two male professors who served to influence Caroline academically. The first was a professor who impressed Caroline with his teaching skills, promoted her interest in her field, and inspired her to teach as she does now. The second was a professor who impressed her as a researcher. Toward the end of her undergraduate career, Caroline was inducted into an honor society, and she graduated with high honors. Caroline got married during her undergraduate career, and balancing family obligations have presented challenges to Caroline both during her graduate career and in academia

In her master's program, Carol was influenced by a professor whom she considered a real and normal person, and at the same time very successful. This showed

her that a person could be normal and still be a successful scientist. In her Ph.D. program, her major professor had a brusque personality that sometimes discouraged Caroline, but he did help her hone her writing skills and learn to write scientifically.

After her postdoctoral work, Caroline's husband agreed to move so that she could pursue her career in academia. During her career in academia, balancing her time at work with her family obligations has hindered her publishing record and thus has hindered her productivity in academia. Within academia, Caroline has had colleagues who have served as sources of support and encouragement, and she has benefited from research collaborations with two male colleagues in a related discipline. Caroline has received encouragement and support from administration as well. Caroline also attributes her religious beliefs as having influenced her success, as she tries to put 100% into her work. She also finds teaching rewarding, and has gained encouragement from the teaching awards she has received during her time in academia.

Challenges

Caroline did not face any perceived challenges in her family of origin or in her elementary and second school years. Caroline does not recall being exposed to any gender-specific academic expectations at home or in school, and was never told directly or indirectly that there was something that she could not do academically because she was a female.

Caroline got married as an undergraduate, and the obligations resulting from her marriage and family have presented challenges throughout her graduate educational background and her career in academia. During her junior high and high school years

Caroline thought she would go to medical school. One factor that influenced her away from a career in medicine was that she was married, and she realized the difficulties going to medical school would place on her family. In addition, medical school would have meant relocating, and her husband had a secure job at their present location. Therefore, her choice not to relocate was one factor that influenced her away from medical school. However, her decision not to attend medical school meant other career options, such as a career in academia, were open for consideration. Thus, her choice not to move because of her marriage was a factor that contributed to her decision to choose a career in academia.

During her master's program, Caroline chose to remain at her undergraduate institution due to an unwillingness to move that came along with her marriage. Although she does not attribute the decision to stay at her undergraduate institution as having any significant influence on her academic career, remaining at this institution did result in her working on a thesis project outside her area of interest. Another institution may have offered research projects more consistent with her interests and thus may have contributed more to her knowledge of the discipline. In addition, this was a teaching college, as opposed to a more research intensive institution. If Caroline had chosen to relocate for her master's program to attend a more research intensive institution that offered projects addressing her area of interest, she could have entered academia with a line of established research and publications in her area of interest.

Caroline entered her Ph.D. program at a different institution. This was a research-intensive institution and, because she had earned both her bachelor's and master's

degrees at a teaching college, she may not have received the preparation needed for this research intensive institution. This institution was 45 minutes away from her home, and the drive and her commitment to family kept her from maintaining long hours at school. She would not compromise her family for her research. The commute, along with her commitment to family, resulted in lower research productivity. Near the end of her Ph.D. program, she had her first child. She took two months off from her research and then returned to finish her dissertation. Although Caroline had intended on working a lot on her dissertation while she was taking time off of from work with her baby, the time it took to care for a newborn was overwhelming and she did not feel like doing anything but being a mother. Thus, having a child during her Ph.D. program delayed progress on her dissertation and degree attainment.

Caroline chose a postdoctoral position close to home, and she continued to put her family first. She had one child when she began working in this position, and gave birth to her second child near the end of her postdoctoral position. Her commitment to family kept her from being able to spend enormous amounts of time in the laboratory, and being concerned about what was going on with her children kept her from being completely focused on her research. Thus, her commitment and obligations to family hindered her research productivity during her postdoctoral career. Spending more time at work may have resulted in a stronger line of research and publications in her field.

Balancing work and school with family obligations was the major challenge faced by Caroline during her academic background and postdoctoral career. Her major professor also presented a few challenges. He had a brusque personality and could be

belittling in his efforts to extract work from his students in the laboratory setting. His approach and actions sometimes discouraged Caroline, and she sometimes questioned whether or not she could finish her program. At the same time, however, this challenge also made her determined to prevail and finish her degree. This professor also exhibited gender discrimination toward Caroline toward the end of her program. After she returned from having her first child, he made a comment to Caroline about wanting to have it both ways, meaning that she wanted a career and a family. However, Caroline quickly defended herself and her professor did not present any other challenge with respect to this issue. Caroline recalls no other instances of discrimination in her academic background or academic career.

Within her academic career, balancing work with family obligations was the only challenge perceived by Caroline as hindering her success in academia. She is adamant about keeping regular work hours, and has chosen to be there for her children during important aspects of their lives and when they are sick. When Caroline leaves work everyday she has another job waiting on her at home, and her children always come first. Balancing work with family obligations has been a trade-off, and has resulted in lower productivity than if she worked the long hours characteristic of some faculty in academia. She has also considered the possibility of working in administration, but believes that she is limited to positions at her current institution, as she has chosen not to consider relocation due to her family obligations. She has not perceived any challenges during her career in academia, such as gender discrimination or sexual harassment, due to her gender.

Accomplishments

Caroline graduated from high school with a 4.0 grade point average on a 4.0 scale and was the co-valedictorian of her class. These accomplishments serve as evidence of her capability of being successful both in her subsequent college career and during her career in academia. As a result of her academic achievement, she also received an academic scholarship as an undergraduate, which served to promote her success as an undergraduate by providing financial support for her education. Toward the end of her undergraduate career, she was inducted into an honor society and graduated with high honors from her undergraduate institution. She also earned both a master's degree and Ph.D. in her discipline. Both of these accomplishments serve as evidence of her capability to be successful in her graduate programs and during her career in academia.

After earning her bachelor's degree, Caroline earned a master's degree and Ph.D. in her discipline. The attainment of each degree was an accomplishment that serves as evidence for her capability to be successful in academia. The completion of a postdoctoral position was also necessary in Caroline's discipline in order to obtain a job and conduct research at the university level. Therefore, the attainment and completion of her postdoctoral position made it possible to secure her current position in academia at a research intensive institution.

Caroline entered academia at her current institution as an assistant professor. Within her department, promotion and tenure depend heavily upon the attainment of grant monies and publications. During her career, Caroline has published numerous articles and has been awarded hundreds of thousands of dollars in grant monies, and

tenure and promotion in her department are based primarily on securing grant funding and publishing. Therefore, the attainment of grants and the publication of articles have served to promote her success in academia. Caroline has also received teaching awards during her career in academia. Caroline believes that her gift is teaching. The teaching awards she has received during her academic career have served as sources of encouragement for her because these awards have been based on her performance as a teacher.

Attributions to Success

Caroline's parents were both educated at the master's degree level, and held high academic expectations for her and her siblings. They always made sure that Caroline and her siblings completed their homework, and her parents monitored their children's academic progress to ensure that they were reaching their full academic potentials. It was always an expectation of her parents that Caroline would go to college, and neither Caroline nor her siblings ever considered any other option.

Caroline's father was a science teacher for several years, and Caroline admired both his intellect and his interest in science. She was around her father in his science laboratory and watched him work. Her admiration for her father and his interest in science, and her exposure to the laboratory setting, all served to stimulate her interest in science and influenced her choice to pursue a career in a branch of science.

Throughout her educational background, Caroline considered herself to be intelligent and scholarly. In high school, one female English teacher served as a contributor to Caroline's later success in her educational background and in her career in

academia. This teacher taught Caroline how to write proficiently and provided Caroline with a strong foundation in her writing skills. These skills were later honed in graduate school with the help of her major professor, who taught her how to write scientifically. Proficient writing skills have been necessary for success in Caroline's college degree programs and in her career in academia. Although her progress on her dissertation was delayed because of the birth of her first child, her writing skills enabled her to finish her dissertation quickly upon her return to school. Securing external funding through the acceptance of grant proposals and having papers accepted for publication are necessary for tenure and promotion in Caroline's discipline. Therefore, being proficient at writing has contributed to her success in completing her Ph.D. program and in performing the tasks necessary for her success in academia.

Caroline also attributed a female math teacher, under whom she had four years of high school math, as contributing to her success in high school. This teacher expected the best from all of her students and showed disappointment with they did not reach their full potentials. Caroline viewed this teacher as a no nonsense woman and was impressed with her ability to lecture. Although Caroline did not directly attribute the knowledge gained with respect to high school mathematics as contributing to her success in her college career, this foundation in mathematics was most likely beneficial in completing the required college mathematics courses both as an undergraduate and as a graduate student.

Caroline associated with intelligent classmates. Her two best friends in high school were scholarly as well, and they all competed in a friendly way for scholarly

awards in high school. Through this competition with her friends, there was always the desire to have the best grades in her class.

During her undergraduate career, Caroline was influenced academically by two male professors. The first professor taught a course that she teaches at her current institution. Caroline was impressed with the way he constructed a lecture, and with his organizational skills. He presented the material in such a way that helped Caroline to realize that, even though the material was difficult, it was still understandable as long as it was presented in a way students could grasp. This professor also understood whether or not his students understood the material he was presenting. His teaching skills and techniques promoted Caroline's interest in her discipline. He served as a role model for her in that she has modeled her approach to teaching after his. The second professor was a researcher with whom she worked in the laboratory setting. He was fun to work with in the laboratory but at the same time he got a lot accomplished in the laboratory. Her interactions with this professor served to promote her interest in research as part of her academic career.

Another male professor served as a role model and mentor for Caroline during her master's degree program. She considered this man a very normal and real person, but at the same time a very successful and accomplished scientist. Caroline values humility and normalcy, and has no tolerance for elitist attitudes. She was encouraged at the ability of this man to be so successful and still be a normal person. Through her interactions with this professor, Caroline realized that she too could be a successful scientist and still possess the humility and normalcy she believes to be important characteristics to display

in her career in academia. In addition, he has always been an advocate for her, and she believes that she can still call on him if there is ever something she needs.

During her Ph.D. program, Caroline's major professor influenced her in a few ways. This professor helped her learn how to write scientifically. Although she had received a strong foundation in writing in high school, writing scientifically is different from the style of writing taught in high school, and her professor aided her in this transition. This professor was very brusque, and sometimes Caroline believed that his approach to motivating his students was quite hard. Her experiences with his style of motivation led her to be somewhat of the opposite with her students. She does not want to hurt her students in her attempts to motivate them, and she believes he could be that way at times. In other words, through her interactions with this professor she learned what approach *not* to use in motivating students to learn.

Caroline's husband has contributed to her success both in her educational background and her academic career. During her master's and Ph.D. programs, Carol received a graduate stipend that provided financial support for her education. However, her husband had a full-time job and provided a major portion of the financial support for their family. After Caroline finished her postdoctoral position and could not find a desirable job near their home, her husband's willingness to move to a different geographic location so that she could have a career in academia also contributed to her success. Caroline would not have been willing to move without her husband and, if her husband had not been willing to relocate, she may not have secured a desirable position in academia.

During her career in academia, Caroline has encountered several influential persons who have served as sources of encouragement and support. Within her department, she has formed relationships with various persons who have served as friends and advocates. When something has happened to get Caroline discouraged, they have been there to encourage her. She believes that they are loyal friends and provide encouragement for her in her work.

Caroline has also received support from two male colleagues outside her department, in an affiliated discipline. The nature of Caroline's discipline has changed since she first entered academia, and these colleagues have helped her learn new areas of her discipline. These colleagues have also helped her graduate students with procedures and techniques with which Caroline was unfamiliar. Without the knowledge and expertise of these colleagues, and their willingness to help, Caroline may have been without the necessary knowledge to advance in her discipline. She has also published with these colleagues, which has served to promote her advancement in academia.

Caroline has also received encouragement from administration. At one point in her career she was encouraged both by her department head and higher administration to explore the possibility of administration as a career. One male administrator in particular was very supportive, encouraging her to go into administration if she chose that route. He chose to build people up rather than tear them down, and was always aware of any problems Caroline was facing in her career. He has always been supportive of Caroline in her career endeavors.

Caroline finds teaching a reward in itself and receives encouragement from her interactions with students. The depression and discouragement she felt when she caught a group of students cheating on a test, and the subsequent reversal of this depression and discouragement by an encouraging comment by a former student, is evidence that her rapport with students contributes to her job satisfaction at her current institution. Teaching performance is not a major consideration with respect to tenure and promotion in Caroline's department. However, a good rapport with students and the resultant contribution this rapport makes to her job satisfaction may have been influential in her decision to remain in academia for 15 years.

Another factor to which Caroline attributes her success is her deep religious convictions and beliefs. She believes that she needs to put 100% into everything that she does, including all aspects of her career in academia. Her religious beliefs are also related to her desire to be viewed as humble and normal person as opposed to displaying arrogant and elitist attitudes. The integrity that comes along with her religious values is also important to Caroline. She believes that a scientist is nothing without her integrity, and when publishing a scientist is basically publishing her word. Along with her ability to publish, the truthfulness of her published work has contributed to the significance of her accomplishments in academia.

Summary of Analysis

Caroline married as an undergraduate, and the obligations resulting from her marriage and family have presented challenges to her success both during her graduate educational background and in her academic career. She chose to remain at her

undergraduate institution during her master's program instead of attending a more research-intensive institution. During her doctoral program the drive to and from school and her commitment to family kept her from maintaining long hours at school. In academia, her commitment to family has resulted in lower research productivity than if she had kept longer hours at work.

Caroline was co-valedictorian of her high school class and was inducted into an honor society as an undergraduate. During academia, teaching awards have served as a source of encouragement for Caroline.

Caroline's parents held high expectations for their children. Caroline's father was a science teacher, and her experiences with him stimulated her interest in science. In high school, Caroline had an English teacher who taught her how to write proficiently. She also had an influential math teacher. Caroline was influenced academically during her undergraduate career by two male professors. In her master's program, a male professor served as a role model and mentor for her. Caroline's major professor in her Ph.D. program helped her learn how to write scientifically. Her husband has been influential to her success through providing financial support for their family while Caroline was pursuing her education. His willingness to relocate after she completed her post-doctoral position so that Caroline could pursue her academic career also contributed to her success. During her career in academia, Caroline has had colleagues within her department and members of administration who have served as sources of support and encouragement. Colleagues from a related discipline have helped Caroline to learn new

aspects of her discipline. She also attributes her success in part to her deep religious beliefs.

Cindy

Summary of Case Study

Cindy is a research professor at a doctoral degree-granting university, and has been in academia for approximately 10 years. Cindy grew up in a loving and supportive family, and the atmosphere was such that she and her siblings knew they were good and smart. Cindy's father was a role model for her. He loved to travel and, through his actions, taught Cindy how to carry out her goals.

Cindy went to an elementary school with poor academic expectations, and moved during middle school. The schools were harder there, but her parents obtained tutoring for her siblings. In high school she changed schools several times, but viewed it as something to be endured. Cindy entered college after graduating from high school and earned a bachelor's degree. After working briefly, she pursued her master's degree and then began her professional career.

Her path to academia was characterized by a series of events in her professional career that led her to pursue a career in research. During Cindy's professional career she was exposed to grant writing, and directed a program funded by grant monies. She met a female university professor who encouraged her to apply for a particular research grant, and when this grant was funded this professor was influential in Cindy securing a job in academia to manage her research project.

During Cindy's professional and academic careers she has been fortunate to have worked in environments where she is supported and left alone to do her work. Her current boss and her funding agency encouraged Cindy to pursue her Ph.D. for the advancement of her career, and she entered the Ph.D. program at her current institution. During her program, Cindy was treated by her professors as a colleague instead of a student. One male professor helped Cindy improve her writing skills, and another helped her overcome her fear of mathematics. She also worked with professors and colleagues on projects and articles, which helped her to learn how to publish.

Cindy's personality has also played a role in her success. She is driven, persistent, and focused on her goals. She is not easily discouraged, and is internally motivated to succeed. Cindy surrounds herself with intelligent people and benefits from mutual reinforcement in her personal relationships.

Challenges

Cindy does not recall being told by anyone at anytime in her family that there was something she could not or was unable do because she was female. In middle school, Cindy's family moved and the schools were bigger, better, and harder than her previous schools. This could have presented a challenge to Cindy academically, but Cindy's parents were conscious of their children's educational needs and got tutoring for them. In addition, she knew from traveling with her father and being exposed to different cultures that change was nothing to be feared. In high school, Cindy changed schools several times, but viewed it simply as something to be endured. The potential challenges faced

during Cindy's educational background were also kept from becoming a hindrance to her progress because of the expectation from her parents that she could succeed.

Cindy does not recall experiencing any form of gender bias in her educational background or in her professional and academic careers. She attributes this to many factors. She has had male bosses, but has also worked in environments with female management and female bosses. In these environments gender discrimination was not an issue. She also considers her profession one that is tolerant and open to human diversity. In academia, she works in a research area and not in an academic department, and there is no competition between colleagues for the attainment of external grant funding. The atmosphere is one of collaboration as opposed to competition, and colleagues support one another and applaud the each other's accomplishments.

There is also another Cindy may not have experienced challenges in her professional and academic careers. As a professor whose primary obligation is research, she is also not faced with the potential challenges that teaching classes, advising students, and performing service roles would pose if she were in an academic department.

Accomplishments

After graduating from high school, Cindy entered college and earned a bachelor's degree. After working briefly, she then earned a master's degree. These accomplishments serve as evidence of her capacity to be successful in academia. Her master's degree qualified her to work in various professional settings, one in which she applied for and received a research grant. The attainment of this research grant was an accomplishment that facilitated her entrance into academia, as she needed to be in a setting that provided

institutional support for her as she managed her grant project. In Cindy's case, her master's degree was sufficient for her to secure a position in academia. The attainment of her Ph.D. however, has served to facilitate the advancement of her career in academia because of knowledge she gained in this program with respect to conducting research, writing, and publishing.

Attributions to Success

Cindy grew up in a loving and supportive family. The family atmosphere was such that Cindy and her siblings knew that they were good, smart, and that with a little work they could do anything they wanted to do. Cindy's parents read to her and her siblings and had a library of books for them to read. Cindy's parents were both college-educated, and demonstrated the value of lifelong learning in their own lives. There was always the expectation by Cindy's parents that she and her siblings were capable of success in their academic endeavors and that they would go to college. Her parents encouraged their children to pursue their interests, whatever they may be.

Cindy's father was driven, outgoing, and persistent. He had his pilot's license, and would plan extravagant trips and invite his children to come along with him. Cindy's family was well-traveled and exposed to different cultures. She learned through her traveling experiences with her family that change was nothing to be feared. Therefore, traveling and being exposed to different cultures, along with the expectations of her parents that she could succeed, were influential in helping Cindy adapt to her middle school environment when her family relocated. Cindy's father also served as a role model for her. He taught himself how to coach various sports and demonstrated through his

actions that, when you have a goal, you develop a plan for that goal and carry out the goal. When situations arise while pursuing that goal, you deal with those situations that hinder your progress so that you can reach that goal. In other words, her father taught her how to successfully reach her goals in life.

Cindy's path to academia was characterized by a series of events that followed the attainment of her master's degree. She initially changed jobs several times while exploring her options in the field, and eventually had a job that entailed directing a program funded by a grant which had to be renewed annually. This exposed Cindy to grant writing, a skill which is imperative to her continued success in academia. Cindy was interested in making the most out of the grant money provided and in utilizing the program effectively, so she kept up with the literature related to her program and collected and analyzed data reflecting the effectiveness of the program. This was not required by her funding agency, but through her motivation to make the program a success she turned her evaluation of the program into research. Later Cindy applied for another grant, and received this as well. These experiences within her professional career not only served as facilitators leading her to her path in academia, but provided her experience in performing the grant-writing and research skills she would need to be successful in a career in academia.

While still directing her program, Cindy met a female university professor who served as a mentor for her. Cindy expressed to this mentor an interest in conducting research and shared an idea for a research project. This mentor encouraged her to apply for the grant and helped Cindy write and edit the proposal. When this grant was funded,

Cindy sought out a university to manage her grant program, and this mentor both suggested an institution where Cindy would receive the institutional support she need to run the grant and recommended her to this institution. Cindy secured a research position at this institution and has worked there for approximately 10 years. The encouragement and support that this mentor provided for Cindy contributed to her receiving this grant and was the reason Cindy entered academia at her institution.

During Cindy's professional and academic careers, she has had bosses that have not only hired her but trusted her to do her job without interference. They have expressed appreciation for her work, recognized her skills, and have supported her in the workplace. Cindy is most productive when she is supported, encouraged, and left alone to do her work. Therefore, her bosses' treatment of her has contributed to her success both in her professional career and in academia. Her current boss, along with her funding agency, encouraged her to pursue her Ph.D. for the advancement of her career. Other contributing factors to her decision to pursue her Ph.D. were that she managed her own projects and her own time and could attend classes whenever they were offered, and her institution paid for her classes.

During Cindy's Ph.D. program she worked with several male professors and colleagues that contributed to her success in the program and in her career in academia. In one class, her professor gave the class frequent writing assignments with constructive feedback, which helped Cindy improve her writing skills. Cindy also worked with other professors and colleagues on research projects and articles. Through her work with these professors and colleagues, she learned skills related to publishing that she did not learn in

graduate classes. These included skills such as how to write a cover letter, how to set up a paper in journal article format, and how to respond to reviewer's comments about an article. Securing grant funding through writing proposals is essential to Cindy's continued success in academia, and writing publications is one of her job responsibilities. Therefore, the influences of these people in helping Cindy strengthen her writing and research skills, along with the knowledge she gained in learning how to publish, promoted the advancement of Cindy's existing career in academia.

Cindy also had an influential statistics teacher who helped her overcome her fear of mathematics. He taught her how to stop, think about the problem, and not get overwhelmed by the problem. The influence of this professor contributed to her success as a researcher in academia because the application of statistical techniques is necessary when conducting research in Cindy's field.

Cindy's personality has also contributed to her success both in her professional and academic career. Cindy is driven and persistent like her father, very focused on her goals, and puts a lot of energy and effort into her work. She always tries to do her best, and is not easily discouraged. When she encounters a barrier to her progress, she formulates an alternate plan so that she can overcome the barrier. This aspect of her personality is also like that of her father. Cindy believes that it is a force in her that wants to do well, and she is internally motivated to succeed in her career endeavors. In Cindy's personal life, she surrounds herself with intelligent people with professional goals and global perspectives on life. Because Cindy's friends are professionals themselves, they

can relate to the issues Cindy faces in her career. The mutual reinforcement characteristic of her personal relationships provides moral support for Cindy in her career in academia.

Summary of Analysis

When Cindy was in middle school her family moved, and the new schools were bigger, better, and harder than her previous schools. However, her parents obtained tutoring for her, and she knew from traveling with her father that change was nothing to be feared. She changed schools several times in high school, but viewed it simply as something to be endured.

The attainment of her master's degree qualified her to work in various professional settings, one in which she applied for and received a research grant. The attainment of this research grant facilitated her entrance into academia. The attainment of her Ph.D. after entrance into academia served to facilitate the advancement of her academic career.

Cindy grew up in a supportive family, and the atmosphere was such that she and her siblings knew they were good, smart, and with a little work they could do anything they wanted to do. Her father served as a role model for her and, through his actions, taught her how to successfully reach her goals in life. Cindy's path to academia was characterized by a series of events. During her professional career she was exposed to grant writing, and met a female professor who encouraged her to apply for a research grant. When this grant was funded, Cindy sought a university to manage her grant program, and this female mentor recommended Cindy to her current institution. During Cindy's professional and academic careers, she has had bosses who have trusted her to do

her job and have expressed appreciation for her work. During her Ph.D. program, several male professors and colleagues contributed to her success in the program. Cindy also worked with professors and colleagues on research projects and, through her work with them, learned skills related to publishing. Cindy's personality has also contributed to her success. She always tries to do her best, and is internally motivated to succeed in her career endeavors.

Minnie

Summary of Case Study

Minnie is an assistant professor, and has been in academia for approximately three years. Minnie grew up in a loving and supportive family which included her father and her extended family. Her father pushed her to be independent and think logically, and both her father and extended family pushed her academically and held high expectations for her. Minnie's father was in the military and she attended a variety of schools growing up. In high school she received a science and engineering award that encouraged her to consider a career in one of these fields, and she received hands-on experience in a branch of science.

As an undergraduate Minnie received scholarships to college and lived in the honors dorm. In this environment she was around people with the mindset that they were going to work hard and do well. Minnie began her undergraduate career considering a degree in medicine, but through the influence of a male mentor and the consideration of the time medical school would take, she chose to pursue another branch of science.

Minnie encountered a female mentor during her undergraduate career who demonstrated to Minnie that a woman could still be feminine and ladylike and still be successful in the field.

Minnie worked for a brief period of time after she finished her bachelor's degree, but soon decided to pursue the Ph.D. She received a graduate fellowship that supported her financially through her program. Minnie's major professor in her Ph.D. program was supportive and flexible with respect to her work in the laboratory, but still expected a lot from his students. She worked with a female professor in a related discipline who helped Minnie improve her writing skills. Another influential person in Minnie's graduate career was a female professor who showed Minnie that it was possible to be who she was, be well-rounded, and still be successful in academia. After Minnie attained her Ph.D., she secured and completed a postdoctoral position.

During her career in academia, Minnie has faced challenges from various sources, such as a lack of support from one male administrator, disrespect from students, and lack of respect and support from staff in her department. Minnie has found encouragement from a female administrator in her department and from a fellow female professor.

Challenges

Minnie does not recall experiencing any major challenges as a child in the home or at school. She was not exposed by her family to any gender-specific academic expectations. In high school, she does recall overhearing some teachers commenting on how girls usually did not perform well on an army entrance test all students were required to take, but Minnie scored very well on the test.

Minnie does not recall experiencing any major challenges as an undergraduate. At one point in graduate school, she did have a family crisis that took away from laboratory time, but her major professor was understanding and flexible. He allowed her to make up the time she missed at work in the laboratory, so this crisis did not significantly hinder her progress in graduate school.

The majority of the challenges to success that Minnie has faced in her life history have been experienced within her career in academia. One male administrator posed a significant challenge to Minnie in her academic career. He has discounted her ideas, has failed to address her issues of concern, and has shown a general lack of support for Minnie. Minnie believes his actions are in part due to his lack of knowledge about issues facing women and a lack of knowledge and experience as an administrator. She sometimes finds this treatment discouraging, and during really low periods may desire to leave work early or not even come in because she is so discouraged. The time she spends away from work could be spent on research or publishing tasks that are important in tenure and promotion in her field. Therefore, the cumulative effects of this administrator's lack of knowledge and experience, and resultant differential treatment by this administrator, sometimes serve to decrease her productivity at work and hinder her success in academia.

The disparate treatment of Minnie by staff members in her department has also presented a challenge to Minnie. She believes their actions toward her are influenced by her gender and relatively young age. These staff members constantly question her in terms of her paperwork and procedural requests. Minnie also believes that she has to do

more of her paperwork than male faculty, as the staff do the paperwork for males. The time she spends doing this paperwork could be spent performing professorial duties such as research and publishing, which are important considerations in tenure and promotions. Therefore, this treatment by staff serves to hinder her success. The constant questioning in terms of her paperwork and procedures may also delay the completion of her paperwork and requests necessary for Minnie to carry out her duties as a professor.

There have been several instances during Minnie's academic career in which students have been disrespectful to her. One male student interrupted a meeting between Minnie and a colleague and persistently insisted on using her stapler. She also gets called "Miss" rather than "Doctor" more often than not. There has been one male student whom Minnie considered emotionally fragile and a little too familiar with her, and she was concerned for her own protection. The actions of these students have not served as a significant hindrance in Minnie's career, but she has considered them a nuisance.

Accomplishments

Minnie received an achievement-based science and engineering award in high school. Before she received this award, her plans were to major in English in college. However, the receipt of this award encouraged her to consider a career in one of these fields. Minnie began her undergraduate education after completing high school, and received scholarships. These scholarships supported her financially through her undergraduate career. Because of the financial support these scholarships provided, Minnie did not have to maintain employment. Therefore, she had more time to concentrate on her studies than if she had worked.

Minnie received a graduate school fellowship that provided her financial support during her Ph.D. program. Minnie's attainment of her bachelor's degree and Ph.D. serve as evidence of her capability for success in academia, and the attainment of her Ph.D. qualified her for a position as assistant professor at her current institution. Within her academic career, Minnie has received hundreds of thousands of dollars in grant funding and has published several articles. Tenure and promotion within Minnie's department depend heavily upon research productivity, so these accomplishments have served to promote her success in academia.

Attributions to Success

Minnie grew up in a loving and supportive family who pushed her academically and held high expectations for her. It was acceptable for the other school-aged children in her extended family to come home with poorer grades or rush through their homework without completing it correctly, but Minnie's family expected her to excel academically. Her father was a military man, and pushed Minnie to be independently and to think logically.

Minnie changed schools several times during her elementary and middle school years. In high school, she attended a school whose admission and continued attendance were based on student achievement. The bar was set pretty high at this school and all students, male and female, were expected to excel academically. Therefore, Minnie was exposed to high academic expectations in the home and in her high school. In high school, Minnie had the opportunity to receive hands-on experience in a branch of science.

This experience, along with the science and engineering award she received, served to stimulate her interest in pursuing a profession in science.

Minnie was in the honors program at her undergraduate institution and, because of this, lived in the honors dorm. In the honors dorm she associated with students who were also in the honors program. They studied together and went to class together. Minnie attributes going to a high school with high academic standards and the environment provided by the honors dorm as motivating her to excel academically, as she was around fellow students who had the mindset that they were going to do well and work hard. In addition, the honors dorm provided Minnie with the structure she needed to excel academically. She believes that if she had been in a freshman dorm in which students partied every night she probably would have flunked out during her first year of college.

Minnie began her undergraduate considering a career in medicine. However, a few factors resulted in her deciding not to pursue a career in medicine, but her Ph.D. instead. Minnie was dissuaded by the long amount of time it would take to become a medical doctor. In addition, a male professor encouraged her to pursue her Ph.D. as opposed to a career in medicine. In addition to the influence this male professor exerted over Minnie's decision not to pursue a career in medicine, he was also very demanding and held high expectations for his students.

Minnie also had a female professor that served as a role model for her during her undergraduate career. She was a distinct and proper woman, always wore skirts and heels, and was very ladylike. This demonstrated to Minnie that a woman could still be

feminine and ladylike and still be successful in her field. This professor also exhibited high expectations for students both academically and with respect to her students' conduct. Minnie worked for a semester after she finished her bachelor's degree, and her realization that she would not be happy with a bachelor's level position in her field and the encouragement from co-workers motivated her to apply for a Ph.D. program in her discipline.

Minnie's major professor in her Ph.D. program expected a lot from his students with respect to their work in the laboratory, but was also supportive, flexible, and understanding. At one point during Minnie's Ph.D. program, she had a family crisis and had to be out of the laboratory at times to tend to family matters. Although this major professor expected Minnie to make up the work she missed, he was flexible in that he allowed her to make up the work on her on time and was very understanding of her situation. Later in her program when she expressed to him an interest in a career in academia, he provided her with exposure to various aspects of the type of work she would be doing in academia, such as grant writing.

Minnie believes that she learned her basic writing skills in high school, but that they were improved in graduate school as a result of working on a paper with a female professor in an affiliated discipline. Minnie worked on her first paper in graduate school with her major professor and this female professor. This professor provided her critical analysis and feedback of her writing. Proficient writing skills are necessary in Minnie's field to have grant proposals accepted and articles published. Minnie's department depends heavily upon research, and the attainment of external grant funding for supplies

and equipment with which to conduct research is crucial in her discipline. Therefore, the sharpening of her writing skills under this female professor has contributed to her success in academia.

Another influential person in Minnie's graduate career was another female professor who continues to serve as a role model for Minnie. This professor was well-rounded, well-integrated, and very feminine. This role model has shown Minnie that it is possible to be a well-rounded woman in academia. In addition, Minnie views this professor as an encouraging person who always has a positive outlook.

Within her career in academia, Minnie has found support from various female colleagues at her institution. One colleague is an administrator who has shared with Minnie different stories about rising in the ranks of academia and dealing with gender issues along the way. She has helped Minnie to realize that the issues she faces in academia are not personal, but that any other woman in Minnie's shoes would be dealing with the same issues Minnie has to deal with in her job. Another colleague that has served as a source of encouragement for Minnie is a professor in a related field. This colleague has two small children and finds encouragement in seeing this colleague balance work with family. Minnie and this colleague also share stories about work and support one another.

Summary of Analysis

The majority of the challenges to success that Minnie has faced in her life history have been experienced within her academic career. One male administrator has shown a lack of support for Minnie. The staff in her department constantly question her in terms

of paperwork and procedural requests. There have been several instances in her academic career when students have been disrespectful, and the actions of one student have made her concerned for her safety.

Minnie received an achievement-based award in high school that influenced her decision to pursue a career in a science or engineering field. She received scholarships to college as an undergraduate and a graduate student fellowship.

Minnie grew up in a supportive family who pushed her academically and held high expectations for her. Her father pushed her to be independent and think logically. In high school, the bar was set high, and all students were expected to excel academically. Minnie lived in the honors dorm at her undergraduate institution and there was associated with students who had the mindset that they were going to do well and work hard. Minnie had a male professor who encouraged her to pursue her Ph.D. and a female professor who served as a role model for her. During her Ph.D. program, her major professor was supportive and held high expectations for her. She worked with a female professor in a related discipline who helped her improve her writing skills, and another female professor served as a role model for her. During her career in academia, Minnie has found support and encouragement from various female colleagues and a female administrator.

Brittany

Summary of Case Report

Brittany is an assistant professor at a doctoral degree-granting university, and has been in academia for approximately three years. Brittany's mother, who held a Ph.D. in a branch of science, was influential in several ways. She expected Brittany to work hard in all her endeavors and let her try to solve problems on her own as opposed to solving them for her. She also served as a role model for Brittany, and provided her with hands-on experience in conducting scientific research. Brittany had an older brother who played tricks on her and sometime made her think she was stupid. As a result, she became very competitive with him, and always wanted to be the best at everything she did.

Brittany went to military school during the last part of her high school year. During her undergraduate career, two male professors were influential in Brittany's success. One professor impressed her with his good intentions towards others. The other professor was one under whom she worked as a research assistant. Brittany married right before she entered her Ph.D. program, and received a graduate fellowship in her program. Her major professor was sometimes rude and verbally abusive, and a fellow graduate student took Brittany under his wing. Brittany believes that the funding from her fellowship kept her from becoming a liability to her major professor. As she progressed through the program, she also gained a sense of purpose from serving as a role model for other graduate students.

When Brittany finished her Ph.D. program, her husband was ready to settle down and find a home, so Brittany chose not to secure a postdoctoral position. She believes that

if she had completed a postdoctoral position before entering academia as a faculty member, she could have gotten a job at a higher-ranked institution. During Brittany's career in academia she has faced considerable challenges. Her department head and staff accommodate a certain group of male faculty. She has had some adverse encounters with male students, and has experienced a lack of support from colleagues and administrators with respect to addressing these instances.

Within academia, Brittany has received advice from a female colleague on how to write grants. This colleague has also been a person with whom Brittany can talk about the problems she has faced in academia. A male administrator has also offered Brittany advice on how to write grants, and has been an advocate for her and has been influential in helping her secure a grant. This administrator has also been an advocate for her. Brittany has considered moving to industry or seeking a position at a comparable institution. However, she realizes that she must gain the expected credentials at her current institution before securing a faculty position at a comparable institution.

Challenges

Brittany does not recall experiencing any major challenges as a child in her home, during her elementary and secondary years at school, or as an undergraduate in college. She does not recall being exposed to gender-specific expectations as a child, and did not experience any form of gender discrimination until she began her career in academia.

Brittany does believe that the exposure as a child to her mother's intolerance for laziness, and the expectation that Brittany work hard in all her endeavors, has had an adverse influence on her in her career. Brittany is always stressed and works all of the

time. When she encounters a problem that may not have a solution, such as some of the problems she has faced in academia, she is persistent in trying to find a solution, and this keeps her diverted from her work. This is Brittany's explanation, but other factors may play a role as well. As a child, Brittany loved mathematics in part because it was absolute. In high school, she was attracted to military school because it was ordered, structured, and she could predict everything that was going on in her life. To the extent that Brittany functions optimally under such conditions, this personal characteristic may have some influence over her performance and job satisfaction in academia. This is because the work environment she described is not always ordered, structured, or characterized by absolutes, and the outcomes of different situations may not always be predictable.

Brittany's undergraduate institution was known for being an applied school, and they only taught mathematics up to a certain point. Brittany therefore left her undergraduate institution with a gap in knowledge with respect to an area of mathematics important in her discipline, and she struggled with some of her graduate classes. This could have posed a hindrance to Brittany's academic progress in graduate school. However, Brittany and her graduate classmates worked in groups on their assignments, and during these sessions two students from foreign cultures with strong backgrounds in mathematics helped her learn the mathematics she needed for her discipline.

During her Ph.D. program, Brittany's major professor was very critical, rude, and sometimes verbally abusive to her. He was from another culture, and his behavior was particularly bad towards American students. A male graduate student already established

in the program took Brittany under his wing when she entered the program, and his support curtailed the hindrances to her success in graduate school that her major professor could have caused due to his lack of support for Brittany.

Brittany's choice not to pursue a postdoctoral position before entering academia as a faculty member may be a factor that has hindered career success. She had been invited to interview for a postdoctoral position and was excited about the prospect, but her husband was not enthusiastic about this option. He told her that she could chose the option if she really wanted to, but he was ready to get settled and find a home. A postdoctoral position would have likely meant they would have to had relocated for this position and then again for a faculty position in academia. Brittany believes that if she had chosen to complete a postdoctoral program before entering academia as a faculty, she may have been able to secure a position at a higher-ranked institution.

During her academic career, Brittany has faced considerable challenges. Within her department, there is a privileged group of male faculty, and Brittany believes that it is the mindset of both the department head and the staff to accommodate these male faculty members, even if it is disadvantageous to other faculty. For example, Brittany was once asked to teach a class normally taught by a member of this privileged group simply because he wanted to teach another class. This was despite the fact that the course Brittany was asked to teach was out of her area of expertise. In another instance, the department accepted a male graduate student without proper credentials because this privileged group wanted him in the program. This student's conduct was horrific, and at

one point he yelled at one of Brittany's graduate students, calling her stupid. The department did not address this situation.

Brittany has had several adverse encounters with male students during her academic career. She had students heckle her in class and others who where physically intimidating, standing over her desk and pointing their fingers at her. She also had a student to stalk her and yell profanity to her in class. She has received a lack of support from some colleagues and administrators with respect to these instances. It has not been the occurrence of these behaviors that have been damaging and frustrating to Brittany, but rather the lack of support from these colleagues and administrators, and what she perceives as the inability of the institution to address any situation.

Both the experiences she has had in her department with the department's advocacy for the privileged group of male faculty, and the lack of support from some colleagues and administrators with respect to adverse encounters with students have hindered Brittany's success in academia. She has felt depressed and has experienced a decrease in self-esteem, which has led to a lack of productivity at work. After her first year at her institution, Brittany contemplated applying to another institution, but has no new publications due to the lack of work productivity that resulted from being depressed and having low self-esteem. The next year she considered it again, but still had no new publications. Therefore, these experiences have not only hindered her success at her current institution but also her ability to secure another position at a comparable institution. Brittany has considered moving to industry as a result of her adverse experiences in academia.

Accomplishments

Brittany graduated from high school with high honors and from her undergraduate institution in the top five of her class in her major. These accomplishments serve as evidence of Brittany's capability for success in academia. Brittany was awarded a graduate fellowship that provided financial support for her during her Ph.D. program. This fellowship was funded externally, and paid for her tuition and stipend. She believes that this external funding contributed to her persistence in graduate school because if she had not had this, she may have become a liability to her major professor. Since her major professor did not have to fund her tuition and stipend, her major professor benefited from her work in the laboratory without paying for it himself.

During her career in academia, Brittany has published several articles and secured hundreds of thousands of dollars in grant monies. Tenure and promotion in her department are based heavily upon publications and external grant funding. Therefore, these accomplishments have contributed to her progress in academia.

Attributions to Success

Brittany's mother contributed to her success in several ways. Her mother held a Ph.D. in a branch of science, and worked in academia first as a professor and then as an administrator. Brittany's mother provided her with hands-on experience in conducting scientific research and served as a role model for Brittany. She sometimes took Brittany out to the field with her while conducting research, and allowed Brittany to help with the field work. When she was in high school, her mother had Brittany to read parts of her manuscripts and would discuss them with Brittany. Her mother's knowledge of the

underrepresentation of women in science and engineering fields was manifest in her parenting. Her mother had read that women did not go into science and engineering because it was the tendency of their parents to solve problems for them, but to allow boys time to solve problems on her own. Brittany's mother did the opposite, allowing Brittany to solve problems by herself.

The firsthand knowledge Brittany's mother possessed concerning the importance of a research background upon entering a graduate program was also beneficial to Brittany. When Brittany entered her undergraduate university her mother told her that if she was going to graduate school she needed to get involved with research as an undergraduate. She told Brittany to go to the main office of the department and inquire about what types of research were conducted and to decide what research she was interesting in practicing as an undergraduate. This resulted in her securing a position as an undergraduate research assistant, which provided her exposure to scientific research as an undergraduate.

Brittany's mother was very critical of laziness. Her mother's parents were farmers and had a very strong work ethic, and Brittany's mother practiced this work ethic as well. She expected Brittany to work hard in all of her endeavors, and through this expectation of hard work and the work ethic displayed by her mother, Brittany was taught to work diligently in all of her endeavors. Brittany's mother also taught Brittany to make good grades in school for Brittany's own satisfaction, and not from some external reward. She did not reward Brittany for high marks, but told her that she made those grades for herself and not for anyone else.

Another familial influence in Brittany's life was her brother. He played tricks on her and made fun of her, and she became very competitive with him as a result of his treatment. Brittany always had one of the highest grades in her classes, and this was in part because of her desire to surpass her brother's accomplishments. She always wanted to be the best at everything she did and to outperform everyone else.

Brittany's military school background served to influence her progress as an undergraduate. When she entered her undergraduate institution, she had become accustomed to the structured schedule in military school, and her adherence to this schedule helped her to adapt to life at her university. Instead of keeping inconsistent hours as some undergraduate students, she still got up at 5:30 or 6:00 in the morning and tried to go to sleep at 10:30 at night. She would also come home from school and start on homework, just as she had done in military school.

During Brittany's undergraduate career, two male professors influenced her success as an undergraduate. The first was a professor under whom she took a course, and Brittany viewed him as a very personable and encouraging person, and a good instructor. This professor served as a role model for Brittany. She was impressed at his unwavering good intentions towards others even though some have not had good intentions towards him. The influence of this professor went beyond her undergraduate career, as he helped her choose options for graduate school and was later influential in helping her secure her current position in academia. The second professor gave Brittany a job as an undergraduate research assistant, and this provided her with experience in conducting research in her discipline. In addition, this professor was always there for

Brittany when she needed to talk about problems in her classes, and helped her choose possible options for graduate schools.

During her Ph.D. program, Brittany found support and encouragement from several male graduate students in her discipline. One male graduate student became a friend and mentor for Brittany. He had the same major professor and had experienced the sometimes harsh treatment this professor. He listened to Brittany when she was struggling with this professor and, because he had experienced it himself, could empathize with her situation. This fellow student also helped Brittany learn how to utilize computer technology necessary to master certain aspects of her discipline. Brittany also benefited from working in groups on her mathematics class assignments. Since Brittany had a critical, rude, and verbally abusive advisor that did not provide much mentorship or support to Brittany, the moral support provided by this friend may have been influential in her staying in the program despite the actions of her major professor.

Brittany had left her undergraduate institution with a weak background in an aspect of mathematics important to her discipline, and two male students from foreign cultures helped the other group members learn the mathematics. The assistance from her male friend in helping her to learn technology necessary for her field and the assistance of the male students in her study group in learning mathematics likely contributed to her ability to remain in her program.

Although Brittany's major professor served as a challenge to her during her graduate career, he did contribute to her knowledge of how to publish. It was with him she published her first article. He gave her feedback on her writing and advised her to

follow the format seen in other articles when writing manuscripts for publication. Since publications are an important consideration in tenure and promotion in academia, the knowledge gained from working with him has served to promote her success in academia.

When Brittany entered her doctoral program, she was the youngest student in her class. As she progressed through the program, she became a role model for Ph.D. students who entered the program in subsequent years. This gave Brittany a sense of purpose, and also helped her to see how far she had progressed in her program. Serving as a role model and the realization of the significant progress she had made in her program served as motivation for her to finish her Ph.D.

During her career in academia, Brittany has received support from a female professor in her department and from a male member of administration. The female professor has had several grant proposals funded and has given Brittany advice on how to write grant proposals. This professor has also been a person with whom Brittany can talk about the problems she has faced during her academic career. The male administrator has also offered Brittany advice on how to write grant proposals, and wrote a persuasive letter of support to the funding agency of one grant she was awarded. He has also been an advocate for her, and is advocating the implementation of policies which address the issues faced by women in Brittany's discipline.

Summary of Analysis

Brittany left her undergraduate institution with a gap in knowledge with respect to a certain aspect of mathematics needed in her discipline, and struggled with some of her

graduate classes. In her Ph.D. program, her professor was critical, rude, and sometimes verbally abusive. Brittany believes that is she had chosen to complete a postdoctoral position prior to beginning her academic career she may have been able to secure a position at a higher-ranked institution. Brittany has faced considerable challenges during her academic career. These challenges include those resulting from the accommodations her department makes for a privileged group of male faculty, several adverse encounters with students, and a lack of support a lack of support from colleagues and administration with respect to these encounters with students.

Brittany was awarded a graduate fellowship during her Ph.D. program. This fellowship was externally funded, and provided her with financial support during college. She also believes that this external funding contributed to her persistence in graduate school because, if she had not had this funding, she may have become a liability to her major professor.

Brittany's mother contributed to her success in several ways, such as holding high expectations for Brittany and providing her with hands-on experience in conducting scientific research. Brittany's brother made fun of her and, as a result, she became very competitive with him. During Brittany's undergraduate career, two male professors influenced her success. One of these professors served as a role model for Brittany, and he was later influential in helping her secure her current position in academia. The second professor gave Brittany a job as an undergraduate research assistant, which provided her with experience in conducting research. During her Ph.D. program, Brittany found encouragement and support from several male colleagues. Serving as a role model for

other graduate students and the realization of the progress she had made served as motivation for her to finish her Ph.D. During academia Brittany has benefited from the support of a male administrator and female colleague.

Cross-Case Analysis

There were three criteria used in this study used to select participants. First, the participants had to be female. Second, the participants had to hold a doctoral degree in a science or engineering field. Third, the participants had to hold a position in a science or engineering field at a doctoral-degree granting university. Seven participants meeting these criteria participated in this study. Two participants were from the same discipline, and the other five participants were from five different disciplines. Therefore, these participants represented six science and engineering disciplines. The demographics of the participants in this study are found in Table 3.

The cross-case analysis of data is divided into four sections: (a) challenges, (b) accomplishments, (c) attributions to success, and (d) summary of analysis. The first three sections are based upon the three areas examined in this study. In each of these sections, themes emerging from the data with respect to influences on the success of women in academia will be discussed. At the end of each section, a summary of the section will be presented. A summary of the cross-case analysis of data will also be presented.

Challenges

Four themes emerged in the cases with respect to challenges that influenced the success of the participants: (a) no perceived academic limitations during their elementary

Table 3: Demographics of Participants

Name	Years in Academia	Professorial Rank	Marital Status	Number of Children	Degree-Level of Spouse	Degree Level of Parents[a]	
						Mother	Father
Elaine	30	Professor	Married	2	Ph.D.	Bachelor's	Master's
Pauline	25	Associate	Married	1	Ph.D.	None	Master's
Jane	17	Professor	Married	2	Ph.D.	None	None
Caroline	15	Associate	Married	2	Master's	Bachelor's	Master's
Cindy	10	Research	Single	0	N/A	Bachelor's	Master's
Minnie	3	Assistant	Single	0	N/A	N/A	Some
Brittany	3	Assistant	Married	0	Master's	Ph.D.	Ph.D.

[a]Indicates highest college degree level completed. If parent did not attend college, this is indicated by "None." If parent attended college but did not earn a bachelor's degree, this is indicated by "Some."

and secondary years, (b) no other challenges during the elementary and secondary school years that hindered achievement in their educational background or their path to academia, (c) no gender-related expectations in the family background, and (d) no gender-related academic expectations or discrimination in graduate school that hindered success in graduate programs or the path to academia. It is important to note that these four themes are characterized by the *absence of* perceived challenges to the participants' success. How the absence of these challenges may have influenced their success will be discussed within the context of each theme.

All seven participants indicated that they never perceived any academic limitations for themselves during their elementary and secondary years because they were female. In all seven cases, the participants were never told directly or indirectly that there was a subject (e.g., math, science) that they could not or should not take because they were female, or that there was *any* academic endeavor that they could not achieve. In fact, all participants indicated that they were exposed to quite the opposite message. All participants reported that their families expected them to excel academically, regardless of the academic endeavor that they were seeking to accomplish. Therefore, the participants had no perceived limits in their abilities, which contributed to their academic achievement during their elementary and secondary years because they believed that they were capable of success.

In a similar theme, six of the participants indicated that they were never exposed to gender-related academic expectations, discrimination, or any other challenges during the elementary and secondary school years that hindered achievement in their educational

backgrounds or their paths to academia. It is important to note that reference to elementary and secondary backgrounds, for the purpose of this discussion, is limited to in-school experiences. The one participant who did experience a notable challenge was Cindy, who struggled academically after changing to a more difficult school during middle school. This did not hinder her long-term, however, because her parents obtained tutoring for her. There was no indication that this experience hindered her path to academia. The general lack of challenges in the elementary and secondary backgrounds of the participants meant that they were not exposed to any factors in school (e.g., gender discrimination in classes, being prohibited or discouraged by teachers from taking advanced math or science courses) that may have stifled their progression to college or influenced their choice of majors in college. Therefore, the general lack of gender-related academic expectations during their elementary and secondary years may have contributed to their choice to attend college and their choice of traditionally male-dominated college majors in the science and engineering professions. Although Cindy did experience a challenge in middle school, there were no indications that this challenge hindered her choice to attend college or her choice of disciplines.

Five of the participants indicated that they did not experience any gender-related expectations in their family backgrounds. These participants did not believe their parents held any disparate expectations for them, academic or otherwise, because they were female. In fact, some of the participants engaged in non-stereotypical play and other activities, and were never discouraged by their parents from engaging in these activities. The general absence of gender-related expectations may have contributed to the

participants' success both in school and career by supporting their belief that there were no limitations to their endeavors based upon their gender and that they were thus capable of success in science an engineering fields, some of which are traditionally male-dominated at all degree levels and in academia.

Jane and Elaine did experience gender-related assumptions with respect to their careers. Jane's mother made her take typing, bookkeeping, and shorthand in high school with the expectation that she would become a secretary. However, Jane became a teacher and eventually a university professor. Elaine was told by everyone that she would follow the career paths of three female members of her families and become a teacher. In Elaine's career as a professor teaching is *one* of the duties, but she teaches college students in a university setting as opposed to teaching in an elementary or secondary setting. Her career involves research and service duties as well. Neither Jane nor Elaine chose the career path expected of them by their families and thus these expectations did not hinder their path to academia.

All seven participants indicated that they were not exposed to any gender-related academic expectations or discrimination in graduate school that hindered success in graduate programs or their paths to academia. Caroline was told by her major professor that she wanted to have it both ways—be a mother and have a career—but this comment did not hinder her progress in any way. Otherwise, none of the participants indicated that they were in any way disadvantaged in graduate school due to gender-related academic expectations or gender discrimination. Therefore, there were no hindrances posed to these participants in graduate school due to gender bias. This lack of exposure to gender bias

may have contributed to their success in graduate school because there were no obstacles placed in front of them due to gender bias. The lack of gender-related expectations and discrimination may have also contributed to the belief in their ability to be successful in their chosen fields.

Four additional themes emerged in four cases with respect to challenges that influenced the success of the participants: (a) one challenge was posed during elementary and secondary years, but did not delay progress to college (b) one or more challenges were posed as an undergraduate that influenced success, (c) challenges were posed by male colleagues or administrators within their respective disciplines, and (d) all four participants with children had more traditional household and child-rearing responsibilities within their academic careers than did their husbands. How these challenges may have influenced the success of the participants will be discussed within the context of each theme.

There were very few perceived challenges posed to the participants during their elementary and secondary years, but four participants did experience one challenge noteworthy of discussion. These challenges, however, did not delay their progression to college. Elaine had bad science teachers in high school, and she believes that this did influence her away from a career in the physical sciences. Her father's influence as a scientist did counteract some of these adverse influences. Pauline changed schools during her elementary years, and the students at her new school made fun of her. However, this potential challenge actually contributed to her academic success, as being made fun of by her peers made her delve into the books even more, seeking academics as a refuge. Cindy

changed schools in middle school, and the school was bigger, better, and harder than her previous school. However, this challenge to her academic achievement was addressed by her parents, who obtained tutoring for her. Jane attended a small school where there were little opportunities for advanced math and science. This made her undergraduate classes in math and science more difficult, but the support and encouragement she received from the women in her classes counteracted the potential adverse influence her weak science and math background may have exerted on her undergraduate achievement.

Four participants were posed with challenges as an undergraduate that influenced their later success in various ways. Pauline attended a Christian college whose values concerning logic and evolution were in sharp contrast to her beliefs, and was completely discouraged during her four years at this college. She lost her self-confidence, and did not believe herself good enough in her field to pursue a graduate degree. If it had not been for a male classmate who encouraged her to apply for graduate school and displayed confidence in her abilities, this challenge may have permanently halted her success. Brittany's undergraduate institution was known for being an applied school, and they only taught mathematics up to a certain point. Therefore, she left her undergraduate institution with a gap in knowledge with respect to an area of mathematics important in her discipline. Brittany and her graduate classmates would work in groups on their class assignments, and during these group sessions two students from foreign cultures with strong backgrounds in mathematics would help the other group members learn mathematics. Jane was exposed as an undergraduate to the expectation at that time for females good in math and science to become teachers. She conformed to this expectation,

and this may have delayed her entrance into a graduate program and a career in academia. Caroline was married during her undergraduate career, and her commitment to family has posed challenges throughout her graduate and academic careers. As an undergraduate, her martial status influenced her away from a career in medicine because of the difficulties it would place on her family. Therefore, this challenge actually influenced her decision to pursue a career in academia since she did not consider a career in medicine as an option.

Four of the participants in this study experienced perceived challenges posed by male colleagues or administrators within their respective disciplines. These challenges have influenced the participants in various ways. Elaine believes that some male administrators do not give her much credit for her work and that they downplay her ideas. This has been a source of frustration for Elaine, but has not delayed her progress in academia. Pauline works with at least one professor from a culture that promotes more traditional and restrictive female roles, and he does not like Pauline and her husband working in the same department. He is worried that she and her husband will become too strong a force, and does not support Pauline's career efforts. She believes his lack of support may pose a challenge when she applies for full professor. Minnie and Brittany have perceived a lack of support from male administrators, and their administrators have failed to address issues of concern. Minnie sometimes becomes discouraged, and this hinders her research productivity. Brittany had experienced a decrease in self-esteem and work productivity, and has thought about leaving her current institution or leaving academia for industry. Minnie and Brittany are still adapting to life in academia. This

lack of support from administrators may eventually lead to their moving to another institution or leaving academia altogether, thus promoting the underrepresentation of women in academia in their fields.

All four participants who were married and had children took on more family obligations than did their husbands. These obligations served as to influence the success of the participants in various ways. Pauline worked for many years as an instructor, and it was not until her current institution established a Ph.D. program that she pursued her Ph.D. because she did not want to move away from her husband. Pauline struggled as an instructor and in her Ph.D. program, balancing her child-care responsibilities with work and school. If it had not been for the support of her major professor, she probably would not have finished her Ph.D. After she secured a position as an assistant professor, Pauline chose to conduct research and publish with other colleagues because of her time limitations due to child-care obligations. She was criticized for this when she applied for associate professor, and was denied tenure and promotion on her first application. Thus, having more of the child-care responsibilities in her home was hindrance to success in her Ph.D. program and these responsibilities delayed her success in academia.

Caroline faced challenges in her graduate career and career in academia related to family obligations. Caroline's choice of a graduate institution at which to pursue her master's degree was influenced by her choice not to relocate due to family obligations. This resulted in her working on a thesis project outside her specific area of interest. If she had attended another institution she may have entered academia with a stronger line of research and publications in her field. In her doctoral program, her choice to put family

first resulted in lower work productivity than if she had spent longer hours in the laboratory. Within her career in academia, she has continued to put family first, and is adamant about keeping regular work hours. She believes that when she leaves her job in academia, she goes home to another job. Her obligations to family have resulted in lower research productivity and fewer publications than if she kept longer hours. Therefore, her family obligations have hindered her success in academia.

Elaine believes that her responsibility of taking care of her newborn while working on her dissertation was actually beneficial in that this responsibility kept her at home and focused on her work. Both Elaine and Jane had greater childcare and traditional household obligations during their careers in academia, but they never viewed these obligations as a hindrance to success. However, since these obligations most likely took time away from their work in academia, they may have delayed the progress of these women in their career advancement.

In summary, the participants in this study did not experience any major challenges in their elementary and secondary years or family backgrounds. Some did experience challenges as undergraduates but these challenges did not delay their progression to college. With the exception of Jane, these did not influence them away from academia or significantly delay their progress. None of the participants experienced any challenges in graduate school that delayed their progression *to* academia, but Pauline did struggle while working on her Ph.D. to balance her work as an instructor in academia with school and child-rearing obligations. The challenge of balancing work with family and challenges posed by male colleagues and administrators were the two major challenges faced in

academia by a majority of participants in this study. Balancing work and family obligations served as challenges for all participants who were married and had children.

Accomplishments

This section includes a discussion of accomplishments that have influenced the success of the participants and how these accomplishments have influenced their success. In addition, accomplishments that serve as evidence for their capability to be successful will be addressed. Because grants and/or publications are general requirements for continued success in academia, these accomplishments will not be addressed in this section. The attainment of a Ph.D. is a necessary prerequisite for an academic faculty position, so this accomplishment will not be discussed for those participants who entered academia as academic faculty.

In six of the cases in this study, participants attained at least one achievement-based accomplishment in high school that served as evidence for their capability to be successful in college and during their academic careers. Four of the participants were valedictorians of their high school classes, four received achievement-based scholarships to college, and two received subject awards in high school based on their academic achievement. In addition to serving as evidence for the capability for future success, these accomplishments likely reinforced their self-confidence and belief that they were capable of achieving all of their endeavors, and that there were no limitations to them because they were female.

Four of the participants received achievement-based honors as undergraduates that served as evidence for their capability to be successful in graduate school and in

academia. Three participants were members of honor societies and one participant graduated in the top five of her class in her major. As with the high school accomplishments, these accomplishments also likely reinforced their belief that they were capable of achieving all of their future academic endeavors.

Three of the participants entered academia with their master's degrees, and later pursued their Ph.D.s. In these three cases, the attainment of a Ph.D. was not a qualification for their initial position in academia but rather served to make possible the advancement of their careers in academia. Pauline and Jane advanced from instructors to academic faculty after earning their Ph.D.s, and Cindy has also advanced in her career as a research professor since the attainment of her Ph.D.

One anticipated finding in this study was the receipt of awards and honors prior to entering academia that served to influence the decision of the participant to choose a career in a science and engineering field and/or to pursue a career in academia instead of other career options. This was found to be the case in only one participant. Minnie received a science and engineering award in high school that resulted in her considering a career in a science or engineering field. Before the receipt of this award, Minnie thought she would major in English in college. After this award, Minnie first considered a career in medicine and then decided to pursue a Ph.D. in her field.

In summary, the majority of the participants in this study attained accomplishments in high school and as undergraduates that served as evidence of their capability for success and likely served to reinforce their belief that they were capable of achieving all their academic endeavors. Three of the participants earned their Ph.D.s after

entering academia and this accomplishment served to make possible their advancement in academia. Only one participant reported an award prior to entering academia that influenced her decision to pursue a career in a science of engineering discipline.

Attributions to Success

Five themes emerged with respect to factors to which the participants attributed their success: (a) parents or other family members held high academic expectations for participants, (b) father served as mentor and role model, (c) at least one mentor in the Ph.D. program contributed to success, (d) at least one colleague or administrator served as a mentor during their academic careers, and (e) collaborative research and publishing with colleagues in academia have contributed to success.

All seven participants indicated that their parents or other family members held high academic expectations for them. Five of the participants—Elaine, Pauline, Jane, Caroline, and Cindy—grew up in two-parent households and, with the exception of Pauline, were exposed to high academic expectations from both parents. Pauline was very close to her father and indicated that she was exposed to high expectations from him. Minnie's father and extended family considered her the smart one in the family, and expected her to excel academically. Brittany was from a single-parent household, but her mother was adamant about Brittany working hard in all of her endeavors. The expectation for success likely contributed to the academic excellence displayed by these participants during their elementary and secondary years, and contributed to their progression to college. The expectation for success set forth and modeled by parents may have also instilled in the participants this expectation for themselves, an expectation to succeed not

only in college but in their careers in academia. In the five cases in which at least one parent held college degrees—Elaine, Pauline, Caroline, Cindy, and Brittany—it is likely that this expectation for success by parents is at least partially influenced by their educational attainment in that they expected their children to excel academically just as they had. Jane's parents were not college-educated but did believe that education was her way to an easier life. Minnie excelled academically early in her educational background, and this likely influenced her family's high expectations for her.

In five of the seven cases, the participants' fathers served as a mentor and role model for them, and this influenced their success in various ways. In four these cases—Elaine, Pauline, Caroline, and Cindy—the father was educated at the master's level in the same or a similar discipline as that of the participants. Elaine's father was a scientist and sometimes took his children to the field with him when he conducted research. Elaine became attracted to science as a result of her experiences with him in the field. Pauline greatly admired her father. His love for his discipline, and her love and admiration for him, instilled in her a love for the discipline. Caroline's father taught science, and as a child was around her father in the school science laboratory. Watching her father work and being exposed to the laboratory setting stimulated her interest in science. Cindy did not attribute her father's occupation to influencing her choice of careers, but he did serve as a role model for her and, through his actions, she learned how to be successful in her endeavors. Minnie's father served as a mentor and role model for her. He pushed her to be independent and think logically, which are important characteristics to possess in science and engineering fields.

Brittany's case also warrants discussion under this theme. Although her father was not present in her life, Brittany's mother served as a mentor and role model for her in much the same way as did the fathers of the other participants. Brittany's mother, who was a professor, served as a role model for her. Her mother also took Brittany out to the field with her and allowed Brittany to help with the field work.

All seven participants had at least one mentor in their Ph.D. programs who contributed to their success. In all cases, mentors contributed to the improving of the writing skills necessary for success in academia by giving them constructive feedback on their writing. These mentors thus contributed to success in academia by helping the participants perfect the writing skills necessary for writing grants and publications, which are important considerations with respect to tenure and promotion. Mentors also contributed to success in their Ph.D. programs in various ways. Elaine and Pauline had major professors who held high expectations and met with them on a regular basis to evaluate their progress in the program. Minnie's major professor also held high expectations, and gave her exposure to certain aspects of work inherent to academia. With Jane, colleagues provided support and encouragement for her during her Ph.D. program. Cindy received encouragement from her statistics professor, who helped her learn to overcome her fear of statistics. Brittany received support from a male colleague who empathized with her bad experiences with their major professor. She also received help from two male classmates from foreign cultures in some of her class assignments.

In all seven cases, the participants have received mentorship from at least one colleague or administrator during their academic careers. These mentors have, in general,

provided support and encouragement for the participants in their career endeavors and have thus contributed to their continued success in academia. The majority of these mentors were male colleagues or administrators. Pauline received support in her career advancement from a male colleague who was her major professor in her Ph.D. program. Both Elaine and Pauline have received support from, and published with, their husbands, who also serve as colleagues. Caroline has received support and encouragement from male administrators and colleagues within her department. She also has had male colleagues in a related field who helped her learn new aspects of her discipline. Cindy has received support, encouragement and recognition from her current male boss. He encouraged her to pursue her Ph.D., which resulted in the opportunity for advancement in her career. Brittany has had a male administrator who served as an advocate for her and who wrote a letter of support for a grant proposal that she was awarded.

Jane, Minnie, and Brittany reported having had *female* mentors in academia who served to influence their success. Jane had a female colleague who served as a friend and source of support when she first entered academia. She also worked with this mentor in writing proposals, conducting research, and publishing. Jane did not have much experience writing grants before entering academia, and writing grants with her mentor helped her enormously in learning how. Minnie had a female administrator who shared her experiences rising in the ranks and dealing with gender issues along the way. This mentor helped Minnie to realize that the issues she faced were not personal, that it could be any woman in Minnie's shoes and she would be dealing with the same issues. Brittany

had a female colleague with whom she talked about problems she had within her department. This colleague also gave Brittany advice on how to write grant proposals.

In five cases, participants have engaged in collaborative research and publishing with colleagues in academia. These collaborations have contributed to their success in academia in various ways. The majority of these collaborations were with male colleagues. Pauline has published with her husband and other colleagues in her discipline. Although she believes the collaborative nature of her research was a factor that led to her not being tenured and promoted during her first attempt, these same publications were influential in her being promoted the next year. Elaine believes her approach to publishing is slow and that she has benefited from collaborations with her husband, whose approach to publishing is much faster. Jane has benefited greatly from research collaborations with her female mentor and other colleagues in her field. She has worked collaboratively on research proposals, projects, and publications that she may not have otherwise been able to accomplish if she had worked alone. Cindy has worked with colleagues on research projects and publications in her field, and has learned through her work with them various aspects of publishing, such as how to set up a paper in journal article format, and how to respond to reviewer's comments about journal articles submitted for publication. Minnie and Brittany are the exceptions to this theme. They did not report any collaborative research and publications with colleagues within academia that have served to promote their success in academia.

Two additional themes emerged in four cases with respect to factors to which the participants attributed their success. The first was at least one high school teacher was

attributed to having influenced success. The second was that an undergraduate professor served as a role model.

Four of the participants had at least one high school teacher they believed contributed to their success in various ways. Jane had a female science teacher who gave her exposure to the field through her instructional methods. This teacher's influence contributed to Jane's decision to major in her initial discipline as an undergraduate. Pauline and Caroline had male math teachers during high school who contributed to their knowledge of mathematics. Caroline also had an English teacher who taught her how to write proficiently. Elaine had an English teacher and a foreign language teacher who were outsiders. The English teacher allowed students to explore their interests and showed Elaine that complex analyses of the literature were possible. The foreign language teacher recognized people for who they were. In Elaine's case, these high school teachers are perhaps better classified as memorable rather than influential, but she nonetheless considered them influential persons during her high school education.

In four of the cases in this study the participants had an undergraduate professor that served as a role model, and influenced their success in various ways. Elaine took courses taught by a male professor who was well-organized and had a concept-oriented approach to the discipline. Her admiration for him and desire to learn under his direction influenced her decision to pursue her Ph.D. at her undergraduate institution, where he served as her major professor. Caroline took an undergraduate class in her discipline with an influential male professor. She was impressed with the way he constructed a lecture and that he was extremely organized. He taught the material in such a way that made her

realize even though it was difficult material, it was very understandable as long as it was presented in a way that students could grasp. This professor inspired Caroline to teach the way she does now, and she attributes his influence as serving to promote her interest in the field. Brittany had a male professor whom she considered very personable and encouraging. He was a good instructor, and she was impressed that he was unwavering in his good intentions towards others. This professor also helped Brittany chose options for graduate school, and later was influential in helping her secure her current position in academia. Minnie had a female professor who served as a role model for her. This woman was distinct and proper, and demonstrated to Minnie that a woman could be feminine and ladylike and be successful in her field. This professor also held high expectations for her students both academically and with respect to conduct.

In summary, parents and other family members were influential in the success of all participants by holding high academic expectations for the participants. In five cases, the participants' fathers served as mentors and role models for them and, in four of these cases, contributed to their choice of careers. Mentors contributed to the success of participants both in college and during their academic careers. All participants had at least one mentor in their Ph.D. programs that helped them perfect the writing skills necessary for writing grants and publications. Some mentors also served as sources of encouragement and support that served to facilitate their success in their programs. All participants also reported having had received mentorship from at least one colleague or administrator in academia. The majority of these mentors were male, although three participants did report having had female mentors in academia. In general, mentors

within academia have served as sources of support and encouragement for the participants during their academic careers. Four participants credited at least one high school teacher as contributing to their success in various ways. In four cases, participants had a role model during their undergraduate career that contributed to their success. The male role models of two participants served to promote their interest in their chosen fields. Another participant had a male role model she considered unwavering in his good intentions towards others. A female role model demonstrated to one participant that a woman could be feminine and ladylike and still be successful in her field.

Summary of Analysis

Four themes emerged in the cases with respect to challenges that influenced the success of the participants: (a) no perceived academic limitations during their elementary and secondary years, (b) no other challenges during the elementary and secondary school years that hindered achievement in their educational background or their path to academia, (c) no gender-related expectations in the family background, and (d) no gender-related academic expectations or discrimination in graduate school that hindered success in graduate programs or the path to academia. How the absence of these challenges influenced success was discussed within the context of each theme.

Four additional themes emerged in four cases with respect to challenges that influenced the success of the participants: (a) one challenge was posed during elementary and secondary years, but did not delay progress to college (b) one or more challenges were posed as an undergraduate that influenced success, (c) challenges were posed by male colleagues or administrators within their respective disciplines, and (d) all four

participants with children had more traditional household and child-rearing responsibilities within their academic careers than did their husbands. How these challenges may have influenced the success of the participants was discussed within the context of each theme.

In six of the cases in this study, participants attained at least one achievement-based accomplishment in high school that served as evidence for their capability to be successful in college and during their academic careers. Three of the participants entered academia with their master's degrees, and later pursued their Ph.D.s. In these three cases, the attainment of a Ph.D. was not a qualification for their initial position in academia but rather served to make possible the advancement of their careers in academia. One anticipated finding in this study was the receipt of awards and honors prior to entering academia that served to influence the decision of the participant to choose a career in a science and engineering field and/or to pursue a career in academia instead of other career options. This was found to be the case in only one participant.

Five themes emerged with respect to factors to which the participants attributed their success: (a) parents or other family members held high academic expectations for participants, (b) father served as mentor and role model, (c) at least one mentor in the Ph.D. program contributed to success, (d) at least one colleague or administrator served as a mentor during their academic careers, and (e) collaborative research and publishing with colleagues in academia have contributed to success. Two additional themes emerged in four cases with respect to factors to which the participants attributed their success. The first was at least one high school teacher was attributed to having influenced success. The

second was an undergraduate professor served as a role model. How these factors influenced the success of the participants was discussed within the context of each theme.

Discussion of Related Literature

The research question posed in this study was: What factors in the life histories of women in academia do they perceive as having influenced their success, and how have these factors influenced success? In answering this question, three areas were addressed: challenges, accomplishments, and attributions to success. The discussion of related literature is grouped into themes that emerged in this study with respect to each of these three areas.

Challenges

Four themes emerged in the case studies of successful women in academia with respect to challenges that influenced their success: (a) no perceived academic limitations during their elementary and secondary years, (b) no other challenges during the elementary and secondary school years that hindered achievement in their educational background or their path to academia, (c) no gender-related expectations in the family background, and (d) no gender-related academic expectations or discrimination in graduate school that hindered success in graduate programs or the path to academia.

These four themes are characterized by the *absence of* perceived challenges to the participants' success. The participants in this study did not experience any major challenges in their elementary and secondary years, gender-related expectations in their family backgrounds, or gender-related academic expectations or discrimination in

graduate school that hindered their progress to academia. A search of the literature found studies addressing challenges faced by women when *contemplating* careers in academia (e.g. Sears, 2003, van Anders, 2004) and addressing challenges faced *within* their careers in academia that adversely influence their success (e.g., AAUW, 2004; Grant et al., 2000; MIT, 1999; O'Laughlin & Bischoff, 2005; Rosser & Daniels, 2004; Stack, 2004). However, no studies were found focusing on challenges faced specifically by women in academia in science and engineering in their early life histories that served to influence their *progression to* academia. Yewchuk et al. (2001) found that successful Canadian and Finnish women identified factors such as stereotypical attitudes and being female as barriers to achievement, but Yewchuk et al. did not focus on women in academia.

Literature addressing gender disparities with respect to girls and boys addresses challenges such as gender bias in girls' educational backgrounds and gender-related academic expectations from parents. For example, Sadker and Sadker (1995) reported that: "Teachers interact with males more frequently, ask them better questions, and give them more precise and helpful feedback" (p 1). According to the authors, when boys call out, teachers are more likely to respond to their comments, regardless of their relevance. But, when a girl calls out, she is "deftly and swiftly put back in her place" (p. 43). Mewborn (1999) reported an instance when a counselor discouraged a female from taking Algebra II "because it was a difficult course and might cut into her extracurricular activities" (p. 107). Parents may also hold disparate expectations for their children based on gender. Sadker and Sadker reported that parents may hold different expectations in math and science as early as the first grade, attributing daughters' low grades to their not

being smart in these subject and their sons' low grades to laziness. The current study reveals that the *absence* of challenges such as those in the literature addressing gender disparities in the educational and family backgrounds of females can promote their success in science and engineering disciplines.

Four additional themes emerged in four case studies of successful women in academia with respect to challenges that influenced their success: (a) one challenge was posed during elementary and secondary years, but did not delay progress to college (b) one or more challenges were posed as an undergraduate that influenced success, (c) challenges were posed by male colleagues or administrators within their respective disciplines, and (d) all four participants with children had more traditional household and child-rearing responsibilities within their academic careers than did their husbands.

In the present study, four participants faced one challenge during their elementary and secondary years, but these challenges did not delay their progress to college. One participant had bad science teachers who influenced her away from a career in the physical sciences, but not away from a career in academia in another science and engineering field. Other than this challenge reported by one participant, none of the participants in this study experienced challenges during their elementary and secondary years that delayed their entrance into college or influenced their choice of majors in college. As previously mentioned, a search of the literature found studies addressing challenges faced by women when *contemplating* careers in academia (e.g. Sears, 2003, van Anders, 2004) and challenges faced *within* their careers in academia that adversely influence their success (e.g., AAUW, 2004; Grant et al., 2000; MIT, 1999; O'Laughlin &

Bischoff, 2005; Rosser & Daniels, 2004; Stack, 2004). However, no studies were found focusing on challenges faced specifically by women in academia in science and engineering in their early life histories that served to influence their *progression to* academia. The current study reveals that there were few challenges posed to participants in their elementary and secondary years, including those discussed in the literature addressing gender disparities with respect to girls in education (e.g., Mewborn, 1999; Sadker & Sadker, 1995). Therefore, the current study provides evidence that the *absence* of gender-related challenges in school can promote the success of females in science and engineering fields.

Four participants in this study reported one or more challenges posed to them as undergraduates that influenced success. Two participants left their institutions with deficient backgrounds in their disciplines, one was exposed to the gender-related assumption that she would become a teacher because she was a woman good in math and science, and one was influenced away from a career in medicine because of family considerations. Xie and Shauman (2003) found that married women with bachelor's degrees in science and engineering are less likely than their male counterparts to continue their science and engineering careers, in part because family responsibilities impede the pursuit of these careers by women. This was not found in any case in the current study, although one participant chose a career in academia instead of medicine in part due to her consideration of the strain going to medical school would place on her family. In addition, the participant exposed as an undergraduate to the assumption she would become a teacher did conform to this assumption and did not pursue her graduate career

for several years. However, she did not attribute family responsibilities as a reason for the delay in her progression to graduate school.

Four of the participants in this study experienced perceived challenges posed by male colleagues or administrators within their respective disciplines. One participant believed that male administrators did not give her much credit for her work and downplayed her ideas. Others reported a lack of support by male colleagues or administrators with respect to their careers and/or in addressing issues of concern. Rosser and Daniels (2004) found that gaining credibility from colleagues and administrators and the boys' club atmosphere were challenges faced by female scientists in academia. Bronstein and Farnsworth (1998) found that female faculty at a research university were more likely than men to experience demeaning and oppressive behaviors from their peers.

All four participants who were married and had children took on more family obligations than did their husbands. Although two participants never viewed these obligations as a hindrance, these obligations may have lowered their research productivity and thus delayed their progression in academia. In two cases, these obligations interfered with the productivity of the participants in their graduate programs and they considered themselves immobile due to family obligations. There is much related literature supporting this finding. Grant et al.(2000) reported that women with children struggled with balancing parenthood demands with work demands. Rosser and Daniels (2004) found that "the issue of balancing work with family responsibilities is the most pervasive and persistent challenge facing female science and engineering faculty

members, spanning the variables of time, type of institution, and discipline" (p. 144). O'Laughlin and Bischoff (2005) found that women were more likely than men to comment on the negative impacts of their careers on family life. Xie and Shauman (2003) found that parenthood was disadvantageous to women scientists in terms of employment and geographic mobility. Women with children, for example, were much more constrained geographically than men by responsibilities associated with parenthood. Stack (2004) found that men published significantly more than women, and that women with young children had relatively low productivity.

In summary, four themes emerged in the case studies of successful women in academia with respect to challenges faced within their life histories, and these themes were characterized by the absence of perceived challenges to the participants' success. A search of the literature found no studies focusing on any of the four major themes which emerged with respect to challenges faced specifically by women in academia in science and engineering in their early life histories that served to influence their progression to academia. Four additional themes emerged in four of the case studies of successful women in academia with respect to challenges that influenced their success. Related literature was found addressing the three of these four themes.

Accomplishments

In six of the cases in this study, participants attained at least one achievement-based accomplishment in high school that served as evidence for their capability to be successful in college and during their academic careers. These included accomplishments such as being valedictorian of their high school classes, achievement-based scholarships

to college, and subject awards in high school. In addition, four of the participants received achievement-based honors as undergraduates that served as evidence for their capability to be successful in graduate school and in academia, such as being members in an honor society. A search of the literature found no established line of research focusing on accomplishments of women in academia in science and engineering within their life histories that influence their success. However, Rosser and Daniels (2004) discussed advantages of Clara Boothe Luce (CBL) Professorships to awardees, such as flexibility of funding and prestige. In addition, Xie and Shauman (2003) noted that an individual's demonstrated aptitude, or ability to perform well in school, is influential during his/her elementary and secondary years in terms of educational outcomes. Xie and Shauman also found that math achievement, although associated with science and engineering degree attainment, does not by itself explain gender differences in undergraduate degree attainment in science and engineering. The accomplishments of participants in the study reflect their abilities to excel academically in all subjects, not explicitly in math and science.

In summary, the participants in this study attained accomplishments that served as evidence of their capability for success in academia. A search of the literature revealed no established line of research focusing on accomplishments within the life histories of women in academia in science and engineering that influence their success, but Rosser and Daniels (2004) did address advantages of CBL Professorships to awardees.

Attributions to Success

Five themes emerged in the case studies of successful women in academia with respect to factors to which they attributed their success: (a) parents or other family members held high academic expectations for participants, (b) father served as mentor and role model, (c) at least one mentor in the Ph.D. program contributed to success, (d) at least one colleague or administrator served as a mentor during their academic careers, and (e) collaborative research and publishing with colleagues in academia have contributed to success.

The participants in the current study reported that parents or other family members held high academic expectations for participants. Sadker and Sadker (1995) reported that "women who have achieved in nontraditional careers point to the expectations and encouragement of parents as key to their success" (p. 257). Dodds (2005) also reported that one female physical education faculty named her uncle as exhibiting high expectations, making sure she reached her full potential in athletic performance.

In five of the cases in the current study, the father served as a role model for them in various ways. Three of these participants reported that their fathers promoted their interest in their fields, and another reported that she learned through the actions of her father how to reach her goals. All four of these participants pursued careers in the same or similar fields as their fathers. A fifth participant reported that her father pushed her to be independent and think logically. In one of the other cases in the current study to which this theme did not apply, both parents held Ph.D.s but the mother was the primary

parental figure and served as a role model for her. Rosser and Daniels (2004) reported that the parents of one Clara Booth Luce Professorship recipient, Colleen, were both scientists holding Ph.D.s. Colleen's mother served as a role model for her. Dodds (2005) reported that one physical education faculty credited her mother for displaying a good work ethic and instilling in her the drive to learn. A search of the literature revealed no studies focusing on the impact of fathers on the career choices of women in academia in science and engineering. However, Sadker and Saker (1995) did report on the impact of parents on the success of women in nontraditional careers.

All participants in this study had at least one mentor during their Ph.D. programs that contributed to their success by helping them perfect their writing skills. Mentors also contributed to success by holding high expectations, and providing encouragement and support. A search of the literature revealed influences exerted by mentors during childhood and adolescence (Dodds, 2005), undergraduate education (Campbell & Skoog, 2004; Downing et al., 2005; Packard et al., 2004; Rosser & Daniels, 2004), and within postsecondary institutions (Dodds, 2005). However, no studies were found that focus on the influences exerted by mentors on women in academia during their Ph.D. programs. Dodds (2005) reported that, within postsecondary institutions, mentors of physical education faculty provided assistance for writing and research activities, which is related to the assistance provided to participants in the current study by mentors present during their Ph.D. programs.

In the current study, all participants received mentorship from at least one colleague or administrator during their academic careers, providing encouragement and

support for them. The mentors of some participants served additional functions. One participant was mentored by a female colleague, with whom she worked in writing proposals, conducting research, and publishing. Another participant had a colleague who gave her advice on how to write grant proposals. In one case, colleagues from a related discipline helped the participant learn new aspects of her discipline. Dodds (2005) found that, within postsecondary institutions, women physical education faculty received mentoring assistance for tenure and promotion and writing and research activities. Some mentors included participants in joint projects and provided mentoring assistance for teaching and advising. Rosser and Daniels (2004) cited a lack of senior women to serve as mentors as a barrier for junior women in science. However, in the current study, the majority of mentors in academia contributing to the success of the participants were male. Furthermore, a lack of female mentors was not reported by participants as a hindrance to their continued success in academia.

Five participants in this study reported that collaborative research and publishing with colleagues in academia have contributed to success. Participants benefited from publications resulting from these collaborations, and one participant worked collaboratively on research proposals, projects, and publications she may not have otherwise been able to accomplish if she had worked alone. This participant also had a research colleague that supported her, gave her advice, and served as a friend. Another participant learned various aspects of publishing by working with colleagues on research projects and publications. Dodds (2005) found that mentors within postsecondary institutions provided assistance for writing and research activities, and included

participants in joint projects. Clark and Watson (1998) reported the development and enrichment of ideas, and emotional support, as benefits of academic collaboration.

Two additional themes emerged in four cases with respect to factors to which the participants attributed their success. The first was that at least one high school teacher was attributed to having influenced success. These teachers promoted success by strengthening academic skills such as mathematics and/or writing, or by promoting the interest of the participant in science. Dodds (2005) found that women faculty in physical education named K-12 teachers as mentors influential in recognizing their potentials and creating opportunities to succeed. However, a search of the literature addressing women in academia in science and engineering found no studies focusing on the influences of high school teachers on women in academia in science and engineering. The second theme that emerged in four cases was that an undergraduate professor served as a role model. Two participants took one or more courses in their disciplines with professors whose approach to the discipline promoted their interest in their discipline and modeled teaching techniques they use in their careers in academia. Another participant had a role model who demonstrated good intentions towards others and helped her choose options for graduate school. One participant had a female role model who demonstrated that a woman could still be feminine and ladylike and still be successful in her field. Downing et al. (2005) found that mentors were reported as the most influential developmental guides by 42% of women undergraduate science majors in their study, and role models were reported as most influential by 34% of these women. Campbell and Skoog (2004) reported on the impact of an undergraduate science education program whose goal was to

increase women and minority participation in the sciences through involving them in research experiences. In this program, mentors provided support and encouragement, and stimulated women's interest in their research field. The interactions these women experienced with influential persons such as mentors and peers were important in their decisions to pursue career in science.

The previously discussed themes emerged from the cross-case analysis of data and were found in a majority of participants. However, two participants also had research experiences noteworthy of comparison with related literature. These two participants worked as laboratory research assistants as undergraduates, giving them the opportunity to gain experience in research that they would use later in their graduate and academic careers. Campbell and Skoog (2004) found that success in research as undergraduates and the attainment of laboratory skills and knowledge promoted self-confidence in women, and exposure to the laboratory setting prepared undergraduates for time demands associated with graduate studies. In addition, two participants attributed their success in part to personal qualities. One participant believed that she was "inner-directed" and motivated by her own research interests and belief that she was contributing to her discipline. Another participant believed that it was a force within her that wants to do well. Yewchuk et al. (2001) reported that successful Canadian and Finnish women attributed their success to personal qualities, personal convictions, hard work, encouragement from parents and spouses, and luck.

Five themes emerged in the present study with respect to factors in the life histories of successful women in academia to which they attributed their success. A

search of the literature found related literature on four of these themes, the exception being the theme addressing the impact of fathers on the career choices of women in academia in science and engineering. However, related literature was found on the influence of mothers on the success of women in academia and on the impact of parents to the success of women in nontraditional careers. Related literature was found for one of the two additional themes which emerged in this study with respect to factors to which successful women in academia attributed their success.

Summary of Discussion

The discussion revealed that no related literature was found with respect to the four major themes in the present study addressing an absence of challenges within the early life histories of women in academia. Literature was found addressing gender disparities with respect to girls and boys. Four additional themes found in four case studies addressed challenges faced during the life histories of women in academia. Related literature was found with respect to the three of these themes. In particular, there was much related literature addressing challenges related to family responsibilities faced by women in academia.

The participants in the current study attained achievement-based accomplishments that served as evidence for their capability of success in academia. The discussion revealed that no established line of research was found which focused on how accomplishments made within the life histories of women in academia in science and engineering have influenced their success. Literature was found which discussed the

advantages of CBL Professorships. Literature was also found addressing the influence of aptitude on educational outcomes.

The discussion revealed that related literature was found addressing four of the five themes which emerged in this study with respect to factors which influenced the success of women in academia. Although no literature was found focusing on the impact that fathers exert on the career choices of women in academia in science and engineering, literature was found addressing the influences of mothers on the success of women in academia and on the impact of parents on the success of women in nontraditional careers. Literature was found for one of the two additional themes which emerged in four cases with respect to factors to which women in academia attributed their success. In addition to themes that emerged from the cross-case analysis, the discussion revealed that related literature was found addressing research experiences reported by two participants in this study. The discussion also revealed that two participants attributed their success in part to personal qualities, and related literature was also found addressing this factor as an attribution to success by successful women.

Chapter Summary

This chapter presented the case studies of the seven participants of this study, provided within-case and cross case analyses of the data collected in this study, and discussed the findings of this study with related literature. The participants were women in academia holding a position in a science or engineering discipline. Two participants were from the same discipline, and the other five participants were from five different

disciplines. This study addressed three major areas with respect to women in academia: challenges, accomplishments, and attributions to success.

A within-case analysis was presented for each of the seven participants in this study. Elaine faced no major challenges in her family background. In high school, she had bad science teachers. In academia, her publication record was slow to develop for several reasons, and she has also faced challenges from administration. Elaine has attained accomplishments such as being valedictorian of her high school class and receiving a prestigious award in graduate school. Elaine believes that the firsthand experience her parents had with respect to targeting her towards college was a major reason she was not only able to go to college but to get a Ph.D. Her father was a scientist, and her experiences with him in the field attracted her to science. She had an influential undergraduate professor that also served as her major professor in college. Within academia, Elaine attributes her success in part to good solid work. She has published with her husband, who is in a related discipline. Throughout her academic career the research opportunities have been plentiful.

Pauline experienced no major challenges in her family background. She was miserable and discouraged during her undergraduate education. Pauline was responsible for the majority of the child-rearing responsibilities in her family and these responsibilities posed challenges to her success. Pauline attained accomplishments such as receiving subject awards in school and graduating as valedictorian of her high school class. The attainment of her Ph.D. after entering academia also provided the opportunity for advancement within academia. Pauline's father was the most important influence in

her educational background. Her grandmother also influenced her success Pauline had a math teacher in high school, a classmate in college, and a major professor during her Ph.D. program that influenced her success. She also attributes her husband and aerobics instructor as contributing to her success.

Jane experienced no major challenges in her family background. When Jane was an undergraduate, women good in math and science were encouraged to be teachers, and Jane conformed to this expectation and taught school for a few years. During her academic career Jane has taken on larger service roles than her male counterparts. Jane has attained such accomplishments as subject awards in high school and an award in academia based on teaching, research and service. The attainment of her Ph.D. after entering academia also provided the opportunity for advancement within academia. Jane's parents were ambitious for their children, and held high academic expectations. She had a female science teacher in high school and a male science teacher in college that influenced her success. She was exposed to research as an undergraduate and in one of her professional positions prior to entering academia. Jane has benefited from collaborations with colleagues in academia. Her husband and children have also influenced her success.

Caroline married as an undergraduate, and her family obligations have presented challenges to her success during her graduate education and academic career. During her Ph.D. program, Caroline's major professor had a brusque personality and his actions sometimes discouraged Caroline. She has attained accomplishments such as being co-valedictorian of her high school class and receiving teaching awards. Caroline's parents

held high academic expectations for their children, and her father was a science teacher. In high school, she received a strong foundation in writing skills from an English teacher. These skills were improved during the Ph.D. program with the help of her major professor. Caroline also had influential male professors during her undergraduate and master's programs. In academia, Caroline has had colleagues and administrators who have served as sources of support, and others who have helped her learn new aspects of the discipline. Caroline also attributes her success in part to her deep religious beliefs.

Cindy's family moved when she was in middle school, and the new schools were bigger, better, and harder than her previous schools. Cindy does not recall experiencing any other major challenges. In her professional career, Cindy attained a research grant that influenced her decision to enter academia. The attainment of her Ph.D. after entering academia also provided the opportunity for advancement within academia. Cindy grew up in a supportive family, and the family atmosphere was such that she and her siblings always knew that they were smart. Cindy's father served as a role model for her. During her professional career, Cindy was exposed to grant writing, and she met a university professor who influenced her path to academia. Cindy has had bosses who have trusted her and appreciated her work. During the Ph.D. program, several male professors and colleagues contributed to her success. Cindy believes that there is a force within her that wants to do well, and she is internally motivated to succeed.

Minnie's challenges to success have been focused in academia. A male administrator, staff members, and students have all posed challenges to her success. Minnie received an achievement-based award in high school that influenced her decision

to pursue a career in science or engineering. Minnie also received scholarships to college and a graduate school fellowship. Minnie's family pushed her academically and held high expectations for her. Her father pushed her to be independent and think logically. In her high school, the bar was set high. As an undergraduate Minnie lived in the honors dorm, and this contributed to her success. During her college background Minnie has encountered both male and female professors that have influenced her success. During her academic career, Minnie has received encouragement and support from a female colleague and a female administrator.

Brittany left her undergraduate institution with a gap in knowledge with respect to a certain aspect of mathematics important in her field, and as a result she struggled with some of her graduate classes. During her Ph.D. program, her major professor was critical, rude, and sometimes verbally abusive. During her academic career, she has experienced adverse encounters with students, a lack of support from administration, and departmental advocacy for a privileged group of male faculty. Brittany has attained accomplishments such as being awarded a graduate fellowship during her Ph.D. program. Brittany's mother contributed to her success in several ways, such as providing her with hands-on experience in science, and holding high expectations for Brittany. Two male professors influenced her success as an undergraduate. During the Ph.D. program, Brittany found support and encouragement from several male graduate students, and found motivation in serving as a role model for other graduate students. In academia, Brittany has received support from a female colleague and a male administrator.

Four themes emerged in the cases with respect to challenges that influenced the success of the participants: (a) no perceived academic limitations during their elementary and secondary years, (b) no other challenges during the elementary and secondary school years that hindered achievement in their educational background or their path to academia, (c) no gender-related expectations in the family background, and (d) no gender-related academic expectations or discrimination in graduate school that hindered success in graduate programs or the path to academia. Four additional themes emerged in four cases with respect to challenges that influenced the success of the participants: (a) one challenge was posed during elementary and secondary years, but did not delay progress to college (b) one or more challenges were posed as an undergraduate that influenced success, (c) challenges were posed by male colleagues or administrators within their respective disciplines, and (d) all four participants with children had more traditional household and child-rearing responsibilities within their academic careers than did their husbands.

In six of the cases in this study, participants attained at least one achievement-based accomplishment in high school that served as evidence for their capability to be successful in college and during their academic careers. Three of the participants entered academia with their master's degrees, and later pursued their Ph.D.s. In these three cases, the attainment of a Ph.D. was not a qualification for their initial position in academia but rather served to make possible the advancement of their careers in academia. One anticipated finding in this study was the receipt of awards and honors prior to entering academia that served to influence the decision of the participant in choosing a career in a

science and engineering field and/or to pursue a career in academia instead of other career options. This was found to be the case in only one participant.

Five themes emerged with respect to factors to which the participants attributed their success: (a) parents or other family members held high academic expectations for participants, (b) father served as mentor and role model, (c) at least one mentor in the Ph.D. program contributed to success, (d) at least one colleague or administrator served as a mentor during their academic careers, and (e) collaborative research and publishing with colleagues in academia have contributed to success. Two other themes emerged in four cases with respect to factors to which the participants attributed their success. The first was at least one high school teacher was attributed to having influenced success. The second was that an undergraduate professor served as a role model.

A discussion of related literature revealed that no literature was found with respect to the four major themes which emerged with respect to the absence of perceived challenges within the early life histories of women in academia in science and engineering fields. Four additional themes emerged in four cases with respect to challenges, and related literature was found in three of the four themes. A search of the literature found no established line of literature focusing on how accomplishments within the life histories of women in academia in science and engineering influence their success. Five themes emerged with respect to factors than influenced the success of women in academia, and related literature was found for four of these themes. Two additional themes emerged in four cases with respect to factors that influenced the success of women in academia, and related literature was found for one of these two

themes. The discussion revealed that related literature was found addressing research experiences reported by two participants in this study. The discussion also revealed that two participants attributed their success in part to personal qualities, and related literature was also found addressing this factor as an attribution to success by successful women.

CHAPTER IV

SUMMARY, IMPLICATIONS, AND RECOMMENDATIONS

The purpose of this study was to investigate the factors in the life histories of women in academia that they perceive to have influenced their success and how these factors have influenced their success. The research question posed in this study was: What factors in the life histories of women in academia do they perceive as having influenced their success, and how have these factors influenced success? These factors included perceived challenges and barriers to success that women in academia have faced in their life histories, ways in which these women have overcome perceived challenges and barrier to success, accomplishments made during their life histories that may have contributed to success, and other perceived facilitators and attributions to success. This chapter contains three sections: (a) summary, (b) implications, and (c) recommendations.

Summary

The review of the related literature presented three lines of evidence related to women in academia: (a) the underrepresentation of women in higher education, (b) challenges faced by women in academia, and (c) attributions and facilitators of success. The first line of evidence established the problem of underrepresentation of women in academia in fields of science and engineering in higher education, including

postsecondary education degree programs and academia. Data from the NSF (2004a) and Freeman (2004) revealed that women have made substantial gains in postsecondary degree attainment over the past three decades. According to data from the NSF (2004a), however, women are still underrepresented in some science and engineering fields at all degree levels. Data from the NSF (2004b) also reflected that women science and engineering doctoral holders are underrepresented in science and engineering occupations at four-year colleges and universities. Data from the NSF (2004b) also revealed that these doctoral holders are less likely than their male counterparts to hold tenured positions and female academic faculty are less likely to hold the rank of full professor. Nelson (2005) examined the status of women in the top 50 departments in 14 science and engineering fields. Results revealed that male faculty made up the majority of faculty in all 14 fields. A study by MIT (1999) found that women made up only 8% of the faculty in the School of Science at MIT. Sears (2003) revealed that women were more likely than men to downgrade their career goals during graduate school, selecting away from research careers in academia.

The second line of evidence discussed literature pertaining to challenges faced by women in academia as they pursue their career goals. The nature of careers in academia was one challenge addressed in this line of evidence. Grant et al. (2000) found that scientists, especially women, struggle with decisions about marriage and parenthood. Ross and Daniels (2004) found that women in academia face challenges such as balancing work with family, gaining credibility from colleagues and administrators, and isolation. In a related study, O'Laughlin and Bischoff (2005) found that women were

more likely than men to report that they had greater household and childcare responsibilities than their spouses, and they were more likely to comment on the negative impacts of their careers on family life. Women were also more likely than men to report limitations in travel due to parenthood, and academic stress and perceived spousal support served as significant predictors of family stress. Similarly, Xie and Shauman (2003) found that parenthood was disadvantageous to women scientists in terms of employment and geographic mobility. Research productivity with respect to parenthood, and discrimination, were two other challenges addressed in the review of related literature. Stack (2004) found that men published significantly more than women, and that women with young children had relatively low productivity. MIT (1999) revealed that discrimination in such forms as distribution of space and teaching assignments were present in the MIT School of Science. The AAUW (2004) presented cases of alleged discrimination in academia. Examples of discriminatory practices included stereotyping, sexual harassment, and a hostile work environment. Yewchuk et al. (2001) also revealed that discrimination in such forms as societal attitudes and chauvinism were reported by successful women as barriers to success. Bronstein and Farnsworth (1998) found that, for longer term faculty, women were more likely than men to experience demeaning and aggressive behaviors from students. Newer women faculty were more likely than men to report exclusion form social activities and policymaking committees.

The third line of evidence presented literature addressing factors to which women attribute their success and other facilitators of success in academia. Yewchuk et al.

(2001) found that successful Canadian and Finnish women attributed their success to their personal qualities, personal convictions, hard work, encouragement from parents and spouses, and luck. Encouraging persons other than family included teachers, counselors, professors, and friends. Sadker and Sadker (1995) reported on the influence that parents exert over women in nontraditional careers. Rosser and Daniels (2004) documented factors such as parents and mentors as influencing success of women in academia. Examples of suggestions for facilitators to success for women in academia included a cafeteria of benefits (Rosser and Daniels), scientific careers conducive to family life (Grant et. al, 2000), and on-site child care (Xie & Shauman, 2003). This line of evidence also revealed that mentors can also facilitate the success of women in academia, both before and after entrance into academia. Packard et al. (2004) found that 1st-year and 4th-year undergraduate women reported both psychosocial and career-related functions associated with mentoring. Dohm and Cummings (2002) found that female clinical psychologists who had research mentors were significantly more likely to choose to conduct research than those who did not have research mentors. Campbell and Skoog (2004) reported that mentors provided support and encouragement, and stimulated women's interest in their research fields. The interactions these women experienced with influential persons such as mentors and peers were important in their decisions to pursue careers in science. Dodds (2005) found that physical education faculty had mentors in childhood and adolescence, various stages of their careers, and within postsecondary institutions. In childhood and adolescence, family and K-12 teachers served as mentors. During various stages of their careers, administrators and colleagues served as mentors.

Within postsecondary institutions, mentors helped participants acclimate to postsecondary culture and displayed positive attitudes when placing them into their new positions. Participants also received mentoring assistance for tenure and promotion, writing and research activities, and teaching and advising.

Arguments from the literature (Nelson, 2005; "How to Boost," 1999) suggested that it is important to continue addressing the issue of underrepresentation of women in academia. The gap in literature with respect to the lack of long-term solutions to the problem of underrepresentation was also cited as a reason for the need for this study. Literature documenting gender disparities in girls was cited, and it was argued that this documentation, along with the documentation of challenges and attributions to success found in the review of the literature, suggests that many factors in the life histories of women in academia may influence their success.

The purpose of this study was to investigate the factors in the life histories of women in academia that they perceive to have influenced their success and how these factors have influenced their success. These factors included perceived challenges and barriers to success that women in academia have faced in their life histories, ways in which these women have overcome perceived challenges and barriers to success, accomplishments made during their life histories that may have contributed to success, and other perceived facilitators and attributions to success.

The research question posed in this study was: What factors in the life histories of women in academia do they perceive as having influenced their success, and how have

these factors influenced success? In answering this question, three major areas were addressed: challenges, accomplishments, and attributions to success.

This study utilized a qualitative, multiple-case study approach in order to investigate the factors in the life histories of women in academia that they perceive to have influenced their success. The incorporation of several cases, along with purposive sampling of participants to achieve variation among participants, increased the external validity of this study. As the researcher, I served as the instrument used in this study to collect and analyze data.

The participants in this study were women in academia, each of whom held a position at a doctoral-degree granting institution. Purposive sampling was employed to select participants for this study, and criteria were established and followed for participant selection. Twenty women were chosen based upon these criteria, and seven of these women accepted the invitation to participate in this study. Therefore, there were seven participants in this study.

Interviews and documents were used to collect data. There were three to four interviews with each participant, varying in length from approximately 30 to 90 minutes. Each interview was audio-recorded and subsequently transcribed. In addition to audio-recording interviews, notes were taken during each interview. Documents were also collected for analysis. These documents not only served as a source of data in their own right, but data found within these documents were used within the context of interviews to generate interview questions unique to each participant.

Data collection and analysis occurred simultaneously in this study. The preliminary analysis of data consisted of the initial categorization of data based on techniques discussed by Merriam (1998). The grouping of data into categories was guided by the three areas addressed in the research question: perceived challenges faced by women in academia, accomplishments made by women and academia, and attributions and facilitators to success. After all data were collected and categorized, further analysis of data was conducted by utilizing a strategy suggested by Miles and Huberman (1994) called "stacking comparable cases" (p. 176).

Reliability and validity of this study were increased by using interview transcripts, field notes taken during the interviews, and documents as sources of evidence. In addition, each participant was asked to read her case study to insure the accuracy of information presented. With respect to reliability, all procedures that were followed during the course of the study were documented and all recruitment materials necessary to conduct the study were discussed. In addition, criteria for the selection of participants were also presented.

The research question in this study was: What factors in the life histories of women in academia do they perceive as having influenced their success, and how have these factors influenced success? In answering this question, three areas were addressed: challenges, accomplishments, and attributions to success. First, an introduction to the results was given. Second, the case studies of the participants in this study were presented. Third, the within-case analysis of each participant was presented.

Elaine was exposed to bad science teachers in high school, which may have influenced her away from a career in the physical sciences. In academia, her publication record was slow to develop for several reasons, such as entering academia without a publication record. Elaine has also experienced challenges related to male administrators. Elaine attained accomplishments such as being valedictorian of her high school class and receiving a prestigious award as a graduate student. She believes that the firsthand knowledge her parents had with respect to targeting her towards college was a major reason she was not only able to go to college but also to get her Ph.D. In school, Elaine was intrinsically motivated to learn. Within academia, she has established a rapport with local experts in her field, and the research opportunities have always been plentiful.

Pauline was completely discouraged and miserable during her undergraduate education, and lost confidence in her abilities. In her marriage, she was responsible for the majority of the child-rearing duties, which hindered her success in academia. Pauline attained accomplishments such as receiving subject awards in high school. Earning her Ph.D. also provided the opportunity for advancement in academia. Pauline attributes her father as the major influence on her educational background. He held high expectations for her, and pushed her in everything. In her Ph.D. program, her major professor was influential in that he held high standards for her and helped her learn how to write and publish. Her husband and aerobics instructor have also been influential in her success.

Jane went to a small school with limited opportunities, and as a result she struggled in some of her undergraduate classes. When Jane was in college, women who were good at math and science were encouraged to be teachers. Jane conformed to this

expectation, and taught school for a few years. In academia, Jane has taken on more service roles than her male colleagues, which has hindered her success. Jane attained accomplishments such as receiving subject awards in high school and receiving an award in academia based on her teaching, research, and service. Jane had supportive parents who were ambitious for their children. She had a high school science teacher and an undergraduate professor who influenced her choice of careers. Jane was exposed to research both as an undergraduate and during one of her professional positions prior to entrance into academia. In academia, she has benefited from research collaborations with colleagues. Her husband and children have also influenced her success.

Caroline married as an undergraduate, and her family obligations have presented challenges to her success during her graduate education and academic career. Her commitment to family has resulted in lower research productivity than if she had spent longer hours at work. During her Ph.D. program, Caroline's major professor had a brusque personality and his approaches and actions sometimes discouraged Caroline. She has attained accomplishments such as being co-valedictorian of her high school class and receiving teaching awards that have served as sources of encouragement. Caroline's parents held high academic expectations for their children, and her father was a science teacher. In high school, she received a strong foundation in writing skills from an English teacher. These skills were improved during the Ph.D. program with the help of her major professor. During her undergraduate career, Caroline was influenced by two male professors. Another male professor served as a role model for her during her master's program. In academia, Caroline has had colleagues and administrators who have served

as sources of encouragement and support, and others who have helped her learn new aspects of the discipline. Caroline also attributes her success in part to her deep religious beliefs.

Cindy's family moved when she was in middle school, and the new schools were more difficult than her previous schools. Cindy does not recall experiencing any other major challenges that have served to potentially influence her success. Prior to her entrance into academia, Cindy attained a research grant that influenced her decision to enter academia. The attainment of the Ph.D. after entering academia also provided the opportunity for advancement within academia. Cindy grew up in a supportive family, and the family atmosphere was such that she and her siblings always knew that they were smart, and that with a little work they could do anything they wanted to do. Cindy's father served as a role model for her and, through his actions, taught her how to successfully reach her goals in life. During her professional career, Cindy was exposed to grant writing, and she met a university professor who influenced her path to academia. Cindy has had bosses who have trusted her and appreciated her work. During her Ph.D. program, several male professors and colleagues contributed to her success. Cindy's personality has contributed to her success. She believes that there is a force within her that wants to do well, and she is internally motivated to succeed.

Minnie's challenges to success have been focused in academia. One male administrator has shown a lack of support for her. Staff members in her department have also posed challenges to her success. Students have been disrespectful, and the actions of one male student made her concerned for her own protection. Minnie received an

achievement-based award in high school that influenced her decision to pursue a career in science or engineering. Minnie also received scholarships to college and a graduate school fellowship. Minnie's family pushed her academically and held high expectations for her. Her father pushed her to be independent and think logically. In her high school, the bar was set high, and all students were expected to excel academically. As an undergraduate Minnie lived in the honors dorm, and this contributed to her success. During her college background Minnie has encountered both male and female professors that have influenced her success. During her academic career, Minnie has received encouragement and support from a female colleague and a female administrator.

Brittany left her undergraduate institution with a gap in knowledge with respect to a certain aspect of mathematics important in her field, and as a result she struggled with some of her graduate classes. During the Ph.D. program, her major professor was critical, rude, and sometimes verbally abusive. During her academic career, she has had several adverse encounters with students, and has experienced a lack of support from administration in terms of addressing these matters. Her department's advocacy for a privileged group of male faculty has also posed challenges to Brittany's success. Brittany has attained accomplishments such as being awarded a graduate fellowship during her Ph.D. program. Brittany's mother contributed to her success in several ways, such as serving as a role model, providing her with hands-on experience in science, and holding high expectations for Brittany. Two male professors influenced her success as an undergraduate. During her Ph.D. program, Brittany found support and encouragement from several male graduate students, and found motivation in serving as a role model for

other graduate students. In academia, Brittany has received support from a female colleague and a male administrator.

The cross-case analysis of data was presented. Four themes emerged through the cross-case analysis with respect to challenges that influenced the success of the participants: (a) no perceived academic limitations during their elementary and secondary years, (b) no other challenges during the elementary and secondary school years that hindered achievement in their educational background or their path to academia, (c) no gender-related expectations in the family background, and (d) no gender-related academic expectations or discrimination in graduate school that hindered success in graduate programs or the path to academia. Four additional themes emerged in four case studies with respect to challenges that influenced the success of the participants: (a) one challenge was posed during elementary and secondary years, but did not delay progress to college (b) one or more challenges were posed as an undergraduate that influenced success, (c) challenges were posed by male colleagues or administrators within their respective disciplines, and (d) all four participants with children had more traditional household and child-rearing responsibilities within their academic careers than did their husbands.

In six of the cases in this study, participants attained at least one achievement-based accomplishment in high school that served as evidence for their capability to be successful in college and during their academic careers. In six of the cases in this study, participants attained at least one achievement-based accomplishment in high school that served as evidence for their capability to be successful in college and during their

academic careers. Three of the participants entered academia with their master's degrees, and later pursued their Ph.D.s. In these three cases, the attainment of a Ph.D. was not a qualification for their initial position in academia but rather served to make possible the advancement of their careers in academia. One anticipated finding in this study was the receipt of awards and honors prior to entering academia that served to influence the decision of the participant to choose a career in a science and engineering field and/or to pursue a career in academia instead of other career options. This was found to be the case in only one participant, who received a science and engineering award in high school that resulted in her considering a career in a science or engineering field.

Five themes emerged with respect to factors to which the participants attributed their success: (a) parents or other family members held high academic expectations for participants, (b) father served as mentor and role model, (c) at least one mentor in the Ph.D. program contributed to success, (d) at least one colleague or administrator served as a mentor during their academic careers, and (e) collaborative research and publishing with colleagues in academia have contributed to success. Two other themes emerged in four cases with respect to factors to which the participants attributed their success. The first was at least one high school teacher was attributed to having influenced success. The second was that an undergraduate professor served as a role model.

With respect to the four themes which emerged addressing challenges faced by women in academia within their life histories, a search of the related literature found no literature specifically focusing on how the absence of challenges within the life histories of women in academia in science and engineering has influenced their success. Related

literature was found for three of the four additional themes which addressed challenges faced by women in academia in their life histories. No literature was found focusing on how accomplishments made within the life histories of women in academia influenced their success. Related literature was found for four of the five themes addressing factors within the life histories of women in academia which served to influence their success. Related literature was found for four of the five themes which emerged in four cases with respect to factors within the life histories of women which served to influence their success. Related literature was found for one of the two additional themes which emerged in four cases with respect to factors within the life histories of women in academia which served to influence their success.

Implications

The challenges faced by the participants in this study, their accomplishments, and the contributors to their success were found throughout the life histories of these successful women in academia, and the results of this study indicate that these factors interacted to influence the success of women in academia both during their educational backgrounds and during their professional and academic careers. Therefore, the results of this study imply that factors which influence the success of women in academia, and how these factors influence success, are best studied from a life histories perspective.

A comparison in the discussion of related literature of a study examining the nature and influences of mentors within the life and career histories of women in academia in physical education (Dodds, 2005) with the results of the current study revealed that there are similarities between mentors present in the life histories of

participants in Dodds' study and with mentors present in the life histories of participants in the current study. In addition, women in the current study represented six academic disciplines, yet there were many common factors to which they attributed their success. Therefore, comparison with the results of Dodds' study with the results of the current study implies that there may be common factors which contribute to the success of women in academia irrespective of their discipline.

The current study revealed that challenges, both gender-related and otherwise, were largely absent from the family and educational backgrounds of participants. In particular, the lack of exposure to gender-related expectations and other limitations to success imply that perceived barriers to success that can accompany such challenges were not present in the minds of the participants in this study. Therefore, one implication of this study is that the absences of these challenges actually serve as contributors to the success of women in academia. In addition, the results revealed that parents and mentors served as major contributors to success in many ways. Therefore, this study implies that parents and other mentors may play a key role in promoting the success of women in academia in science and engineering.

In the current study, women in academia with children faced challenges related to balancing work and family obligations. These women were highly accomplished and successful in their fields. Therefore, this study implies that women in academia can have a majority of child-rearing obligations in the home and still be successful, but even in cases where women are highly accomplished in academia child-rearing obligations still pose potential challenges to success.

Other challenges posed to some participants in this study were from male colleagues and administrators. However, male mentors prior to entering academia, and male colleagues and administrators within academia, also emerged as contributors to success more often than did women. Therefore, the results of this study imply that being male is not synonymous with hindrances to the success of females in academia. Fathers, male high school teachers, male undergraduate and graduate professors, male colleagues, and male administrators were all named as contributing to the success of the participants in this study.

Recommendations

The current study was comprehensive in scope in that it examined factors throughout the life histories of women in academia that influenced their success. Three main areas—challenges, accomplishments, and attributions to success—were addressed in this study. Since a search of the literature revealed no previous studies taking an approach this comprehensive in scope to investigating factors which influence the success of women in academia in science and engineering, I recommend that the current study be replicated to increase the reliability of the results of the current study and to provide additional insights into factors which influence the success of women in academia.

A comparison of the study by Dodds (2005) with the roles of mentors in the life histories of participants in this study implies that there may be common contributors to the success of women in academia regardless of discipline. The diversity of science and

engineering disciplines represented in this study strengthens this argument. Therefore, I recommend that research comparing the factors influencing success of women in academia in science and engineering disciplines with those in other disciplines be conducted to provide insights into the similarities and differences between disciplines with respect to factors influencing the success of women in academia.

The current study focused on women who were successful in academia. Results revealed that challenges, both gender-related and otherwise, were largely absent from the family and educational backgrounds of participants. In addition, parents and mentors served as major contributors to success in many ways. I recommend research along the same lines of that employed in the current study be conducted comparing the factors which influence the success of women in science and engineering who have entered and persisted in academia with those who have not been successful in their educational and/or career endeavors. A lack of success could be defined in a variety of ways, such as not completing a graduate program in a science or engineering field, or attrition from an academic career within a specified amount of time. For example, a multiple-case study approach could be employed comparing the influences of family and educational backgrounds, mentors, and other influential persons and events within the life histories of highly accomplished, tenured women in academia with women who did not complete their graduate programs in a given field and/or women who left academia without being tenured. This type of comparative research can serve to further delineate factors influencing the success of women in academia which are not present in the life histories of women who have not entered or persisted in academia.

The results of this study revealed that, as girls, the participants did not perceive academic limitations because they were female, and parents and other educational stakeholders held high academic expectations. I recommend that all educational stakeholders within the lives of females (e.g., parents, K-12 teachers, college professors) hold high academic expectations for females and strive to make gender a non-issue with respect to the nature and quality of the academic endeavors of females. I recommend that these stakeholders keep in mind that, when girls do not perceive limitations in their abilities and are expected to perform to the best of their abilities in all of their educational endeavors, these stakeholders are promoting the educational success of girls, and may be increasing the likelihood that these girls become women capable of overcoming challenges faced within their lives, choosing nontraditional career fields, and pursuing careers in and persisting within academia.

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APPENDIX A

CURRICULUM VITAE

Anna Tiffany Tindall
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(662) 338-9239 or (662) 769-0770
att19@msstate.edu

.

EDUCATION:

Ph. D. Secondary Education—Biology, Mississippi State University, May, 2006 (Anticipated).

M. S. Secondary Education, Mississippi State University, December, 2003.

B. A. Biological Sciences, University of Mississippi, May, 1997.

B. A. Psychology, University of Mississippi, May, 1995.

CERTIFICATIONS, PROFESSIONAL AFFILIATIONS:

Class AA Certification, Biology (7-12)—Mississippi

Class A Certification, Mild/Moderate Disabilities (K-12)—Mississippi

National Science Teachers Association—Member

ACADEMIC AND TEACHING EXPERIENCE:

Adjunct Faculty, East Mississippi Community College, Mayhew MS: 2004 to present

Teaching: Anatomy and Physiology I and II, Biology I

Technology: Have developed multimedia materials, including power point presentations, overhead transparencies, and handouts for both lecture and laboratory.

Laboratory Instructor, Biological Sciences, Mississippi State University, University, MS: 2002 to 2005

Teaching: Biological Sciences laboratory, Plants and Humans Laboratory

Instructor, Curriculum and Instruction, Mississippi State University, University, MS: 2004

Teaching: Teaching of Science (Practicum), Professional Seminar in Secondary Education (Practicum, team taught).

Technology: Have developed multimedia materials, including power point presentations, overhead transparencies, and handouts.

Graduate Assistant, Curriculum and Instruction, Mississippi State University, University, MS: 2003 to 2004.

Grant Management: Responsible for planning activities and maintaining financial records for two major grants in Curriculum and Instruction.

Advising: Advised undergraduate secondary education majors.

Secondary Education Teacher, Horn Lake Middle School, Horn Lake, MS: 1999 to 2001

Teaching: Eighth-grade science.

Advising: Advised eighth-grade students concerning proper course selection as they prepared to enter high school.

Sponsor Activities: Served as Junior Beta Club sponsor, treasurer, and chaperone on annual Junior Beta Club conference.

Special Education Inclusion: Served as regular education science teacher for special education inclusion program, and worked with special education teacher to ensure that each student was learning in his or her least restrictive environment.

Secondary Education Teacher, Calhoun Academy, Calhoun, MS 1997 to 1998

Teaching: Biology I, Biology II, Anatomy and Physiology I, Spanish I.

Leadership: Served as Science Department Head and head of science fair.

Sponsor Activities: Served as Junior Class sponsor, and was responsible for co-coordinating prom and fundraising activities.

NON ACADEMIC WORK EXPERIENCE

Vocational Training Instructor, Haven Homes (Department of Mental Health Facility), Hernando, MS 1999

- Training persons with mental retardation to reach their full potentials in the work setting.
- Writing vocational training programs for each client.
- Assisting clients with life skills within the group home setting.
- Participating in community-related activities aimed at integrating clients into the local community.

Psychology Technician, South Mississippi Regional Center (Department of Mental Health Facility), Long Beach, MS 1998

- Carrying out behavior modification plans for clients with mental retardation.
- Assisting clients with life skills within the group home setting.
- Participating in community-related activities aimed at integrating clients into the local community.
- Serving as Department of Psychology representative in client IEP meetings.

PUBLICATION

Tindall, A. T., & Hamil, B. (2004). Gender disparity in science education: The causes, consequences, and solutions. *Education, 125*, 282-295.

APPENDIX B

APPROVAL OF THE RESEARCH STUDY BY THE MISSISSIPPI STATE UNIVERSITY INSTITUTIONAL REVIEW BOARD FOR THE PROTECTION OF HUMAN SUBJECTS IN RESEARCH

Mississippi State University

June 15, 2005

Anna Tindall
P. O. Box 569
Mississippi State, MS 39762

Re: IRB Docket #05-154: Case Studies of Women in Academia: Challenges, Accomplishments, and Attributions to Success

Dear Ms. Tindall:

The above referenced project was reviewed and approved via expedited review for a period of June 13, 2005 through June 15, 2006 in accordance with 45 CFR 46.110 #7. Please note the expiration date for approval of this project is June 15, 2006. If additional time is needed to complete the project, you will need to submit a Continuing Review Request form 30 days prior to the date of expiration. Any modifications made to this project must be submitted for approval prior to implementation. Forms for both Continuing Review and Modifications are located on our website at http://www.msstate.edu/dept/compliance.

Any failure to adhere to the approved protocol could result in suspension or termination of your project. Please note that the IRB reserves the right, at anytime, to observe you and any associated researchers as they conduct the project and audit research records associated with this project.

Please refer to your docket number (#05-154) when contacting our office regarding this project.

We wish you the very best of luck in your research and look forward to working with you again. If you have questions or concerns, please contact me at 325-3294 or at tarwood@research.msstate.edu.

Sincerely,

Tracy S. Arwood
Director

cc: Burnette Hamil

Office for Regulatory Compliance
P. O. Box 6223 • 300 Bowen Hall • Mailstop 9563 • Mississippi State, MS 39762 • (662) 325-3294 • FAX (662) 325-8776

APPENDIX C

INTERVIEW PROTOCOL

INTERVIEW PROTOCOL

1. Demographics
2. Family Background
3. Educational Background
4. Marriage
5. Parenthood
6. Professional Career(s)
7. Accomplishments
8. Challenges to Success
9. Factors Contributing to Success

APPENDIX D

EXAMPLES OF ARCHIVAL DATA

EXAMPLES OF ARCHIVAL DATA

- Vitae
- Homepage (or other websites containing information about participant)
- Certificates/Awards
- Publications (e.g., articles, books)
- Unpublished papers/journals/other writings