

BALANCING MOTHERHOOD EXPERIENCES AND ACADEMIC SCIENCE: WHAT  
MAKES SOME WOMEN PERSIST IN THEIR PROFESSIONS?

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**Title**

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**MASTER OF ARTS**

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## **ABSTRACT**

Women both enter and leave science fields in numbers disproportionate to men (Long, Valian). Although many researchers have studied the reasons women leave the workplace in general, and STEM professions specifically, particularly after motherhood (Mason, Williams), there has been little work completed on why women stay in academic science once they become mothers. This paper employs two methods of interpreting published essays written by mothers who are also successful academic scientists.

This research spotlights women who both wish to pursue motherhood and opted to stay in successful careers in academic science, despite what is the well-documented discrimination mothers face in the workplace (Mason, “Do Babies Matter?”). The central research question is: with what do women who are mothers associate their success in academic science in terms of resources, supports, and lifestyle? This study indicates balancing parenting and working as scientists is plausible for those who have strong personal support systems.

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## CHAPTER 1. INTRODUCTION

In the concluding segment of her book, *The Price of a Motherhood*, the author Ann Crittenden states:

In a truly diverse world, people with direct child-rearing experience should be well-represented in positions of power. Every institution should ask itself not only “Do we have enough blacks, Hispanics, Asian-Americans, and women in our high ranks?” but “Do we have enough people who have spent serious time with children?” Parenting . . . ought to be seen as a credential. (274)

Whether or not we agree with Crittenden’s statement about the importance of parenting as a human task, it arises from her concern that a full complement of human roles are not represented equitably, especially in the higher ranks of fields such as government, industry, and academia, but especially in academic sciences. Because of cultural gender expectations, parenting is one role that women more often than men are expected to do exclusively; men do not often find parenting and career incompatible. On the contrary, researcher such as Mary Ann Mason note that “Nationally, ‘married with children’ is the academic success formula for men, but the opposite is true for women” (Mason, *Chronicle*). Often, women who choose both pay the price for career success in delayed marriage, procreation, and promotion. Choosing motherhood as a role often affects a woman’s potential contributions to her society; choosing to contribute to society may make women opt out of motherhood. Placing women in this situation, one in which they must choose between parenthood and a career, (a choice men are not often asked to make), hurts societies. As Crittenden writes, “a society that beggars its mothers beggars its own future” (274). These statements project a powerful message to the reader about the significant roles of an educated mother, because she is the builder and nurturer of the future assets of a society: her children and her children’s children, as well as her own contributions to her society through her

career. In the future, these children may hold the powerful positions for their generation. But often a mother can feel cultural tensions as she balances commitments to both paid work and parenting, resulting in choices that cause her suffering, psychologically, emotionally, and/or intellectually.

My interest in women professionals in science stems from Crittenden's book. She portrayed various facets of woman who are deprived of the equal privileges as men in their social, economic, and professional positions. Often such denials lead women to relinquish valuable contributions to their professional fields, research and studies, and to society. Scholars such as Crittenden, Robert Drago, Ruth Hubbard, and Virginia Valian argue that women in the science fields are one of the groups most affected by such situations, because of the time commitment academic science requires combined with the challenges to women when entering a male dominated field. But even these well worn analyses, as Collen Hollenshead notes "rely on an individual rather than an institutional model" (214). Academic science is "enmeshed in institutions whose practices of hiring, rewarding and promoting faculty are embedded in assumptions that originated in the 19<sup>th</sup> century"—assumptions about family, parenting and gender that are even more outmoded than those of society at large (214-15). While this paper is fully aware of the institutional practices that inhibit women's (and mother's) success in academic science, there is a vital need to measure the factors that have helped successful women persevere in academic science careers, particularly attempting to understand institutional supports that have enabled successes.

In this paper, I will investigate the factors of success behind eight women in science, women who wrote short personal essays for Emily Monosson's book, *Motherhood: The Elephant in the Laboratory*. In these essays, women describe their willingness to choose motherhood while having active science careers. My research employs a content analysis of

these essays, but also uses a more contemporary web tool, Many Eyes, to help me consider word occurrences and word relationships to find patterns of similarity among the women's experiences. This analysis of their essays explores the authors' motherhood choices and impacts on their careers; strategies and elements that worked well for their career success while parenting; and also issues of balancing their career and parenting lives. This research is an important study because it confronts the predominant notions of motherhood experiences of women scientists, and rather than asking why women who are mothers leave science, as much of the literature documents, it explores why some mothers persevere, and the institutional and personal factors that have enabled their success.

I employ content analysis as a tool to investigate the factors behind their success. The research objective of this paper is to study, what, why, and how have these women in science fields stayed in their profession, embracing the challenging life of parenting. I selected the eight essays in Monosson's book that correspond to women who began their science careers after the year 2000, women professionals in academic science who share their thoughts and experiences of being mothers and scientists at the same time, rather than those essays of women reflecting back on either their parenting choices or careers.

This paper explores the gap between literature about women who are scientists and women who are mothers by focusing on those factors these women note as important to their perseverance as mothers and scientists. After identifying a gap in this literature, I suggest a method for better understanding the key factors these women themselves identify. I will mine data through analysis of these eight essays that are central to my study, and then I will analyze those data, attempting to answer my central research question: what resources, support systems, habits, or desires do women who are mothers associate with their ability to persevere in a science career?

## CHAPTER 2. LITERATURE REVIEW

Women's roles have gone through much recent change due to increasing educational and economic opportunities, many of which have been brought about by legal changes and challenges, from 1972's Title IX, prohibiting discrimination in education; to definitions of harassment and hostile work environments that extended the 1964 civil rights legislation; to the Family Leave and medical Act of 1993. However, even brilliant and educated women with parenting responsibilities still face challenges in terms of negotiating their own roles as parents and professionals according to society's expectations. They often face challenges reconciling their multiple roles. Many scholars (Crittendon; Hewlitt; Mason; Valian; Williams) have argued that mothers who try to achieve work/life balance often get overwhelmed and have trouble handling their many stresses. The juxtaposition of their various roles, and how mothers cope with the associated stresses, play a crucial role for women in determining their career paths: whether to persist in their career after bearing children, and even whether to bear children.

Both motherhood and professional roles are constructed in relation to sometimes conflicting gender and social expectations. To understand how some women successfully negotiate motherhood and careers in science, it is important to study specific cases of women's success. This literature review examines contemporary attitudes about women in general and in academic science. This search is segmented into six sections. First, I discuss work limitations and inflexibilities for women with children, second I discuss challenges of women's roles with children in society. Third, I discuss challenges of motherhood experiences. Fourth, I discuss motherhood experiences in academic science. Fifth, I discuss the importance of role models. The goal of this literature review is to demonstrate the ways that the conversation about women in science, and particularly mothers in science, is reshaping academic facilities and policies as well as shaping science fields and the knowledge those fields create.

### **Work limitations and inflexibilities for women with children**

According to some scholars, despite the fact that women now are more successful than previous generations, still their gender roles in present situations have their own limitations in terms of parenting roles. As Crittenden writes, “on the contrary, as we have seen, more women with children are employed full-time than ever before. But they are not necessarily working at the careers for which they have been trained, or at the most challenging levels of those careers, or at the salaries that their training would normally command” (28). To summarize, despite the fact that women are becoming more career-oriented, many mothers still look for jobs that they perceive as less challenging, more flexible, and more beneficial to their children. In some cases, mothers look for part time jobs. As Joan Williams offers “Most women still work in jobs that are located near residential areas; are open to part-time workers; are easy to start, drop, and start again; and don’t require skills that get stale with time” (Williams 81).

Similarly, Sylvia Hewlett, in her book, *Off-Ramps and On-Ramps: Keeping Talented Women on the Road to Success*, did a survey that indicated, “16 percent of highly qualified women currently work part-time” (30). Because academic careers are far less likely to allow part-time work, or modified tenure-track appointments, mothers in academic science are especially vulnerable to leaving the discipline entirely. As Mason notes, of the small numbers of women who earned PhDs in math, engineering and physics in 2005, “Less than half . . . continue through to positions in academic research” (Mason). Of those who do, more than 20% fewer of them than their male counterparts will choose to have children (Mason). Their challenges balancing work and home life are exacerbated by the reality that they will make less money and be promoted more slowly in the academy—even in studies that control for productivity (Valian 249).

While accommodating their work choices along with their parenting roles, many mothers are choosing professions with less cultural prestige or with more time flexibility. Thus gender roles play another limiting role for women's lack of representation in hierarchy professions. Often the reason behind mothers' absences from highly productive jobs is the choice of prioritizing based on enculturated gender roles; for example, giving priority to their parenting life over their professional life based on cultural pressure. As Williams states "I have found that when mothers quit, they often say that it was because it just wasn't working: everyone was grumpy and rushed, there never seemed to be anything clean to wear or anything for dinner, every childhood illness created a family crisis of who would miss work" (33.) Thus women who are mothers are more likely to make career decisions based on their own social and professional perspectives, of which, society tells them, mothering is the priority.

Another limitation women face is the legislation and policies in many workplaces that do not recognize or accurately describe mother's experiences and difficulties in pregnancy, childbirth, and parenting. Describing time off for childbirth as sick leave in workplace policy, for example, create what Ruth Hubbard asserts is "the ideology of woman's nature that is invoked at these times would have us believe that a women's capacity to become pregnant leaves her always physically disabled by comparison with men" (Tuana 123). In fact, many professional and educational institutions still consider pregnancy as an illness when offering leave. Such language impacts all women, and not just mothers, and is reflective of those 19<sup>th</sup> century values surrounding motherhood that many institutions still embrace.

Flexibilities concerning legislation in the work place require sincere attention from the appropriate authorities. Flexibility works for the institution and employees when utilized properly as Williams suggests, "A survey by the American Management Association found that

allowing workers flexibility not only cuts absenteeism by as much as 50 percent but also improves work quality and morale” (Williams 91). She also notes that:

Flexible policies can improve productivity in four basic ways: by allowing employers to stay open longer hours with the same number of employees; by improving staffing during vacations or illness; by increasing worker loyalty and job commitment; and, in the case of part-time schedules, by providing a fresh worker at just the point when full-time workers are slowing down. (Williams 92)

Although institutional flexibilities such as childbearing leave (as opposed to sick leave), family leave, part-time tenure track, and stopping the tenure clock, can offer splendid supports for mothers in their academic workplace, there remains a significant challenge for women in hierarchical professions such as the academy: the challenge of occupying what is perceived as a man’s job.

### **Challenges of women’s roles with children**

Virginia Valian, the author of *Why So Slow?*, introduces a hypothesis which she calls “gender schema” (2) that refers to her “intuitive hypotheses about the behaviors, traits, and preferences of men and women, boys and girls” (11). Under the definition of this “gender schema” she states that “we are accustomed to calling our conceptions of certain groups’ stereotypes. The word (stereotype) is misleading, for it implies that something is fundamentally wrong with having such concepts” (2). She implies that a woman’s greatest challenge is to face her stereotyped roles granted by her society. Such stereotyped notions about women’s roles cause confusions and undervalue women’s actual role they play in their community. Stereotyped concepts are often challenging as women address societal expectations, such as to be “nurturant, expressive, communal and concerned about other” (13). At present day, women perceive their both parenting and professional roles more comprehensively than their spouses since “Still today

within heterosexual dual-career marriages, women more than men are expected to be the partner who finds a way to combine occupational aspirations with family roles and responsibilities” (qtd. in Hallet and Gilbert 308). This means, by default, women’s roles are taken for granted and the expectation for mothers is that they subsume their careers to their partner. The danger here is not just that women and their partners have been socialized to believe this is right, but that their co-workers and employers have. Mothers become caught in a “double-bind” in which if they are exceptional professionals, they are seen as less “womanly” gender traitors, who are also abandoning their families for their personal success (“Double Bind”). As Joan Williams writes in the Gender Bias Learning Project,

When ambivalent sexism is at work, women who adhere to traditionally feminine roles meet with benevolent approval—but are not seen as go-getters. Women who don't adhere to feminine scripts are respected but seen as having personality problems. When this occurs, women are called to task for behavior that is seen as unobjectionable in their male colleagues. (Double-Bind)

The above statement shows that by default women are judged by the preconceived gender roles by her ‘male colleagues’ who respects their female colleagues not by her performance but by her feminine traits. Often their professional behavior are considered as mental problem even that behavior is as professional as their ‘male colleagues.’

Williams also helps readers understand the concept of the maternal wall, kind of bias mothers especially face, though it is based on cultural beliefs about women and the motherhood role. She writes:

Maternal Wall is the strongest and most open form of gender bias. It stems from stereotypes that link motherhood with lack of competence and commitment. The

leading study on maternal wall stereotypes found that, compared to women with identical resumes but no children, mothers were:

- 79% less likely to be hired
- 100% less likely to be promoted
- Offered \$11,000 less in salary for the same position
- Held to higher performance and punctuality standards. (Maternal Wall)

The combination of sexism and 19<sup>th</sup> century cultural values surrounding motherhood (and the academy) make the workplace a very challenging place to be a mother.

Instead of spending time describing how mothers are expected to be, Valian employs decisive and concrete language in understanding of mother's interests and competencies of how they are doing of what they are doing. She concentrates on the external or as she states "invisible barriers" that women need to overcome that often comes with prices, as she states that "A women who aspires to success *needs* to worry about being ignored; each time it happens she loses prestige and the people around her become less inclined to take her seriously" (Valian 5.) This implies that women, because of their gendered roles, are in a less advantageous position when they desire for a higher position in their career. The challenge lies on their performance as women in profession previously dominated by men. Women who are mothers achieving higher positions have their disadvantages maybe a little more than the rest of women because they have two challenging duties to execute, at home and at office. As Valian states, "mothers who remain in full-time positions may be those who have found solutions to child care, such as more equitable domestic arrangements, reduction or elimination of leisure time, or outside help. Women may also cope by exploiting the flexible work hours and work location of academia (271.) This is common scenario among women with children that can be seen in today's community for instance, struggling through the childcare process, cutting out their spare time,

and often seeking non-academic jobs with more flexible hours. Therefore there is a constant price that mothers are paying invisibly and silently for their motherhood experiences either by quitting their better jobs or by staying in their profession feeling moral guiltiness towards their offspring by not spending time with them.

### **Challenges of motherhood experiences**

Despite the challenges of their stereotyped gender roles, women with their offspring carry out their obligation for parenting. Williams, in *Unbending Gender*, gives data that describes, “despite our self-image of gender equality, American women still do 80 percent of the child care and two-thirds of the housework,” (2). Like Williams, Crittenden affirms, “The majority of American mothers are still primarily engaged in the oldest economy in the world: the household” (13). She believes that parenting is still the “focus of the most women’s lives” (Crittenden 14). Yet, this serious matter of women’s experience as parenting is significantly overlooked by western society. Robert Drago, the author of the book, *Striking a Balance: Work, Family, Life* states similar assertion of what Crittenden suggests about socialized preferences that starts with women’s motherhood experience. He mentions that motherhood experience is constructed with certain norms that encompass women in everyday life, as he states that:

The norm of motherhood leads women to expect, and be expected, to serve as the caregivers for their families, more broadly, to care for anyone in need, and do so for love rather than money. (7)

Drago defines norm of motherhood into three segments. First is the motherhood norm that whose expectation is that “women should become mothers, and perform unpaid family care” (7). Second is the ideal worker norm that is “a belief among managers and professionals in total commitments to career and high rewards for this commitment” (7). Third is the individualism norm that is “a society-wide belief that the government should not help those needing care” (7).

Drago's assertions on norms of motherhood experiences can also be explained as mothers who are expected to behave in a certain fashion so that the society would know that they are mothers first. Women with family in the USA are facing exactly the situation Drago, Crittenden, and Williams elaborated above. Women are vulnerable to their community and professional environments in terms of their gender role expectation where women's environments is based on multitasking roles to perform. But those environments send women very different messages about their priorities than are sent men. Moreover, employers already envision men as that "ideal worker" employers often envisioned. No wonder that some women will pause in their higher studies and career field and will fail to take their own ambitions seriously, for those ambitions defy enculturated social expectations. Such situations can also cause dilemma to people who want to procreate until they reach the highest point of their career, and then, for many women, childbirth is no longer an option.

In western society it is not uncommon for women to choose either to have or have not children, and women who chose not to have children also face many cultural stigmas. Drago notes, however that many elements can play in women's consideration of not becoming parents, such as many may not have met the right partner, or may wait to achieve desired level of degree and profession, financial stability, or simply no desire at all to become parent (71). But Drago sounds optimistic about stating that such expected traits are not going to stay forever, it can be changed and for that "especial attention" are needed to make "positive changes" (13). Like Drago, Ruth Hubbard, the author of "Science, Facts, and Feminism," depicts the role of women based on a social norm by asserting that "women have played a very large role in the production of science—as wives, sisters, secretaries, technicians, and students of "great men"—though usually not as accredited scientists" (qtd. in Tuana 128). This is another way of saying that, women have not yet "accredited" their roles in the science field because their roles are always

seen subjectively rather than objectively (Tauna 128). Therefore women need to prevail over their subjective representation of their expected characteristics, and establish their persona and competencies in their communal and professional meadow. Such situation calls for their perseverance, because the real problem is that women cannot win in the present system. She is a gender traitor if she does not have children, and an incompetent employee if she does.

### **Motherhood experiences in academic science**

Among the various issues that women professionals deal with in academic fields, Crittenden states that women in science fields are affected significantly by research work, and the choice to become parent. She also concurs that “women’s situation” in the science field is “compar[able] to a leaky pipe” (Crittenden 39). She further argues that a significant percentage of women end up dropping their studies in science due to become mothers (Crittenden 39-40). Similarly, Jacob Blickenstaff, author of “Women and Science Careers: Leaky Pipeline or Gender Filter?” writes that “women who have become physicists report that one of the major obstacles in their path on the way was the expectation that they would also be the primary caregiver for their children” (Blickenstaff 381). Williams concurs suggesting that this problem extends beyond physicists, to other disciplines, “The chief reasons for women’s lack of representation [in disciplines dominated by men] are the glass ceiling and the maternal wall” (68). On the other hand, there is an equal importance to understand that childrearing is not only the issue for which women leave science, as Blickenstaff argues that:

not all women become mothers, and a woman’s identity should not be defined first by her participation (or lack of participation) in biological reproduction.

Many women who have become successful scientists are quite vehement in their opposition to [essentialist] feminist critiques of science. (Blickenstaff 383)

Moreover, as Robyn Roland notes, “Many women made the choice to be childfree” (513). But childlessness does not save women from being critiqued or facing negative impacts concerning social expectations around women and motherhood, for while childless women are more able to conform to Drago’s “ideal worker” the choice to remain childless calls into question their womanliness and ability to conform to gender expectations, which Williams demonstrates is exceptionally important for female success (“Double Bind”). These arguments depict that maternity is women’s issue no matter if an individual woman is a mother or not.

In fact, women can face motherhood-related discrimination simply because employers fear they will exercise their option to have children. Because of this, the motherhood experience “impact[s]” all women, with or without children. As Williams suggests when she discusses a statement from a senior editor of *Working Mother* magazine, that “[T]he impact of motherhood shadows every woman, narrowing her options. Even those without children may be harmed; the mere fact that they are of childbearing age may compromise their career prospects” (70). This supports the concept that all women share potential motherhood discrimination, for even if a woman doesn’t choose to experience motherhood, she still faces the double-bind: discrimination for her potential to bear children, and questioning of her “womanliness” and priorities if she chooses not to have children or cannot have children.

### **Importance of role models**

Despite success in many professional fields, women face many issues for which they need to look to other successful women who balanced both parenting and professional roles. As role models are always a benefit for women, especially those who are juggling between professional and procreational roles. Some academic studies are done with related issues of women’s professional, domestic, social and parenting practices. Scholars show that women in academic fields face challenges to choose between having children, and pursuing tenured

positions. Carmen Armenti, is the author of “Women Faculty Seeking Tenure and Parenthood: Lessons from Previous Generation,” undertake research on 19 women academics who were on the verge of pursuing “tenure with having and raising children” (65). She studies stories shared by 19 women in one of Canadian university. Her study focuses on the dilemma addressed by these women while they were pursuing faculty positions and motherhood experiences.

Armenti studies the women’s stories in two ways: first she looks at the senior women’s viewpoints about their career and how they are passing those onto their younger female colleagues. Second, she studies the issues identified by these women when they thought of pregnancy prior to their tenured positions. Her study demonstrates that senior women have different perspectives than their younger colleagues, and their messages impact their younger female colleagues’ decisions. The impact often increases the younger women’s dilemmas as they choose between having a child and striving for tenured positions (77). Her data also shows that the younger females who are in academic professions are “virtually as likely as their predecessors to encounter the ideology that one must sacrifice a personal life in order to have a professional life” (80). Therefore, although role models or mentors play a significant role for young women in the academia, the previous generation of women scientists cannot be wholly positive role models, because of the personal sacrifices many were forced to make for their careers. Nonetheless, research “indicates that students who have a mentoring relationship with their advisors feel professionally affirmed and are more productive after graduation” (qtd. in Ferreira). Likewise other scholars emphasize having role models in science for women as they state, “Encouraging more women to enter the pipeline is fruitless if so few emerge as professional scientists” (Ethzkowitz et al. 53).

In academic science, lack of mentoring and role models may also cause a significant dilemma in considering parenting practices. Also the lack of supports from administrators may

influence women to leave their research fields too. Jennifer M. Kidd and Frances Green study some significant issues that generated less presence of female bio researchers in the UK. Their objectives were to identify some of the factors which explain career commitment or prompt individuals to consider leaving a scientific research career (230). Their research attempted to answer three questions:

- To what extent are the factors predisposing individuals to leave a research career a function of their work or other experiences?
- Do these differ between men and women, and between those with different family responsibilities?
- What then are the practical implications of the finding for the career management of scientists? (Kidd and Frances 230).

To answer these questions, the researchers made a set of questionnaires that assessed “the predictor’s variables and intention to quit a scientific career,” and surveyed “a sample of 120 research scientists” (237). Their study shows that several factors are responsible for women considering leaving their research scientists’ careers. The most frequent reason cited for “planning to leave the profession [was the] anticipation of motherhood” (232). Their study also showed other related elements: disappointments in salary range, inequitable treatment in the workplaces, lack of group supports within the research team, and personal insecurity. These elements worked as catalysts causing women to quit scientific academia. In contrast, Valian states “rather than role models, people need equal access to information, opportunity, and recognition. People need fairness” (331) and by “fairness” she implies that “average women” should be exposed to equal chances of becoming successful like any “average man” (331). By this she means that women should not have to be extraordinary to be successful. Men who are “average” have good careers and happy family lives. Both average and extraordinary people can

be role models for balanced lived. Valian's view point is also echoed in Williams's statement when she says "The people who currently rise to the top are not necessarily the most competent: they are that small minority of people ready, willing, and able to work eighty hours a week" (93). As we know, working eighty hours a week is not compatible with being a mother, especially of small children. Therefore women need more exposure to the fair opportunities, and successful role models.

Juliann Emmons Allison, who studies women's issues related to motherhood experiences and women's inclination in the academic fields, finds that despite the fact that many educational organizations have changed their rules and regulations to facilitate the broader participation of women with children, mothers who are faculty members still are stressed to meet the demands of their jobs (23). This is largely because women are in need of understanding and cooperating assistant at home too, usually by spouses. Cowdery and Knudson-Martin also gave importance on women's spouses in terms of understanding their motherhood experiences, they state that "it is also important that the meaning and practice of motherhood is intricately related to how fatherhood is constructed" (323). Simultaneously, husband's active parenting roles are as crucial for women's success as having role models.

### **Conclusion**

According to Crittenden, sociologists "discovered" that mothers today spend more time with their children than mothers of the 1960s (13). This revelation demonstrates the cultural pressure on working mothers to be supermoms. Today's mothers are busier than ever building their careers while feeling pressured and "guilted" to spend time with their children. While this discovery could imply that women are capable of balancing their professional and parenting practices, the reality is that, for many women, sleep and personal time are sacrificed to work and motherhood tasks. Similarly, Judith Glover states in her book *Women and Scientific*

*Employment*, that women in general are assumed to have tendency to balance in practically in every domain of existence; career, family, social and personal life, etc. This balancing is responsible in part for the ascription of the ‘nurturer’ role of women as Glover writes:

Women would address science differently. Women are viewed from this perspective as having certain characteristics – either driving from ‘nature’ or from ‘nurturer’ or from both – which could change the scientific agenda (Glover 27).

Therefore, the values of women’s perspectives in science fields are to reconcile their role with work/life balance. Some scholars echo what Glover has stated about on the importance of women, particularly who are mothers, entering science fields, by stating that, “Mothers who, despite the obstacles, are able to combine paid work and family life are making important contributions to the paid economy. Even more, the children they are raising” (Avellar and Smock 605). Where a man has a perspective to the field of science, a woman’s perspective for the same field can be seen as adding more dimensions to that field. Also Glover addresses the question “does the issue of ‘Women and the Science’ matter?” She answers when she states that from the 1970s “feminist writers” have argued that there is a need for women in sciences because they are able to bring different perspectives to their fields that can change how the world sees science (27).

The above discussions lead to the crossroads for women who are struggling to grasp both motherhood and academic experiences. Science is considered one of the academic hierarchical achievements that require tremendous expenditure of time and energy. Women who are in academic science can only depict the scenario of their coping with both parenting and professional roles. Studying their stories is important because only then do we understand their situations and how they are balancing their motherhood experience when their having research and work. Many developments have been achieved so far to improve the social and economic

perspectives for women with or without children. Nevertheless the comprehensive achievements of being both parents and professionals are best measured by the true success stories stated by the women themselves.

### **CHAPTER 3. PROJECT OBJECTIVES AND METHODS OF INQUIRY**

The project objectives of this research are to identify and understand how women scientists construct their motherhood experiences and the factors that enable them to persist in their careers in science. This construction is associated with factors such as mother's beliefs about their parents' lives, their own lives, their choice of careers, and their partners' cooperation. My goal is to understand the mothers' own identification of their motherhood experiences; their connections with children; inquiries of issues motherhood practices; and their perceptions of gender and social roles in terms of maternal roles. Therefore I have laid out five research questions that will inquire into the motherhood experiences that have regulated, and shaped women's scope in the science fields. I will analyze the elements the women have encountered in the science disciplines, and how they persisted in their careers to overcome issues related to their motherhood experiences. To explore my research objectives, I will investigate the answers for the following questions:

- How are women scientists constructing their motherhood experiences?
- What impact does motherhood have on these women scientists' careers?
- What strategies have these women scientists taken to balance both their careers and parenting lives?
- What elements of their lives or professions have enabled the women scientists stay in their professions?
- What issues have they addressed while balancing their parenting and professional lives?

To answer these questions, I employ two methods to analyze eight previously published essays, from Emily Monosson's *Motherhood, The Elephant In The Laboratory*. Because I am exploring research methods new to me, I wanted to use already published text, for three reasons: the

articles are of similar length, were already professionally edited, and represented women who had success in academic science by the measure of someone else. I wanted to focus on using new methods more than gathering and editing a sample. Monosson's book, with its short and very recent essays seemed like a good source of data.

Then, I used a form of content analysis to procure data from the eight essays. This method is taken from Klause Krippendorf's book, *Content Analysis: An Introduction to Its Methodology*. Krippendorf defines content analysis as "a research technique for making replicable and valid inferences from texts (or other meaningful matter) to the context of their use" (19). He asserts that meaningful thoughts can be inferred by looking into the contents of a piece or artifact from various aspects. Usage of repeated words, certain issues and word uses and phrasings, sentence structures, etc. can be considered under the various aspect of content. This process can be repeated over and over to cluster similar meaningful words. Then these meaningful words can generate implications from the clusters.

The above technique is applied to clustering frequently occurring words and thoughtful sentences to bring repeated words and word phrases to generate meaningful statements, definitions, and expressions from the eight essays. For example, if two women out of eight have mentioned family supports have influenced them to persist in their careers following motherhood, the collective data of such will show that people like mothers, parents, family babysitter etc. are crucial to their success. Krippendorf also states that through the use of clustering, "other meaningful matter" of content analysis provides a method to "speak to someone to about phenomena outside of what can be sensed or observed" (19). In the data analysis section, the collected data potentially generates an insight into the phenomenon of motherhood construction. This is done by analyzing like definitions given by the contributors through their essays. Furthermore, Krippendorf states that the content analysis can be done as an

investigation from the clusters of meaningful words; that infers figurative messages as he states, “intuitively, content analysis could be characterized as a method of inquiry into symbolic meaning of messages” (22). Besides the investigation of words and sentences and their meanings, this study renders the symbolic inquiry about the lives of these women who hold their own working and parenting ideology uniquely on individual levels.

In other words, content analysis for this study contains an investigation of eight author’s thoughts about a specific subject, within a specific context, which is: the persistence of mothers in academic science, despite the sorts of challenges these mothers face in terms of institutional patriarchies and gender bias described in the literature review. Therefore, this method is appropriate for this study since this research performs partly social analysis, and partly personal analysis from the contents of the selected eight essays in which contributors elaborately describe the environments in which they grew up, choices of studies, preferred academic situations, and career constructions. I analyzed the contributor’s emotional responses by assessing positive and negative words and expressions from their essays. These meaningful words, as I have mentioned above, will be collected as data, data that represent the experiences and feelings of these women, and elements related to this particular topic: women scientist’s construction of their own motherhood experiences.

The essays that are chosen for this study are all of those in Monosson’s book written after the year 2000, and thus represent contemporary ideologies of women in motherhood experiences. The data collection process is divided into two categories: demographic data and descriptive data. I used three categories to obtain the demographic and descriptive data about the authors from the essays. They are: demographic data in table format, descriptive data in narrative format and figurative data in snapshot format. In descriptive data collection part, I analyzed narrative paragraphs to identify the elements that are related to marriage, children, relations, education,

success in professions, and external and internal influences on careers. Although for copyright reasons, I cannot include the complete essays in this paper, they may be found as written in Monosson's book.

In addition, I used what I would think of as digital tools to understand this data set. I used Microsoft Word and Many Eyes software to collect and count word frequencies from the essays. IBM's Many Eyes software helps visualize data in various ways, using existing data sets. Some of the key features of this software are its creative and interactive visualization of any data set of which it can generate various charts, maps, diagrams, word clouds etc. For this study, I used Word Tree and Tag Clouds to visualize data. Word Tree generates visual occurrences of sentences and phrases related to certain key words that I identified through discourse analysis, such as career, husband, mentor etc. Tag Clouds is used to count word frequencies, which are how many times one word occurred, in individual essays and across the entire data set. Similarly, I used Microsoft Word to count particular word occurrences from individual essays and matched the word occurrences in Tag Clouds. This comparison suggests the credibility of the word occurrences from both software. All the data collection can be understood by following section of Data Collection tables that are made for this study.

## CHAPTER 4. DATA, RESULTS, AND DISCUSSION

Employing the methods I described above to the eight essays that comprise my raw data has produced some interesting results, which I divide into demographic data (that which describes the participants) and descriptive data (that which describes the participant's motherhood experiences). Table 1 (below) compares the demographic information of eight women whose essays were used in this study. This table helps compare their educational attainment in academic science with their personal situations (partners, children, etc.).

**Table 1. Demographic Data**

<b>Contributors</b>	<b>Educational Data</b>	<b>Occupational Data</b>	<b>Family Data</b>	<b>Marital Status</b>
M01	Candidate for PhD and MS	Graduate researcher	One offspring	Single mother
M02	PhD Candidate	Graduate Student	none	Single
M03	MD & MS Candidate	Fellow	none	Supportive Partner
M04	PhD	Research Associate	One offspring	Married
M05	PhD	Scientist	Two Offspring	Separated
M06	PhD Candidate	Graduate researcher	none	Married
M07	PhD	Postdoc	One offspring	Married
M08	PhD Candidate	Graduate Researcher	Two offspring	Married

The table above represents the demographic information collected from the essays and other parts of the book (introductions, author notes, and the essays themselves) for this study. Among eight women three hold PhD degree, four are PhD candidates, and one is an MD and also pursuing a science MS. Three of them have full time jobs; three of them are graduate researchers, one an awarded fellow. Five out of eight have currently have children. Although three do not

have offspring, their essays reflect on motherhood and supports necessary before they would seek motherhood experiences.

The educational data show that most of the responders hold or in the process of getting PhD degrees. These data clearly establish that these women in science attained their highest levels of degrees and are successful in achieving maximum credentials for a career in science academia (Table 1). From the marital data, I found that five out eight women are partnered, two are not partnered, and one is separated from her partner and parenting singly (Table 1.). These data show that these women are open to being married and having a work/ social life like any others. The majority of them have already established marital status which shows that there is high interest in establishing work/life experience.

Table 2 represents the childless scientists’ thoughts on having children, which indicate their positive attitude towards potential parenting experiences.

**Table 2. Demographic Data Count of Women without Offspring**

<b>Contributors</b>	<b>Educational Data</b>	<b>Occupational Data</b>	<b>Family Data</b>	<b>Marital Status</b>	<b>Comments of Children</b>
M02	1	0	0	0	I know that I can both have a family and be a scientist
M03	2	1	0	1	I hope and plan to add children
M06	1	0	0	1	considering having children

This table is a subset of the Table 1 as the contributors do not mention of having offspring in their essays, but they do write about their thoughts on thinking about, planning, and having offspring. The rationale for including this table is to show that even though these contributors did not have children the time of writing their essays, their comments on having children indicate their desire to at some point add children to their busy lives while maintaining their career in science. For example, one said, “I know that I can both have a family and be a scientist.” Other’s

comments were as follows: “I hope and plan to add children.” And “considering having children” (Table 2). These data imply that all these women are already considering child-rearing while they pursuing their degrees simultaneously. It also shows that women who do not yet have children felt more confident about their abilities to balance career and family. M02, for example writes that she “knows” she can have both, something not all the women who have children are quite as confident about, despite their successes as scientists.

The first set of descriptive data, which comes from women describing their lives, is represented in Table 3. This table records the most frequent word occurrences in the eight essays regarding parenting and professional life. The following data are collected on the basis of word frequencies as generated from Many Eyes software. The following 18 words occurrences are generated cumulatively from the eight essays generated with the Many Eyes. First eight words are the totals of singular and plural occurrences of those words. The rest are done on the single word occurrences from the cumulative of eight essays.

**Table 3. Frequent Occurrence of Words**

	<b>Words</b>	<b>Numbers of frequencies</b>
1	Children/child	79
2	Family/(s)	57
3	Career/(s)	52
4	Mother/(s)	37
5	Advisor/(s)	30
6	Support/(s)/Supportive	27
7	Partner/(s)	24
8	Childcare/child care	11
9	Maternity leave	10
10	Difficult	10
11	Funding	10
12	Hard	09
13	Policies	09
14	Mentor	08
15	Gender	08
16	Supportive	08
17	Award	04
18	Community	02

While it is not the purpose of this paper to show the centrality of talking about the motherhood experience for these career women, the reader will note that top two most occurring words are “children/child,” and “family/families.” Although this is certainly related to the writing task these scientists were asked to complete, children/families by far outdistance “careers,” which suggests perhaps that the family piece of these women’s lives, which is usually introduced after career, and becomes the piece hard to fit in.

In addition, most of the other words are actually supports that are in place (or not in place) to enable these women’s success. When taken together, the supports out number any other factor. Therefore, along with the top three topics of children, family and career, other nouns from the table also indicate significant values that can be seen as accelerators of their successful staying in their profession. Because right after the children, family and career we see the mentions mother, spouse, advisor and support and childcare. These five nouns plays as supportive roles for their life that helps them to stay in their profession, these supportive hands have enabled them to stay successful. (The word “mother” is complicated here, because sometime “mother” is the woman’s own experience as a parent, sometimes it is her own mother as a role model, and sometime it means her mother as a support.)

Table 4 represents credibility of data counting process for this study, by showing the breakdown of word occurrences in individual essays. I searched each word occurrences under each individual essay from the eight contributors, whom I tagged as MO1 – M08. Then I totaled individual occurrences of each word from the individual’s essays that summed up exactly the same as Table 3.

**Table 4. Word Occurrence Analysis from Individual Essays using MS Word**

Contributors	Children	Family	Career	Mother	Advisor	Support	Partner	Childcare
M01	10	5	1	6	3	4	0	2
<b>M02</b>	3	7	5	2	0	0	0	1
<b>M03</b>	6	5	5	2	0	2	0	1
M04	6	6	7	4	0	1	5	4
M05	5	3	2	2	0	2	0	1
<b>M06</b>	16	13	11	9	15	7	11	1
M07	4	6	17	2	8	5	3	0
M08	29	12	4	10	4	6	5	1
<b>Total</b>	<b>79</b>	<b>57</b>	<b>52</b>	<b>37</b>	<b>30</b>	<b>27</b>	<b>24</b>	<b>11</b>

The women who do not yet have children (M02, M03, and M06) are bolded in the table below. The women who do not yet have children write about supports less, on average than the group that does have children (3 occurrences per essay vs. 3.6 occurrences), which suggests that those without children might not yet have a full understanding of the types of institutional and policy supports that will be necessary to balance science careers and motherhood experiences. Another result of this data shows that the word child occurs 29 times in M08's essay. Because among the eight contributors, she considered herself as the victim of her academic policies as she had to fight for her rights to have maternity leave.

All the responders have mentioned about having support from their mentors, advisors, mothers and partners, and in one way or the other, those supports work very effectively (Table 1 and 4.) These data show the level of support that has helped these women achieving their

success. The more support they have, the more comfortable they are in doing their job. I also found that two out of eight mentioned partners and parents as primary caregiver. One mentioned of “supportive advisors and parents.” It is important to note that these are individual and not institutional support systems. And while it may be that these individual support systems are the most important for women’s success and persistence, it may also be that these support systems were needed because institutional supports were lacking or under-developed. If that latter is the case, it may mean that many women who do not persist in academic science simply do not have access to the same personal support systems to replace missing policies or institutional supports.

Many of the eight women mentioned institutional and policy supports, however, these were mentioned much less. One mentioned her partner’s company was flexible. One mentioned childcare availabilities when needed. One mentioned company’s generous maternity leave. One worked out childcare with her “community childcare exchange.” These data reflect on the concerns for these women with having more childcare facilities at their workplace. The above discussion shows that trusted childcare is absolutely necessary to responders, whether from family supports or institutional policies. In cases where institutional supports were absent, women needed access to personal and family supports.

In addition to using software tools to look at specific word occurrences in these essays, discourse analysis data revealed five important themes in the essays of these eight women: Personal Supports (Table 5), Institutional Supports, (Table 6), Actions and Suggestions for change (Table 7), Voice, or the need to stand up for women of the future (Table 8), and the Motherhood Experience (Table 9). These themes revealed themselves as I studied the essays, and they show how women wrote about their experiences in their own words (Table 5).

**Table 5. Phrase and Sentences Related to Personal Supports**

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**Mother support:**

- “Today I can say with certainty that my mom played a critical role in the enabling me to become a successful woman in my profession. My dad did as well, and together they created an environment in which they taught by example that anything is possible. I think it is not too hard to believe you can do anything in the world when your mom is truly a rocket scientist.”
- “My mother has supported me every step of the way and this is a big part of my success as a scientist. I hope I can help my children achieve their goals, whatever they are.”
- “I grew up to be more like my mother, who tends to listen more than speak, she pushed me to be more outgoing and self – confident, knowing that this skill was important regardless of career choice.”
- “...the time required for advancement seems to make it almost impossible to have career in science and a family. Having my mom as a role model throughout my life has proved to me that it is possible...”
- “my mother and I had had many chances to discuss the challenges of being a woman in science, particularly a successful woman in science.”
- “.I hope and plan to add children to that equation, I will look back on my mom and dad and the enabling, unbiased environment we grew up in and try as much as possible to emulate that.”
- “with parental encouragement and support, I transferred to engineering school where I graduated...”
- “my mother has supported me every step of the way, and this is a big part of my success as a scientist.”
- “I have found that support [mother’s] is the key to my success in science.”
- “young scientists now have many role models like my mom and many examples of how to make life as a scientist and mother work.”

**Mentor/Advisor support:**

- “My postdoctoral mentor, bless her heart, was understanding and did not pressure me about returning to work.”
- “I had the good fortune to meet a friend and mentor . . . [who] has taught me many skills helpful for managing gender –based perceptions and issues . . . ”
- “Thank goodness I have been so fortunate as to have a supportive advisor and mentor.”
- “I am lucky that my advisor is supportive of my limited schedule [following childbirth].”

**Spouse support:**

- “My husband stayed home because I had a meeting that couldn’t be postponed.”
- “My husband was willing to be the primary caregiver of our child so I could pursue my career.”
- “I now find myself with a wonderful, caring, supportive partner who is in no way threatened by my successes.”
- “My husband and I trade off time on the weekends to allow the other spouse to work.”

**Community support:**

- “I was usually able to work out child care exchanges that gave me the flexibility to carry out experiments at odd hours or to attend early or late meeting.”

**Personal request and preferences:**

- “I had requested that the search committee provide a few fifteen-minutes breaks in my schedule so I could pump breast milk.”
- “I was just grateful that the co-chair of the search committee was a woman and mother who had breast –fed her own children years earlier. Asking a man for break to pump milk would have been very awkward.”
- “I demanded that institution change its family leave and antidiscrimination policy and the way it implemented the policy to ensure that what happened to me would never happen to others.”
- “At the university.....there was a parents’ co-operative that was run entirely by the parents who participated.”

**Full Family support:**

- “Thank goodness for the rising number of stay-at-home dads, extended family members chipping in to help out, and parents who continue to financially support their grown-up children and by extension their grandchildren.”

In the category of personal supports, I found that the woman's own mother received maximum positive feedback by the women in this sample. Mother is defined as a "role model," "encouragement support," "big part of my success," and "possible to emulate (having children and career together)." The support mentioned second most often as important by the authors is mentor or adviser. Supportive mentors are described as "understanding and did not pressure [in] returning to work," "taught many skills helpful for managing gender-based perceptions and issue," "supportive" etc. Partners represent an important support for the women in this sample who were partnered. Fathers who stayed at home to provide primary childcare were a key factor to several women. Some women were more general in their partner's duties, and mentioned about the partner as wonderful, caring, and supportive. In addition, there is a broader mention about family support of the extended family, and finally, several women described the need for self-advocacy in gaining access to needed resources.

Therefore, the analysis indicates that personal supports, and family specifically, play a significant influence over the success of these women who stay in academic science. Both the role models of their own mothers, and her actual help and support are keys to their success. Supportive mentors in their profession and education also seem a necessary condition for their success. Equally, the woman's partner is an important factor for those women who are partnered. None who were partnered claimed an unsupportive partner. These personal supports that the authors mention are telling, as they equal somewhat unconditional love and support by families, which means that there is a slim chance that all the women are lucky enough to have such supports all the time. A mother, who can provide a role model for balancing a career and family, while supporting a daughter in achievement in science, is not common, and if this is a necessary factor, it suggests an important reason women are still under-represented in sciences. These

supports are not in abundance for all women to have them whenever they need. Therefore, it can be concluded that established policies and institutional supports are essential to support the full inclusion of mothers in academic science.

Perhaps the most interesting thing to note about institutional supports is that the most common experience women report is of inflexibilities and lack of policy or help. In fact, many participants described responses to their motherhood or pregnancy that were likely illegal: firing and inadequate access to family leave. Moreover, the institutional supports they reported were more likely to be vague: more role models exist, and that some institutions are mostly free of outright discrimination. Some, like the ability to collect food stamps, while it is a structural support, only reinforces the poverty of the graduate school experience and the lack of reasonable pay and insurance as institutional supports that would help the writers avoid poverty (Table 6).

**Table 6. Phrase and Sentences Related to Institutional Policies and Support**

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**Institutional inflexibilities:**

- “I was fired for getting pregnant.”
- “A professor at another institution has used my situation to advocate for better policies at her university.”
- “Despite the presently changing gender profile of physicians, a lot of the behavior and traditions still come from the “old school.”
- “Many women, because of the requirements and expectations of medical school and residency, wait to have children until later in life, as their career paths can clearly conflict with starting a family.”
- “Now, graduate school, with long hours and low pay, is not designed for parents, much less single ones.”
- “Academia, however still retains the same demands regardless of our familial obligations. And it is this institution of constant productivity that does not allow for time off dedicated to family.”
- “Even the allowance of six week’s maternity leave without compensation (which is the policy for assistant professors) is deficient.”
- “Will my employer understand and grant me maternity leave? My earlier experience with my advisor only reinforces my fear.”
- “Our national policy is to allow six week’s maternity leave with no pay.”
- “Unfortunately, my school has no policy on maternity leave for graduate students.”
- “I encounter the same problem with conferences that don’t provide child care.”

**Institutional flexibilities:**

- “the university of Pennsylvania.....I’m working at as a research associate .....hours are great and flexible.”
- “Scripps is a great place to be a female oceanographer now: of the twenty-one students in physical oceanography, eleven of us are women.”
- “Medical college of Pennsylvania (MCP), ....it is a place defined by its fascinating history as the first medical school for women in the United States.”

(Continued)

**Table 6. Phrase and Sentences Related to Institutional Policies and Support (Continued)**

- “MCP.....inspiring place without so many of the gender stereotypes that continue to exist at many traditional medical schools. For the most part my colleagues and teachers at MCP made no distinction between men and women.”
- “My husband’s employer was very accommodating.”
- “In addition, the kids are included in our professional work.”
- “As noted in the Stanford Graduate Student Handbook, it is important to acknowledge that a women’s prime childbearing years are likely to be the same years that she will be studying in graduate school, pursuing postdoctoral training, and establishing herself in a career.”
- “Role models abound. And the field itself is becoming more accommodating – for example, child care is available at most major meetings.”

**Foreign policies:**

- “In Denmark,.....some mothers can take fifty-two weeks of maternity leave and are often given a full salary while at home with their infants.....Fathers too have option for extended paternity leave.”

**National policies:**

- “I collected food stamps and child care funds from the country in order to support my son and myself.”
- 

Institutional inflexibilities play crucial role in terms of these authors’ educational and professional lives. One author mentions of getting fired from her workplace because she was pregnant. Another felt obligated not to have children due to the demand of her profession. Another mentioned that graduate school is not “designed” for parents—that the educational institution itself is incompatible with parenting. Another author mentions that six weeks maternity leave without compensation is not satisfactory, while another was anxious whether her employer would grant her even that legally required amount of maternity leave. One writer clearly mentions that no maternity leave policy existed for graduate students in her institution, reinforcing the idea that this level of education is not compatible with parenting. One encounters childcare issues while attending conferences, part of her work-related obligations. One woman’s situation was so dire that it became a role model for others to advocate for better policies at other institutions.

In contrast to inflexibilities, there are mentions of institutional flexibilities that these women experienced, although, as I noted while these were important, they were not of the

significance of the inflexibilities the women perceived. One mentions the University of Pennsylvania that provides flexible working hours to research associates. Another mentioned Scripps is a great place to work for female oceanographers. And finally one suggested that her medical college is an inspiring place that discourages gender stereotypes that distinguishes men from women. However, each of these mentions notes the specific place these flexibilities occur, noting that, in fact, these are not common. Finally, one mentions a policy from Stanford graduate student handbook that recognizes women's parenting periods that most likely to be the same years that they will be pursuing their graduation and post graduation degrees. It is worth noting that Stanford's handbook was developed with Mary Ann Mason's help and support, Mason being one of the top advocates in the nation for supporting women's full inclusion in academia through institutional interventions.

Although some women offered examples of self-advocacy that I listed as personal supports, most women also wrote about needed actions for large-scale change to bring mothers into full participation at the highest ranks of academic science. Many of these suggestions are about institutional changes and reframing of women's and mother's contributions to the field, but others are about the ways that individuals can respond to stressors on their time and energy (Table 7).

#### **Table 7. Phrase and Sentences Related to Suggestions/Actions**

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**Suggestions:**

- "Social interaction is important, and to succeed you need a measure of self-confidence and belief that your work and ideas are important, along with the measure of willingness to listen to other people's ideas and integrate them into your own."
- "As with my mom, we talked about the typically feminine traits of collaboration and communication and how these qualities are extremely effective and desirable and work to create even better emergency physicians."
- "During graduate school I had the opportunity to mentor younger students both formally, through mentoring programs, and informally. I always told them, "if you do what you love, you will be good at it and the money will take care of itself."

(Continued)

**Table 7. Phrase and Sentences Related to Suggestions/Actions (Continued)**

- “There is a way to contribute to academia and to raise children. It will require a major shift in view of the pace needed to fulfill requirements for a successful academic career.”
- “Wouldn’t it be helpful if we could organize a temporary leave of absence and return to our studies without being penalized by, for example, having to re-apply to the program and paying re-entry fees?”
- “Financial assistance to allow graduate students to have families, in other words, to avoid limiting the graduate body to childless students – should come from the universities, who ought to receive funding from both the state and the federal governments. This is radical challenge; however, we can begin simply by changing our view about mothers in science.”
- “I dream of a job in academia where I can teach, do research, have access to on-site day care where I can visit my child to nurse or check on him or her as I please, and be home during the evening hours and on weekends to be the mother and wife I would like to be.”
- “I also hope to give the message to women in science who have children or are thinking about having children that it can be done, and done well. This was something I was unaware of when I entered the sciences.”

**Actions:**

- “My professional future is still bright, although I have taken a detour and the direction of my career has shifted. Most important, I have redefined what I consider success. Part of this new definition is standing up for right. Losing half of my family’s income was only part of the cost of fighting, but the reward is in helping women who come after me and in the hope that my story will convince other women to stand up rather than leave quietly to preserve their careers.”
  - “We (three graduate students in microbiology, zoology, and medicine) are currently working to establish a policy for a family leave for graduate students on our campus (whether for maternity or paternity, to assist in handling adoption or foster care placements or to care for a sick parent or spouse.)”
- 

The data from the third theme, segment 3, describes these authors’ suggestions for better support systems and a warmer culture in order to have all women gain more flexibility in their choice of becoming mothers and scientists. There are also mentions of importance of “social interaction”, “self-confidence” and “believing in own idea” and have ears and respects to others idea and to incorporate those ideas into one’s own. There is mention of “feminine traits” or qualities that are “collaboration and communication” that play essential and effective parts for women in science professions. One suggests that doing what she loves will make her good at it and “money will take care of itself.” One mentions about success in balancing between parenting and working by changing the view in “pace” that is required for an “academic career.” There is a suggestion of making college easier for returning mothers with simplified procedures without the hassle of reapplying or paying “re-entry fees.” Financial assistantships with consideration for incremental increases of allowances should benefit graduate students

maintaining their families. Also there is a mention of dreaming a utopian academia and professional place where one can do research, have access to daycare and able to see her child whenever she pleases and be able to be at evening and weekend to be a mother to her children. One author mentions “hope” for women in science that both parenting and building career in science is possible and can be done “well.” These suggestions ask for a fundamental restructuring of academia; these women show they understand that institutions and structures must change if more mothers are to participate in science careers.

Along with suggestions for change, several authors have provided action along with suggestions for how to build better place for mother and children in the professions and academia. There is mention of taking a “detour” and shifting career in order to “standing for right”; also at the same time, one writer found rewards by becoming model for other women who need to confront bias rather than “leaving quietly their [profession/studies] to preserve their career.” Another action was to make a policy for the graduate students for “maternity leave, child care benefits, and care placement for sick parents or spouse.” The refrain in these essays is the necessity of institutional and policy supports for successful change.

A closely related theme was of these women finding their voices for advocacy, perhaps through the act of writing and publishing their experiences (Table 8).

**Table 8. Phrases and Sentences Related to Their Own Voice for Other Women**

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**Voice:**

- “The scary part is, I have no road map, and I’m not quite sure where I’m going. That’s another lesson I hope to teach my daughter by example: never let fear of the unknown stop you from exploring paths less traveled.”
- “If we don’t stand up, discrimination will continue, and equality will take much longer to achieve.
- My route has not been the most direct, not the easier. It is hard to change careers and to pursue graduate school when you are already have children.”
- “I am the scientist in the family. I am the one who can tell you how things work, who can fix the car, and who can help you with your math home-work...I’m not the world’s best cook, but I can explain the chemistry behind cooking.”

(Continued)

**Table 8. Phrases and Sentences Related to Their Own Voice for Other Women (Continued)**

- “We have a wide breath of experience. We are dedicated. We are motivated. We care about our jobs, we care about our families. We want to contribute to society, and we have the skills to do so. Don’t shut us out. Embrace us. We will complement our fellow scientists.”
  - “I’m guessing there really is no “best” time to have children when pursuing a scientific career in academia. Life as female scientist is difficult, and the challenges of being a mother and scientist can be brutal. I can only hope that when I become a mother, I will have the strength and ability to pursue the career I want as well. I do not feel I should have to give up one or the other.”
  - “I don’t know how long I will stay in science. I can only hope that as more women with children enter the academia sciences, science will become more accommodating to our needs as mothers, which ultimately will increase the quality of the work.”
- 

These comments, which I have characterized as being about finding voice and speaking out, also reflect great uncertainty about personal futures and the futures of other women in the profession. There is a mention of uncertainty and “no road map” to follow but still have firm confidence to teach one’s daughter to “never let fear” dominant to unknown path in their career. Phrases like “I guess” and “I don’t know” reflect the uncertainty these comments reflect. They also describe that women need to stand up together against discrimination so that “equality” does not take too long to achieve for women in science. One author mentions that her route was not “direct” path but rearing children in the graduate level and changing career is not always easy. There is a tone of pride and tranquility when one author says that she is the scientist in her family who can tell the mechanism behind “how things work” or “can fix car” or “can help children in their homework and certainly explain “the chemistry behind cooking even though may not be the “best cook.” She is directly addressing that her gender roles as mother and scientist may not always match up, but that women should not have to choose between the career they want and the family life they wish.

One writer mentions various traits that women poses such as “dedicated”, “motivated,” “care for ... jobs,” “care for families.” Women who want to “contribute to society.” There is urging for women not to “shut us up,” but for society to “embrace us” because women are “complements to their fellow scientists.” Another mentions that “life as female scientist is

difficult” and there is no “best” time to have children. The experience of being parent and scientist can be “brutal.” One just need to “strength” and “ability” to live such life without giving up easily. These words describe what is really a battle between competing forces, but one that all these women seem to think has not yet defeated them. Most importantly, there is mention of accommodating more women with motherhood experiences into science field so that will “ultimately increase the quality of the work” by broadening perspectives and bringing to the bench a different set of skills (Table 9).

**Table 9. Phrases and Sentences Related to Define Motherhood Experience**

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**Motherhood role in science opportunities:**

- “Becoming a mother and trying to find a balance between career and family has prompted me to consider unorthodox ways of putting my scientific background to work.”
  - “We have to stand up and show society and our daughters and sons that mothers can be scientists too.”
  - “There are still advances to be made in attitudes toward the idea of combining a career in research with raising a family and in accommodations for those trying to do just that. Even today, I have friends of my age who have been asked. In the course of a job interview, if they intend to have children. But young scientists now have many role models like my mom and many examples of how to make life as a scientist and mother work.”
  - “Women are a valuable part of society, and given the extra time to be both mothers and scientists, we will add value to campus life. If I can achieve being a mother and a scientist, perhaps my daughter can imagine having a career and a family. Perhaps in another generation we can make the necessary changes to make that a reasonable goal.”
  - “If we want to increase the number of women in scientific academia, we need to understand and support the many roles a female scientist may play in today’s society, including both wife and mother.”
  - “I assumed most women in science chose not to have children and that female scientist with families were rare. I now know differently and am so happy to meet other mothers in science because we need to know that even if we feel we are alone, we’re not.”
- 

The women whose comments extended these of motherhood’s relation to science not only are related to those first set of comments about how their own mothers supported these scientists (sometimes by being scientists themselves), but are also thinking both about how they will support their own children’s science interests and how their motherhood experiences make them better scientists. For example, her motherhood experience has made one to consider “unorthodox ways” to use her scientific background at work. There is a mention of standing up for their children and society to demonstrate that “mothers can be scientist too.” One mentions of the need of changes to attitudes towards women in science, and that young women scientists are

getting more role models and examples to fulfill their both desires. There is mention of women as the “vulnerable part of society.” But allowing extra time for mothers in science field can “add value to campus value.” Also same author mentions that now is the time to make “necessary changes” for next generations who can understand that both mothering and working are a “reasonable goal.” Another author mentions that to see more women in science academia one must “understand and support” the assorted roles of women. Other author mentions that her assumptions that women in science chose not to have children has changed when she meets other scientists who are mothers.

These five themes that appeared through the discourse analysis show that women scientists who successfully persist in their careers are very aware of missing institutional supports, and the necessity of personal supports to fill that gap. Most seem to realize that everyone doesn't have access to the same personal supports. The two women who struggled most both had the fewest personal supports and the greatest desire to assure more institutional supports would be in place for the next generation of women scientists.

Another way of looking at these data involves the software Many Eyes, which offers ways of visualizing these same data I considered through discourse analysis. This method offers a profound look at the words and phrases that surround a central concept. While using Many Eyes does not replace discourse analysis as a method of inquiry, it does quickly make some of the connection among concepts appear quickly and clearly for analysis.

In this section of the paper, I look at four keys terms (career, child, husband, and mentor) and offer word trees that help readers grasp the level of uncertainty these authors reveal, perhaps unknowingly and in aggregate, about the key terms of their essay. I chose these words because they were the most commonly occurring in the essays. I used husband instead of the “partner” I have used throughout this paper because it is the term the women in my sample used.

The word career created the most complex and uncertain word tree (Figure 1.)

From the above word tree we find that the word Career is connected with, in order words like panic, jeopardy, discrimination, equality, imagine, pause, moving, women, scientist, worry, proper, balance, family, wife, prompted, consider, unorthodox, family, academia, research, raising, accommodation, path, abandon, pursue, passions, society, support, difficulty, choices, decision, role model, rewarding, upheaval, confidence. Although the discourse analysis did not even identify “career” as a singular theme, but a concept that kept coming up within all the themes, as one of the top three terms, it seemed important to explore. Many of the words surrounding it are words that are negative or about uncertainty or anxiety: panic, jeopardy, pause, worry, discrimination, balance, unorthodox, abandon, difficulty, upheaval. These are offset by a number of very positive terms: equality, imagine, raising, pursue, passions, rewarding, and confidence. This mixture of terms suggests that, when taken together, the essay writers feel tensions surrounding their careers and motherhood experiences.

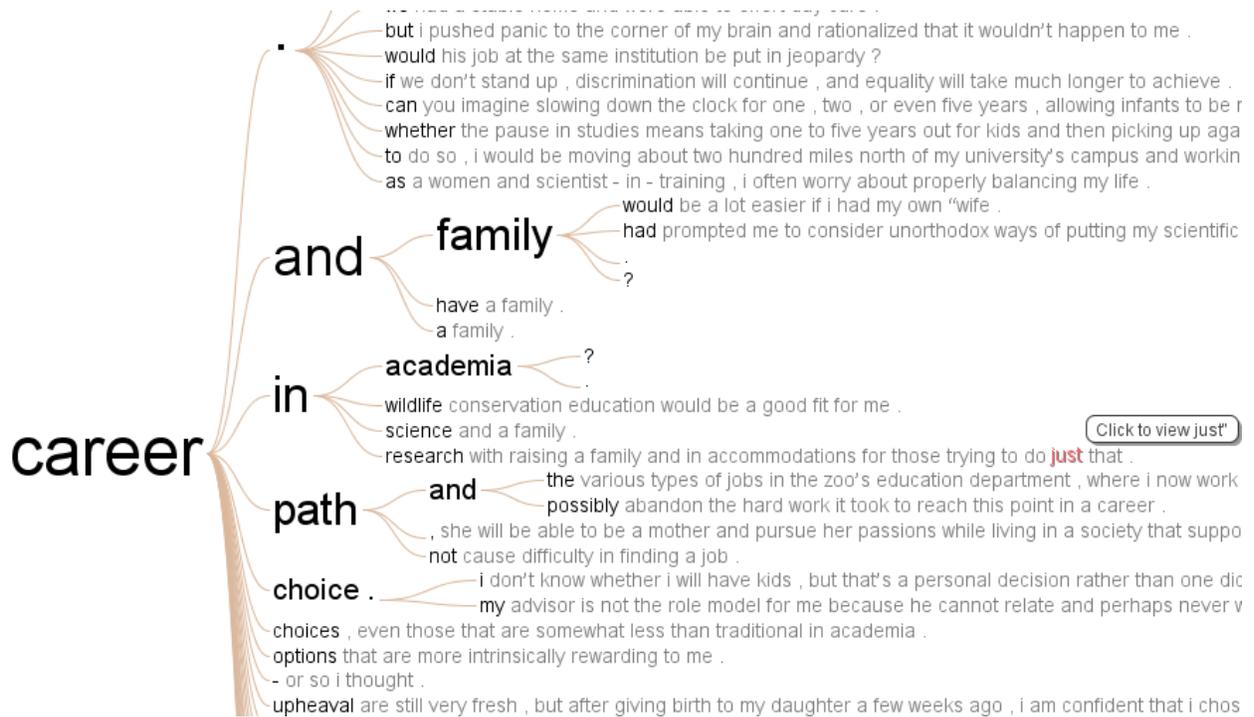


Figure 1. A Snapshot of “Career” Relation from Word Tree

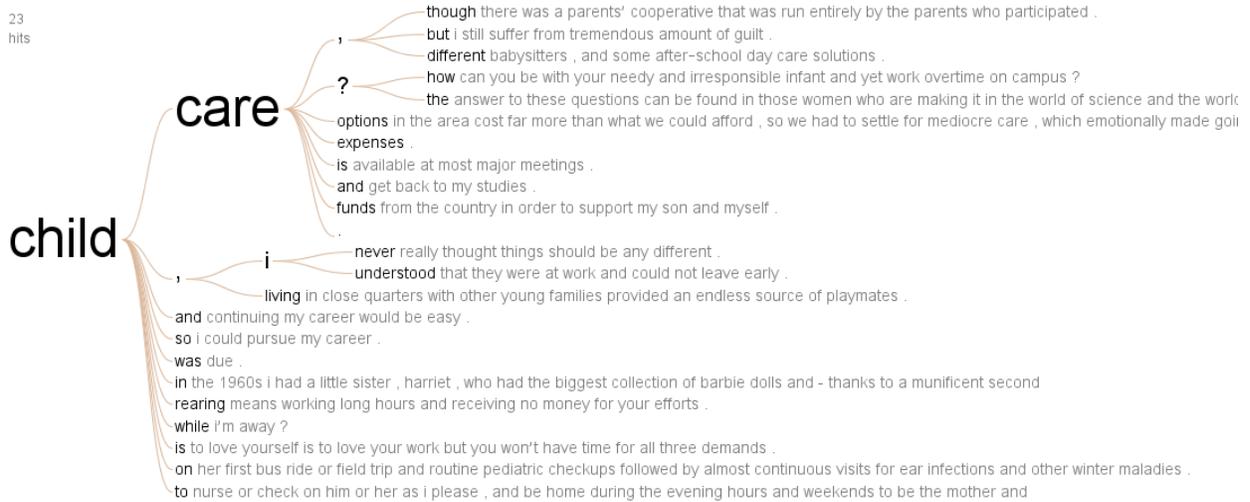
For the women in this group, the word husband (Figure 2.) had highly positive connotations and associations, which suggests that partner support of these specific men was very important to these women’s success. The word husband is connected with words in order like decided, long conversation, lack of time for [the relationship], trade off time with spouses for weekend work, happy, move, grow, works, stayed home, willing[ness], family. In addition, in most cases the word husband is directly associated with the writer’s “husband and I” which suggests a positive team approach to parenting. Although the women note their lack of time for their partners, the word husband has only positive associations as a support in their lives. Words that are missing are also telling—there is no mention of guilt or anger surrounding the relationship.



**Figure 2. A Snapshot of Family (Husband) Relation from Word Tree**

Interestingly, the word child connects most directly to (care) as in childcare (Figure 3). Although word occurrence counts could not demonstrate this, Many Eyes helped reveal that most of the mothers’ primary concerns about their children was related to childcare. While this is not

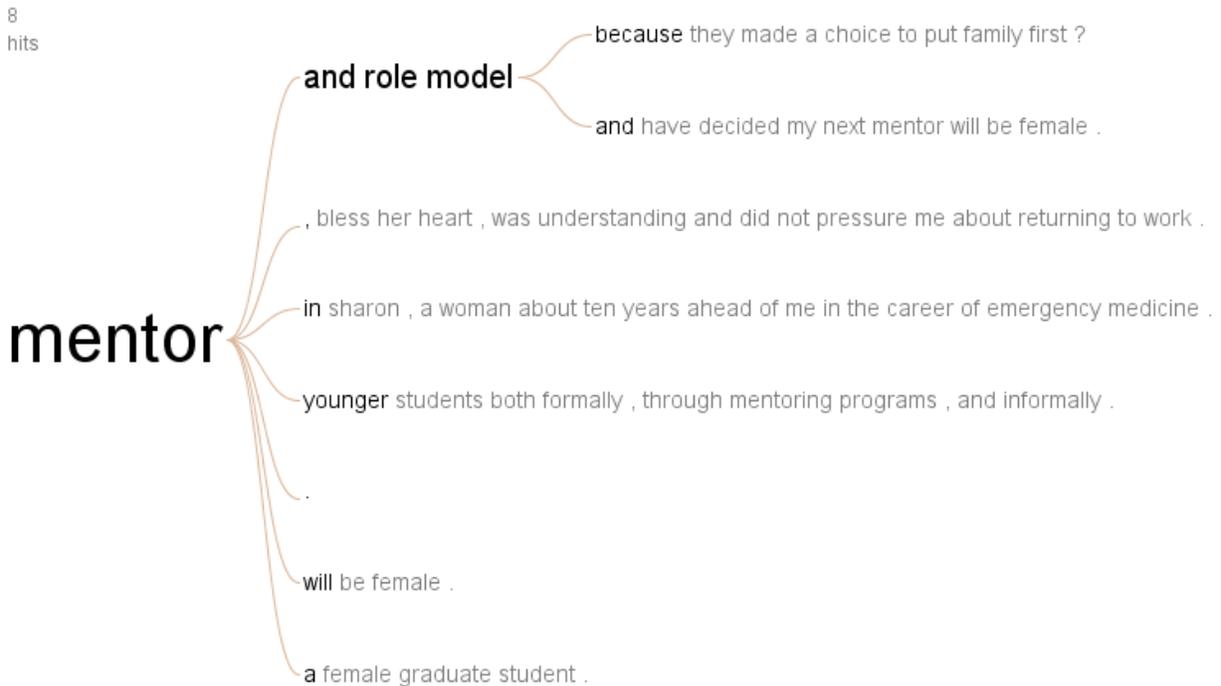
surprising, and one of the most necessary supports for women in science professions to persevere is trusted childcare, this confirmation in these essays was interesting.



**Figure 3. A Snapshot of Child (Care) Relation from Word Tree**

From the above word tree we find that the word child is connected with care, cooperative, suffer, guilt, babysitters, daycare, expenses, funds, support, playmates, pursue, rearing, away, love, demands, needy, pediatric, checkups, maladies, nurse, mother. Unlike the husband word tree, which had few negative associations, child and the closely related childcare had a wealth of negative associations: suffer, guilt, needy, expenses, [child] rearing (as unpaid labor), funds, away, demands, nurse one's baby (as opposed to having to pump), and maladies. I think this suggests something potentially worth further study. These women, who have unconventional jobs for women, do not feel cultural pressure to be guilty and unhappy about their relationships with their partners, but they do claim guilt and anxiety about their motherhood experiences and ability to mother. It would be interesting to explore whether cultural pressure to mother in specific ways and by cultural formulas is so powerful that it intrudes upon the psychic well-being of otherwise comfortably gender-rebellious women.

Although the support of mentors was identified as important in previous data, the word tree (Figure 4.) demonstrates an important additional fact about mentoring: all of the writers who found their mentors positive supports, had women mentors, or wanted to find women mentors.



**Figure 4. A Snapshot of Mentor Analysis from Word Tree**

From the above figure one can see that the word Mentor is connected to words like role models, choices, female, heart, understanding, pressure[less], senior role mode (Sharon), mentoring program, female and female students. Therefore we find the strong presence of or desire for female model and mentors in this word tree.

At the beginning of this paper, I identified five questions I hoped to explore through this research. This final section attempts to summarize answers to those questions based on the data I have collected and the literature I have read.

### **1) How are women scientists constructing their motherhood experiences?**

Most of the women wrote about their motherhood experiences in positive ways, although ways that show they feel cultural pressure (or they desire to) to parent in particular, usually time intensive ways. The women note anxieties about childcare, and “guilt” about leaving their infants. The word guilt makes me think that these women are responding to cultural pressures, perhaps more than internal desires, though some women do use the terms “wish” and “hope” when describing their parenting activities and interactions with their infants and children. They note that their jobs do not allow them to nurse their babies, but that they must instead self-advocate for time and places to pump. One mother “wished” for on-site daycare, where she could “drop-in” and nurse her baby. Even women without children suggested they hoped to have them, and even the woman (M07) whose essay seemed most ambivalent about children, did not think that women should be asked to choose between parenting and a career.

Women with their offspring felt that parenting was as rewarding as achieving professional success, and several argued that the skilled gained through effective parenting should help women in their science careers. Such experiences made one writer consider “unorthodox ways” to use her mothering background as a scientist. There is a mention of standing up for their children and society to demonstrate that “mothers can be scientists, too.” One mentions the need of changes to attitude towards women in science who is willing to raise children and to be scientist. One mentions about having role models for young women scientists to fulfill their both gender and social roles.

These writers seem to be constructing a positive relationship between their science careers and their motherhood experiences, and their comments suggest that the work they have had to do to manage these two roles have in some ways politicized them, making them want to stand up not only for their children’s futures, but for future generations of women scientists.

They have become “mothers” of not only their children, but the women who will next step into science roles and perhaps find a transformed landscape due to their work. There is mention of women as the “vulnerable part of society.” But allowing extra time for mothers in science fields, and changing the structures that keep mothers out of science can “add value to campuses.” Also, the same author mentions that now is the time to make “necessary changes” for next generations who can think that mothering and working as “reasonable goal.” Another author mentions that to see more women in academic one must “understand and support” the multiple roles of women.

## **2) What impact does motherhood have on these women scientists’ careers?**

Motherhood experiences have made those women with children more aware of their own relationship with their parents, especially with the influence of their own mothers on both their career and mothering choices. The women contributors of the eight essays have significantly talked about their relationship with their own mothers. Their very own idea of motherhood experiences started at home from their mothers, many of whom were scientists themselves, all of who were supportive of their daughters’ careers. This childhood and adulthood experiences of the contributors have a great impact on their own gender and career roles.

This parenting experience has also made these women become aware of their institutional policies and practices that are still challenging for mothers to negotiate. Those writers who hope to become mothers or support the motherhood experience also intend to see more considerate changes to the professional and institutional policies. Institutional inflexibilities play crucial role in terms of these authors, in both their educational and professional lives. One author mentions getting fired from her workplace because she was pregnant. Another felt obligated not to have children when she hoped due to the demand of her profession. Another mentioned that graduate school is not designed for parents, while yet another author mentioned that six weeks maternity leave without compensation is not satisfactory. These women came to understand that

motherhood impacts science careers, and that institutional supports are needed to mitigate that problem. While all the women recognize the role of their personal support systems in their success, what becomes clear in studying these cases together is that success is because of strong personal support networks, and that institutions far from providing supports usually have no policies, or explicitly discriminatory practices.

### **3) What strategies have these women scientists taken to balance both their careers and parenting lives?**

The analysis of these essays clearly demonstrates that family supports were a necessary condition for these women's success. Also spouse, community and workplace support are needed to ensure their stress-free working condition where optimal research and focus can occur. However, these conditions rarely exist, and most of these writers work to improve conditions for the next generation of women while they attempt to navigate these challenging systems. If mothers worked in institutions where they did not have to both work in specifically challenging situations AND work to change those situations, think how much these mothers in science could accomplish!

Of all available supports, the author's mother is the most important. She is both a role model and an emotional, financial, and hand-on grandmother supporter. The mother is in the pinnacle of all the support systems described by these women in science. Specifically, the mother is defined as a "role model," "encouragement support," "big part of my success," and "possible to emulate (having children and career together)." A helpful, understanding, and most of all female mentor is another important factor in women scientists persistence. Finally, the scientist's partner in parenting is especially important. A stay-at-home partner who was a primary childcare giver was one of the best supports some of these women had.

**4) What elements of their lives or professions have enabled the women scientists stay in their professions?**

As previously mentioned, mothers, female mentors, and supportive co-parents were the three personal supports most named by these either authors in their essays. But these personal supports are highly problematic, and actually point to the reasons that there are not as many mothers in the sciences as other professions. Institutional supports seem to be missing, broken, or are actually roadblocks. One woman, from Stanford, mentioned effective policies to support women at all stages of their science careers, including those years when they needed to be parenting. However most of the stories the women in these essays told were about personal advocacy when they lacked institutional structures, and fighting to make things better for the next generation of scientists.

**5) What issues have they addressed while balancing their parenting and professional lives?**

The most significant part of these women in academic scientist is to confront with their institutional and professional policies for post-pregnancy and childcare policies. Institutional inflexibilities made these women's motherhood experiences less than satisfactory and could have easily led to their withdrawal from academic science if they had not had strong personal support systems.

## CHAPTER 5. CONCLUSION AND FUTURE RESEARCH

In this paper, I have investigated eight essay studies involving mothers from science backgrounds and the supports that have helped them to persist as scientists, despite the conditions one of them calls “brutal.” This study indicates that simultaneously balancing parenting and working as scientists is plausible for some women, especially those who have strong personal support systems including a supportive mother, a female mentor, and a co-parenting partner. Their success in science is made possible because of their family’s unconditional offers and support for childcare, and resources in terms of role models. Majority of mothers in this study affirm that work/life balance in academic science with children is possible for them, despite their gender and social impediments. There is no question that these support systems are not universal, and the woman in the study who lacked a supportive, co-parenting partner was also the woman who struggled most, and who worked hardest to develop institutional supports for future scientist mothers.

Joan Williams writes that women’s vulnerable situation starts with the moment she chooses to “stand up” for herself because, “[t]hough everyone must fight their own battles, professional women often feel they are handed more battles to fight because they have to struggle to get what men are offered automatically” (253). She notes that such situations can get more serious when they face “sexual harassment, pregnancy, or other issues men do not face” (253). Women in this study were aware of such facts and created a sustainable atmosphere by having supportive hands from their families and mentors along with determination to finish what they have started. However, to treat these women as individual success stories undermines the real findings of this paper: that women who are mothers in male fields must fight constantly for institutional supports that men do not typically even think about: the necessity of lactation facilities, the desire for safe and inexpensive childcare, the right to time off following childbirth.

This study also indicates that family plays a significant role in the success of these women involved in the profession of science. Both their mothers and mentors have played crucial conditions for their successful persistence. On the other hand spouse, community and workplace support are needed to ensure their stress-free working conditions. These supports are not in abundance for women to have them whenever they wish. It can be concluded that established rules and regulations are needed to support positive motherhood experiences while in an academic science role.

The investigation of this study is limited to eight contributors, all of whom were, or hoped to be mothers despite the full demands of their academic and professional lives. The result from this study offers a context to apprehend motherhood constructions perceived by successful women in academic science. They mentioned specifically the need for more flexibility in post pregnancy and on-site childcare facilities; role models in their career fields who were mothers, and the need for the profession to accommodate women with more motherhood experiences. Although this study made interesting use of a combination of content analysis and software technologies, survey and interview data with a much larger sample size could test the validity of these methods. Further studies in the fields of policy and legislative interventions concerning post pregnancy leave and childcare facilitation and how they are affecting women's career in various fields can also provide insights into motherhood construction and its impact on science fields.

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